ECOCAS Wind Farm

(Esgair Cwmowen Central and South)

Volume 3

Environmental Statement

Independent Power Systems Limited (IPS)

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ECOCAS Wind Farm

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Acronyms

AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BERR	Department of Business, Enterprise and Regulatory Reform
BGS	British Geological Survey
BIS	Biodiversity Information Service
CAA	Civil Aviation Authority
Cadw	Historic Environment Service of the Welsh Assembly Government
CPAT	Clwyd Powys Archaeological Trust
CRoW	Countryside and Rights of Way
CCW	Countryside Council for Wales
CDM	Construction Design & Management
CPP	Construction Phase Plan
CSS	CSS Spectrum Management Services
CSSP	Construction Site Safety Plan
DECC	Department of Energy and Climate Change
DMRB	Design Manual for Roads and Bridges
DTI	Department of Trade and Industry
EA	Environment Agency
EIA	Environmental Impact Assessment
ECOCAS	Esgair Cwmowen Central and South
EMP	Environmental Management Plan
ES	Environmental Statement
FCA	Flood Consequence Assessment

GPS	Global Positioning System
HCAs	Historic Character Areas
HGV	Heavy Goods Vehicle
HLC	Historic Landscape Character
HLVA	Historic Landscape and Visual Assessment
HV	High Voltage
IDCG	Interim Development Control Guidance
IPCC	Intergovernmental Panel on Climate Change
IEMA	Institute of Environmental Management and Assessment
IHT	Institution of highways and Transportation
IPS	Independent Power Systems Ltd
IUCN	International Union for Conservation of Nature
JRC	Joint Radio Company
LCA	Landscape Character Area
LB	Listed Building
LGV	Light Goods Vehicle
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
MIPPS	Ministerial Interim Planning Policy Statement
MoD	Ministry of Defence
MV	Medium Voltage
NATS	National Air Traffic Services
NBN	National Biodiversity Network
NERC	Natural Environment and Rural Communities

NRA	National Roads Authority
NVC	National Vegetation Classification
OTMP	Outline Traffic Management Plan
PCC	Powys County Council
PPS 22	Planning Policy Statement 22: Renewable Energy
RHL	Registered Historic Landscape
RIGs	Regionally Important Geological and Geological Sites
RSNC	Royal Society for Nature Conservation
RSPB	Royal Society for the Protection of Birds
SACs	Special Areas of Conservation
SAMs	Scheduled Ancient Monuments
SLA	Special Landscape Area
SNH	Scottish Natural Heritage
SP	Scottish Power Manweb
SPAs	Special Protection Areas
SPEC	Species of European Conservation Concern
SPZ	Source Protection Zone
SSA	Strategic Search Area
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Solution
TAN 8	Technical Advice Note 8
TAN 5	Technical Advice Note 5
TMP	Traffic Management Plan
UDP	Unitary Development Plan

WAG	Welsh Assembly Government
ZTV	Zone of Theoretical Visibility

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1 Preface

This Environmental Statement accompanies the planning application to DECC Under Section 36 of the Electricity Act 1989 for permission to build and operate a Wind Farm to be known as ECOCAS (Esgair Cwmowen Central and South), which is some 3 miles north east of the village of Carno, within the Powys County Council Authority.

The Planning Application and Environmental Statement have been prepared by Independent Power Systems Limited for Greenspan Renewables Limited, a company controlled by Messrs Watkins and Jones, and the terms Greenspan, Messrs Watkins and Jones, either jointly or individually, or sponsors, all refer to their interest in Greenspan Renewables Limited. For ease of reference, handling and presentation, it comprises the following Volumes:

Volume 1 : Non-Technical Summary

Volume 2 : Planning, Design and Access Statement

Volume 3 : Environmental Statement

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The Planning, Design and Access Statement is incorporated as part of the planning application and is not formally a part of the Environmental Statement.

Environmental Statement and Non-Technical Summary Availability

Copies of the Environmental Statement can be viewed at any of the following locations by arrangement, using the telephone numbers provided below:

- Powys County Council Planning Office, Neuadd Maldwyn, Severn Road, Welshpool, SY21 7AS (Tel: 01938 552828)
- Powys County Council Planning Office, The Gwalia, Ithon Road, Llandrindod Wells, LD1 6AA. (Tel: 01597 823737)
- Newtown Library, Park Lane, Newtown, Powys, SY16 1EJ (Tel: 01686 626934)

Additional Access to Non-Technical Summary

In addition to the Non-Technical Summary being available for viewing at the above locations, it may be downloaded from the Independent Power Systems Limited website at www.independent-power.co.uk/ecocas/ or obtained free of charge by contacting Independent Power Systems Limited at the address below.

Purchase of Environmental Statement

A full copy of the full Environmental Statement (Volumes 1 to 6) can be purchased for £400 per copy and is also available on DVD at a cost of £30 from:

Independent Power Systems Limited

Canada House

272 Field End Road

Eastcote, Ruislip, Middlesex

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Telephone: 02088 66 44 00

2 Introduction

2.1 Environmental Statement

This Environmental Statement (ES) has been prepared in order to advise on the likely major environmental impacts of the proposed Wind Farm at Esgair Cwmowen Central and South (referred to as ECOCAS). This Statement has been prepared by Independent Power Systems Limited, an independent energy consultancy company, who specialise in renewable energy and low CO_2 emission energy installations. The proposed ECOCAS Wind Farm development is situated some three miles north east of the village of Carno which itself is some 5 miles from the major conurbation of Newtown, Mid Wales. The Site location is shown at Volume 5, Figure 8, with the detailed boundary line of the development shown at a 1:10,000 scale at Volume 5, Figure 9. The detailed site layout, including site access roads, borrow pits, cable routes, electrical substation, construction compound and anemometry mast, is shown at Volume 5, Figures 1 & 2.

2.2 Consent and Planning Permission

Consent is being sought for the proposed Wind Farm under Section 36 of the Electricity Act 1989, which requires submission to DECC for consideration and consultation with all statutory and interested parties, as the generation capacity is in excess of 50 MW. Also, planning permission is sought under Section 90(2) of the Town & Country Planning (England & Wales) Act 1990. The proposed development is comprised of the following main items of plant, equipment and facilities:

- 17 wind turbines each of 3 MW capacity with a maximum hub height of 80 m, maximum blade radius of 45 m, giving an overall maximum height to blade tip of 125 m
- Internal site access roads
- Crane pads (at each turbine site, for turbine construction)
- Four borrow pits, utilizing existing quarried areas
- A 70 m high anemometry mast (for permanent on-site wind monitoring)

- A temporary construction compound including offices and messing and toilet facilities, site and security control
- Electrical substation, and on-site electrical and communications cabling
- Highways works

2.3 Scoping

Scoping was undertaken with DECC to determine any significant issues that needed to be considered and any information that should be included in the ES. A letter (see Volume 4, Appendix 4, Pages 1.1-1.6) requesting a formal scoping opinion was sent to Gary Mohammed at the then Department of Trade and Industry (DTI) on the 28th September 2006. This request was also copied to Mr Thomas at Powys County Council (PCC), Mr Redmond at Welsh Assembly Government, Mr Revill at Environment Agency (EA), Ken Perry at Countryside Council for Wales (CCW), Mr Kevern at Cadw, Ms Allen at NATs and Mr Smailes at CAA.

In response to the letter to the DTI detailed comments were received from Rob Pridham at the DTI dated 2nd November 2008 (see Volume 4, Appendix 4, Pages 1.7-1.8) giving their opinion as to what information should be included in the Environmental Statement (ES). Comments were also received through the DTI from CCW, EA, and NATS. A summary of the matters received to the scoping opinion request under Regulation 7 of the Electricity Works (Environmental Impact Assessment) Regulations 2000 that should be covered are detailed below. Full correspondence can be found in Volume 4, Appendix 4, Pages 1.1-1.32.

- Landscape and Visual assessments including capacity, character, quality and value
- Cumulative visual assessment within a 30 km radius from the Site boundary
- Noise assessments during construction and operation
- Traffic and Transport
- Site selection
- Proposed electricity grid connection
- Ecology including the impact on species protected under the Habitats Regulations or the Wildlife and Countryside Act 1981

- Archaeology and Cultural Heritage assessment within 10 km from the boundary of the Site
- Hydrology and Hydrogeology impacts
- Telecommunications and Aviation
- Construction materials
- Impact on designated sites such as National Parks, SSSIs, SPAs
- Cumulative impacts should be considered where applicable

2.4 Project Layout and Capacity Determination

2.4.1 Site Layout

Detailed evaluation of the size of the Wind Farm and the positioning of the wind turbines was undertaken and the optimum site layout was determined, taking into consideration the possible environmental impact of the proposals and the potential electricity output. The optimisation process excluded the positioning of any wind turbine within 700 m of any residences, within 300 m of any third party boundary and taking account of the need for minimum interference with sensitive areas including water courses and cultural heritage sites. Further evaluation of bird and bat habitats and breeding and movement, hydrology, noise and accessibility were also taken into consideration in achieving an optimal site layout.

2.4.1.1 Turbine Positions

The grid references for the positions of the wind turbines at the ECOCAS Site are shown in Table 2.1. Further detail on the evolution of the turbine positions is discussed in Section 3.2.1.

Turbine no.	Eastings	Northings
1	298956	299883
2	299287	299837
3	298878	299486
4	298886	299139
5	299386	299328
6	299748	299357
7	299161	298898
8	299602	298945
9	299265	298533
10	299580	298501
11	299956	298880
12	300253	299306
13	300473	299149
14	300134	298665
15	300745	298665
16	300965	298485
17	300686	299582

Table 2.1 Turbine grid references

2.4.2 Energy Output

With a total electrical power capacity of 51 MW and taking into consideration the projected prevailing wind conditions at each of the proposed turbine locations, the total annual output is estimated at 134 GWh which is equal to meeting the domestic needs of some 28,500 average households.

2.4.3 Operating Timeframe

The Wind Farm has been designed and planned to have a working life of 25 years, after which a number of options will be available, namely, to decommission the Wind Farm, dismantle the turbines and remove them from the Site, to apply for an extension of operation of the Site using the existing turbines or apply for the installation of new turbines. We have assumed in this application that the Wind Farm will be decommissioned 25 years after becoming fully operational.

2.4.4 Grid Connection

The Wind Farm will be connected to the Grid by means of a 132 kV overhead line from the on-site substation. The line is in the process of design by Scottish Power Manweb (SP). Messrs Watkins and Jones have paid SP a sum of money, as their agreed proportion of the design fees, in order that SP could undertake an initial design study which would enable electricity to be exported from the TAN 8 Strategic Search Area B (see Volume 5, Figure 10) in the most environmentally acceptable manner, while allowing full development of the renewable energy resource available. The proposals for this grid connection will be the subject of a separate Section 37 application, following the detailed design study being undertaken by SP, and therefore do not form part of this Environmental Statement.

2.4.5 Carbon Dioxide Emissions

Wind energy has a lifecycle carbon emission factor of about 10 grams of CO_2 per kWh of energy produced (Sovacool, 'Valuing the Greenhouse Gas Emissions from Nuclear Power: A Critical Survey', 2008). When comparing the CO_2 emissions from a wind turbine installation with a CO_2 level projected from the current mix of generation capacity, we have assumed the 'pessimistic' level provided by the Advertising Standard Authority of 430 g/kWh. This is also the level supported by the BWEA and recommended to all of its members which includes IPS. With an estimated annual production of 134 GWh, the ECOCAS Wind Farm will produce about 1,340 tonnes of CO_2 per annum. The offset emissions, using the above, is 57,620 tonnes of CO_2 per annum, and the offset from the ECOCAS Wind Farm is therefore 56,280 tonnes of CO_2 per annum (i.e 57,620 minus 1,340 tonnes). Another way to look at the carbon offset achievable

by adopting a wind energy approach is by considering the ratio of CO_2 per kWh of energy produced between a conventional power plant and the ECOCAS Wind Farm, which is 43:1.

2.4.6 The Project Sponsors

The intention of the two sponsors, Messrs Eurfyl Watkins and John Jones, both local farmers, is to endeavour to provide renewable energy for use through the National Grid, at a level of development that is not disproportionate to the total land area available for potential development. The two project sponsors are wholly independent of any organisation or company, making the project a totally locally funded planning application for a wind farm development. No external funds have been sought or used by the sponsors in the development of their proposals. Both of them have spent all of their lives in and around Newtown and Carno and, with their families, farm the hills above Carno, mainly sheep rearing, with some supporting livestock together with growing and harvesting crops for animal feed. Some of the land is also use for forestry, including where possible because of the nature of the land, native deciduous trees.

The two project sponsors, jointly own some 454 hectares of land in the area to the north of Carno, in the county of Montgomeryshire. This land, together with a further 68 hectares of contiguous land owned by another local farmer, gives an overall land ownership available to the sponsors of some 522 hectares. The total area of the proposed Site development is 278 hectares, which represents 53% of the total land available to the sponsors. The proportion of land that has been identified as being available for the development has resulted from a detailed evaluation of all of the impacts and constraints including environmental, ecological, wind resource and topographical elements. It can therefore be stated that over 90% of land, currently used for farming activities by the landowners to the proposed development, will continue to be used for those farming activities, with little or no effect on the land use. It is further emphasised that the actual area of land 'disturbed' during construction of the wind turbines will be approximately 4% of the total site area; this percentage will also be lower if consideration is given to the need to restore, for example, cable trenches and turbine foundations. The area of 'disturbed' ground includes all internal site access roads, drainage channels, cable trenches, crane pads and lay down areas, wind turbine foundations and substation with associated facilities.

2.4.6.1 Mr Watkins

Mr Eurfyl Watkins' family history has deep roots in the County of Montgomeryshire and he and his family currently own and manage 'Craigfryn Farm' within the Parish of Carno. He is the third generation of the Watkins' family at Craigfryn Farm and took over the business on his marriage in 1972. Mr Watkins' son is a partner in the business and is committed to being the fourth generation of the Watkins' family to own and manage the family farming business. In 1976 Mr Watkins acquired 'Carneddau Farm' from his father and merged it into the existing business. Further expansion of the farm took place in 1991 by the addition of the farming land knows as Gors dyfwch. Over the past decade, farming incomes have declined and this has resulted in a general movement of farmers and farming employees away from the land. In proposing to develop a wind farm on his land Mr Watkins is seeking to provide the farm with a sustainable income while at the same time allowing the land to be utilised, as it has for centuries, for agricultural use. Further, the support provided by the Wind Farm development income will enable traditional sheep rearing to continue in the land above Carno and retain employment within the Carno, Newtown and Welshpool area.

Mr Watkins has, over the decades, been very supportive of local history and the need to conserve cultural and archaeological history on his farm and the local area. Over a number of years he has invited Clwyd Powys Archaeological Trust (CPAT) onto his land to determine the extent of early Welsh habitation on the land above Carno. An excavation was undertaken at Carneddau in the 1990s by CPAT and this revealed a Bronze Age burial mound of great significance; a number of artefacts were discovered at the Site and Mr Watkins placed these on permanent loan at the Powysland Museum in Welshpool. Later in this EIA (see Chapter 14) photographs of the artefacts (Photographed by kind permission of Eva Bredsdorf, Curator, Powysland Museum) can be seen. Mr Watkins has undertaken with CPAT that he will seek to protect, from all sources, the Welsh cultural heritage to the extent that there are a number of identified heritage sites on his land, in order that future generations, who have enhanced scientific ability from that available at present, to be able to undertake in-depth archaeological investigations. These issues are dealt with in depth in Chapter 14 of this EIA.

Mr Watkins' interests also extend to include organic farming, sustenance of the natural environment and the development of renewable energy sources, in order to protect the environment and assist in the reduction of the impact of climate change.

2.4.6.2 Mr Jones

Mr John Jones has lived all of his life in the area around Newtown. Born into a family of 10 children he was brought up on a 50 acre farm. He started buying land from the age of 25 years and acquired land in the early 1980's contiguous with that of Mr Watkins and which now forms part of the proposed ECOCAS Wind Farm.

In earlier years the Government placed significant emphasis on the need to develop farming infrastructure and Mr Jones was a substantial employer in the local area, directly employing 15 people. They were mainly engaged in land drainage and access road works (very useful knowledge when applied to the proposed development of the Wind Farm). This period was during the 1980's but the Government placed increasing emphasis on environmental works in the 1990's and as a result the number of employees reduced substantially. This reduction in employment prospects left Mr Jones with almost no support for his activities on the land he owned. The opportunity to jointly develop a wind farm on his and Mr Watkins' land has enabled him to be reinvigorated in regard to the farming opportunities and to continue his interests in acquiring woodland for sustainable forestry, including broadleaf trees. His woodlands, in total of some 70 acres, mainly to the south west of the proposed Wind Farm is used for preparation of fencing products for sale into the local area and use on his own land. His farming is mainly concentrated on the rearing of sheep and he sells lambs into the local markets, thereby benefiting the commercial activities of the local area and people, including auctioneers, merchants, dealers and drovers and the indirect economic spin-off from this.

It is the proposed ECOCAS Wind Farm development that will allow Mr Jones to sustain his input into the local economy and it cannot be emphasised too greatly that both he and Mr Watkins are committed to the continuing support of this.

Mr Jones has a son and grandson who, it is expected, will carry on the history of family farming. Mr Jones has an interest in environmental methods of farming and is registered under the Tir Gofal Scheme which is administered by the WAG aimed at promoting whole farm conservation

and management, to which he is committed. Further, he is also aware of the need to minimise global warming by the promotion of renewable energy development.

2.4.7 Renewable Energy and Climate Change Overview

Climate change is the greatest environmental challenge facing the world today and there is agreement that one of the main contributing factors is the human influence on the increasing levels of key greenhouse gases (carbon dioxide (CO_2), methane and nitrous oxide). The recent Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) leaves us in no doubt that human activity is the primary driver of the observed changes in climate.

"Human activities ... are modifying the concentration of atmospheric constituents ... that absorb or scatter radiant energy. ... Most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations.".

Global emissions of CO_2 have grown by about 80% between 1970-2004 and emissions of CO_2 from the burning of fossil fuels is responsible for more than 75% of the increase in atmospheric CO_2 concentration since pre-industrial times. At present, just over 7 billion tonnes of CO_2 is emitted globally each year through fossil fuel use, and an additional 1.6 billion tonnes are emitted by land use change, largely by deforestation. Scientists now believe that the changes in greenhouse gases in the atmosphere are what is causing the average temperature of the earth to increase, leading to climate change. Rising global temperatures as a result of climate change will bring about global changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather.

The suggested solution to tackling climate change is a mixture of a reduction in energy consumption combined with a significant switch from a carbon-based economy to a more sustainable economy based on renewable energy. The Energy White Paper 2007, sets out the Government's international and domestic energy strategy to the long term energy challenges including cutting CO_2 emissions by some 60% by about 2050, with real progress by 2020. Wind energy is set to account for 8% of electricity generation by 2010 as it is by far the cheapest of

the renewable energy technologies, already generating electricity at prices that are competitive with conventional thermal power plants and well below those for coal and nuclear.

2.4.8 Renewable Energy Policy in Wales

The UK Government is proactive in establishing a planning environment that stimulates the growth of renewable energy developments. Global climate change has been a driving force for this change as commitments to international agreements aiming to reduce greenhouse gases mean that Governments look towards renewable energy as an initiative to tackling climate change. Renewable energy developments such as wind farms have been determined as a way to achieve these goals and are detailed in a number of national and regional policies which stem from the Kyoto protocol.

The WAG's aim is to secure an appropriate mix of energy for Wales by strengthening its renewable energy production. This forms the basis of the WAG's requirement to provide policies that will underpin their aims and secure the growth of clean energy in Wales by the use of natural resources. The target set by the WAG is for 4 Terawatt hours of electricity to be generated from renewable sources by 2010. This will require 800 MW of additional installed capacity from onshore wind resources, and 200 MW of additional capacity from offshore and other renewables.

The WAG recognises that although the introduction of large structures in the landscape needs careful consideration during planning, the need for wind turbines is now established and imperative as a key to reaching the WAG's targets. There has been much extensive technical work commissioned by the WAG which has led to the conclusion that developments should be actively steered by the land use planning systems to those areas deemed to be the most appropriate for large scale (over 25 MW) developments, referred to as Strategic Search Areas (SSAs) and these areas are set out in Technical Advice Notice 8 (TAN 8) Renewable Energy.

3 Proposed Development

This Section of the Environmental Statement (ES) gives details of the proposed development, the phases of the development and the control and timing over the construction phase of the project. Also addressed is the operational control of the project and the eventual decommissioning, based on the anticipated life of the project being 25 years after installation.

3.1 Project Outline

The ECOCAS Wind Farm will be comprised of 17 wind turbines each of 3 MW capacity with a maximum hub height of 80 m and a maximum blade radius of 45 m, giving an overall maximum height to the blade tip of 125 m. With each wind turbine being capable of electrical generation of up to a maximum of 3 MW, the total output from the Wind Farm will be up to 51 MW, depending on the prevailing wind conditions. The layout of the Wind Farm is shown in Volume 5, Figures 1 & 2. Together, these drawings show the following key elements of the site design:

- Each turbine will occupy an area of ground up to 42 m by 22 m, which includes the foundations of the turbine and crane pad.
- On-site access tracks cover a distance of some 8,440 m and include drainage channels and power and communications cable routes, parallel with the tracks. Culverting and water crossings have been kept to a minimum and the Environment Agency (EA) has been consulted on this. This is further detailed in Chapter 12.
- A temporary, secure, construction area has been identified adjacent to the entrance to the Site which will be used for all site staff amenities, including personnel car parking, mess and toilet facilities and site offices. All deliveries and site movements will be controlled through the facilities and, to be agreed with the Highways Agency, any necessary wheel washing facilities with associated water run-off controls. Some storage will take place within secure facilities, e.g. containers and bunded area, although all major components of the turbines (tower sections, blades, nacelle) will be delivered direct to the turbine locations so as to avoid double handling.

- A substation, using four ring connections, will be used in order to minimise the possible loss of power through cable faults or damage. The detailed substation design will be completed when a connection to the grid has been agreed with interested parties including other wind turbine developers, Scottish Power, Local Authorities and the Welsh Assembly Government (WAG).
- Four Borrow Pits, utilizing existing quarried areas.
- A 70 m high lattice anemometry mast for permanent on-site wind monitoring. The mast layout is shown in Volume 5, Figure 11.

3.2 Site Layout

The overall layout of the Site, including the turbine locations, together with their related site access tracks, electrical site infrastructure and construction support facilities, has been undertaken by IPS using sophisticated software for wind profiling that is operated under licence from Garrad Hassan and the Risø DTU National Laboratory. This evaluation is undertaken over many thousands of iterations, in order to optimise the site layout, taking into account various design components, including the wind resource availability at each proposed turbine position from every point of the compass. The wind resource available at each turbine is determined from wind speed and direction, land contours and surface characteristics (e.g. forestry or grassland). Turbulence (wake effect) results from interaction between each of the turbines and this potential effect is also taken into the iterations in order to optimise the site layout. Some basic parameters input into the model include that no residence should be closer than 700 m to the nearest turbine, that the 'exclusion area' for other turbines be 6 rotor diameters in the direction of the main wind flow and not less than 4 diameters at 90 degrees to this; this results in exclusion areas with an elliptical shape which give main wind resource exclusivity to each turbine. Further, also input into the computer evaluation, in order to take recognition of the possible environmental impact of the proposals, are the proximity of residences, boundaries, water courses and archaeological sites. The generated optimum site layouts were then subjected to detailed scrutiny to determine that no turbines were proposed for location in positions that were detrimental to the local environment and, as far as could be determined at that stage, to any cultural heritage sites or wildlife habitats. Details of any possible

telecommunication and radio interference were also taken into consideration. All of the initial locations required 'micro-siting' and this was initiated by a walkover of the Site during which each proposed turbine location was marked by a wooden post driven into the ground, for fixed reference of any person undertaking a site visit. The turbine locations were identified by GPS with readings taken at tolerances of accuracy not greater than 6 m and the results recorded on Ordnance Survey maps.

As the design progressed, consultation took place with Powys County Council (PCC) planning officers and related organisations, such that no features of the ECOCAS Wind Farm conflicted with any major concepts of the various interested parties. This consultation included a site 'walk-over' on the 20th January 2009 which was attended by Kayna Tregay, Nichola Tomlinson and Paul Williams from the EA, Ken Perry from CCW, Steve Packer from PCC, IPS staff, and the landowners Messrs Watkins and Jones. IPS provided detailed mapping of the proposed individual turbine positions and access tracks and on the visit all proposed turbine locations were visited and discussed. This included taking into consideration whether the locations were suitable for the turbine and the overall impact that the turbine and access tracks may have at the Site. Where appropriate, the Officers suggested how turbine locations and access tracks may be modified to cause minimum effects to water courses and other geographical features. For example, turbine number 4's access track in its initial design included a 'double crossing' of a water course and this, following detailed consideration, was able to be modified to a single crossing and this was incorporated into the revised site design. All of the Officers' suggested modifications were later reviewed and modifications were made to the design in order to embrace their suggested design amendments. As the Site contains some cultural heritage aspects, this was specifically addressed on the visit and the possible impact on some Bronze Age 'cairns' was discussed. The various issues relating to all environmental issues, including possible ecological and cultural heritage impacts are dealt with in depth in the particular Sections and Reports contained within this ES.

It is evident from the map of the Site (see Volume 5, Figure 1) that the Wind Farm design has been undertaken with the overall design being of paramount importance, but having regard to all the environmental constraints of the Site. The Site is compact and the turbine positions are optimal in terms of maximum use of available wind. This has been possible because of only two landowners being sponsors of the development (and one other landowner being involved).

Other wind farm designs that we have reviewed seem to have been compromised by the need to meet the requirements of individual landowners which has resulted in a 'sub-optimal' layout because of the need to placate particular land-owning participants. This is not an issue in the ECOCAS development where participants have been kept to a minimum while at the same time seeking to exploit all of the available wind resource by means of deploying the most suitable number and capacity of turbines.

As development of the Site progresses it may be necessary to 'micro-site' particular turbines and associated services and we propose that planning approval permits micro-siting within (+) or (-) 50 m of the locations shown in Volume 5, Figure 1. Such measure is the typical tolerance used by wind farm developers, as reported in the correspondence with DECC (see Volume 4, Appendix 4, Page 11.1) although it is for individual developers to justify the distance they apply for.

3.2.1 Project Design Evolution

It is recognised that during the development of any project modifications are made to the original concepts as internal and external forces are identified or arise. The initial approach was by the landowning sponsors Messrs Watkins and Jones. The area of land that had been identified by them as a potential Wind Farm Site was self-selecting in that the land is within the TAN 8 Area and there was already a wind farm on the opposite side of the valley, namely Mynydd Clogau. The ECOCAS Wind Farm has been designed from the outset to take into consideration the possible impact on the environment, whilst at the same time seeking to maximise the use of the available wind resource within the landowners' property. Initially it was contemplated that more than the two initial farm owners would be interested in pursuing development of a wind farm in the Carno Area and a number of farmers were approached by Messrs Watkins and Jones to join a 'consortium'. A number of farmers did express an interest and initial discussions took place with a number of them. However, as these discussions progressed, it became evident that as the number of interested parties grew, the ability to meet all of their desires and needs was increasingly difficult and it was decided to constrain the number of active member farmers to Messrs Watkins and Jones themselves but with one other farmer as a contributor of land (in respect of one potential turbine on his land – contiguous with the land proposed for development). Messrs Watkins and Jones therefore agreed to meet all of

the costs of evaluation of a wind farm including all studies and reports, costs of preparation of all documentation and planning application costs.

On the 9th October 2006 IPS received a response from the Department of Trade and Industry (as it then was) to their letter dated the 28th September 2006 which requested an initial scoping opinion under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations ('the 2000 Regulations'). In this response the DTI identified that they had copied IPS' letter to appropriate consultative bodies identifying the proposal for a 63 MW wind generating station at Esgair Cwm Owen Uplands South. This capacity is equivalent to 21 wind turbine with individual capacity of 3 MW and their location is shown in Volume 4, Appendix 2, Figure 1. At that time, four landowners were involved in seeking opinion on applying for permission under Section 36 of the 1989 Electricity Act. However, on enquiry from the DTI it was determined that the only applications that could be submitted under Section 36 of the 1989 Electricity Act had to be for contiguous plots of land. As a result of this, three of the turbines originally identified in the scoping opinion request were eliminated from the wind farm design. It is emphasised that the design of the remaining wind farm was not compromised in any way by the exclusion of these three wind turbines; the only reason for the inclusion of these three had been that they were also proposed for inclusion on land in the ownership of Mr Watkins in an area north of the major proportion of the Site.

The above resulted in a potential wind farm of 18 wind turbines, each of a capacity of 3 MW, corresponding to a total capacity of 54 MW. This intermediate layout is shown in Volume 4, Appendix 2, Figure 2. Subsequently one of the landowners decided that he did not wish to proceed with the proposed wind turbine on his land and this reduced the 18 wind turbine to the final design of 17 turbines, each with a capacity of 3 MW, resulting in a 51 MW wind farm. The removal of this one turbine did not in any way affect the overall design of the wind farm as it was the most easterly of the planned turbines and leaves a wind farm which is compact and well structured in terms of exploiting the available wind resource.

It can be seen from the above that the original design has not been compromised as each of the modifications from the original layout was in relation to turbines at the margin of the proposed development. Moreover, the final layout of the wind farm is considered to be optimum in terms of its visual impact and this can be clearly seen from the photomontages

determined by using the viewpoints suggested by the Countryside Council for Wales (CCW) and PCC.

It is emphasised that consideration has been given at every stage of the design and development to the impact on the environmental, ecological and cultural heritage elements. In addition, during the above period of evolution of the project, consultation has taken place with all the interested parties, such that any modifications have been made to embrace each of the consultees specific concerns or requirements. Among these were modifications to the access tracks and water course crossings. Further, the design has been specifically undertaken to minimise the impact of, for example, noise, by using sophisticated software to exclude areas of sensitivity and to minimise the possible disturbance at the boundary of the proposed development.

Studies relating to all aspects of the environmental impact of the development have been undertaken and in the few cases where these were determined as being significant, due regard and modifications have been made to the infrastructure of the Site.

In conclusion, it can be seen from the above that during the evolution of the design of the proposed wind farm development regard has been given to all aspects of the possible impact of the development and modifications made as necessary, while at the same time seeking to maximise the electricity generation from the available wind resource.

3.3 Wind Turbines and Their Installation

A major component in the design of a wind farm is the decision on the type of turbine to be installed. There are natural conflicts between the physics of wind utilisation and the impact that they may have on the environment. For example, height (altitude) and wind speeds are correlated, therefore, the higher a wind turbine the more wind resource it will be able to utilise. It therefore figures that a wind turbine should be as high as possible but low enough not to have a significant impact on the environment. The area of land available for development by the ECOCAS Wind Farm is predominately upland grazing with intermittent blocks of coniferous and mixed woodland parcels, including, to the east of the Site two commercial forestry plantations Bryn yr Ysbyty and Cryniarth. To the south of the Site lies Garreg Hir and two lakes, Lake Llyn Mawr, which is a Site of Special Scientific Interest (SSSI) and the Llyn Du Lake.

The landscape to the south has a distinctive pattern of a rolling and undulating landscape into the valley bottom. The northern part of the Site is primarily open upland grazing with intermittent streams whilst to the east of the Site views are dominated by the Mynydd Clogau Wind Farm. This landscape profile gives significant protection from the turbines impinging on the view from local and more distant urban conurbations e.g. Carno, Newtown and Welshpool. It is believed that the balance between visual & environmental impact and the need to extract the maximum potential electrical output from the wind resource has been met in the selection of appropriate turbines. Although the eventual make and type of turbine will need to be made following planning approval, the application is based on using 17 Vestas V90 machines with an 80 m height to hub with a blade radius of 45 m, giving an overall height to the blade tip (when one of the blades is in the vertical position) of 125 m. There is very little difference in the aesthetic appearance of various modern wind turbine designs and this application is made on the basis of the overall tip height of each turbine. The environmental impact of the Wind Farm is of course dealt with throughout the ES.

A drawing of the indicative turbine model, the Vestas V90 is shown in Volume 5, Figure 12 and the full specification of this Vestas machine is included in Volume 4, Appendix 1 so that the various components, operation and performances parameters of a typical turbine can be consulted as required. However, a number of key operational and performance details are given here which are believed to be significant in terms of appreciation of the turbine function. The blades will rotate at between 8.6 and 18.4 times per minute depending on the wind speed, in order to give optimum electrical generation output. The blades will only rotate when the wind speed reaches 3.5 m per second (m/s) and will cut out at greater than 25 m/s, in order that the turbine is not damaged.

It is normal for the turbine and blades to be light grey in colour in order to give the best overall appearance against most landscapes and in various weather conditions. However, if required, the planning approval could be conditioned to specify a colour or colours that are considered appropriate, following full consultation with all interested parties.

3.4 Wind Turbine Foundations

The typical design of the wind turbine foundations are shown in Volume 5, Figure 2. To the extent that geotechnical surveys reveal a need, it is possible that some piling may be necessary, although not expected. Evidently this will be kept to a minimum, as a result of the need to minimise ground disturbance, ecological impact and cost, all within the bounds of the need to produce a safe structure. The foundations, as shown, will be up to 20 m by 20 m and between 3 and 4 m in depth which will be dependent on the load bearing quality of the underlying strata. Because the Site is elevated it is not considered necessary to form a 'plinth' around the base and the turbine tower will stand at ground level.

3.5 Crane Pads and Wind Turbine Erection Process

Depending on the methodology recommended by the eventual Wind Turbine Supplier, either one or two crane pads will be necessary, on which to stand the cranes that will lift into position the various wind turbine major components. The crane pad plus the wind turbine foundation will typically be some 42 m long by 22 m wide, or 66 m long if two crane pads are necessary. These dimensions and plan of the crane pads plus wind turbine foundations are shown in Volume 5, Figure 2. The major component of a wind turbine is the tower which, for the Vestas V90 is steel, made up of four tubular sections. These are transported to the Site as separate sections and constructed on-site using a crane or cranes to construct the complete tower. The maximum size of a tower section is 23.3 m and weighs some 30 tonnes. The second major component, in terms of its order of handling, is the nacelle. The nacelle is the 'box-like' unit which is attached to the top of the tower; the dimensions for a Vestas V90 nacelle is 9.65 m long by 4.05 m high and 3.6 m wide and weighs some 83 tonnes. The nacelle performs two major functions; it carries the hub to which the turbine blades are attached and contains the drive shaft mechanism which is attached to the electricity generator. The final major components are the 3 blades, this number of blades now being almost standard for modern large turbines.

3.6 On-site Tracks and Services

The entry to the Site is from its western boundary, adjacent to turbine 3. This entry forms a 'T' Junction with the roadway coming up from Carno which is dealt with as part of the off-site route shown as a separate section at Chapter 5 of this ES. Both evaluations, of the off-site and on-site routes, design and layouts, together with associated service areas and wind turbine foundations have been undertaken by Entec UK Limited (Entec), one of the Country's largest environmental and engineering consultancies. Entec have also been responsible for evaluation of the site hydrology. As a result of this in-depth involvement in the Project design they have had available, in-house, the major elements that would determine on-site track design requirements. The basis of the design has been to keep the on-site access route to a minimum length while utilising best practice regarding determining that the route is suitable for all purposes, including delivery of the turbines to the Site and the long term maintenance of the equipment and associated facilities on the Site. Further, the design has also embraced mitigation of all of the possible environmental problems that may be associated with such a development including water courses and crossings, avoidance of sensitive areas and known cultural heritage sites within the Site boundaries. The complete length of the access tracks, including existing tracks, is 8,440 m for a wind farm of 17 turbines. This is equal to 496 m per turbine, thereby minimising the impact of access tracks construction. This is emphasised because the sites with similar capacity turbines, with which we are familiar, have average access routes of between 550 m to 690 m per turbine. The ECOCAS Wind Farm low access route length is synonymous with the compactness of the Wind Farm itself which, by its very design, has a low overall environmental impact relative to maximum electricity generation capacity.

Wherever possible, existing tracks have been utilised as the route through the Site and new dug tracks have only been proposed where it was not possible to gain access otherwise. The complete track layout of the Site and associated services are shown on the map in Volume 5, Figure 1. It can be seen from the map that steep gradients have been avoided by planning that the tracks follow natural contour lines. Details of the gradients are shown in five 'Transect' plans, covering the whole track route, at Volume 5, Figures 3-7. This is important in order that laden delivery vehicles are able to cope with any of the gradients determined along the planned on-site route to each turbine and associated facility. It is expected that the on-site

access tracks will remain and be maintained by the operator throughout the estimated 25 year life of the project. In addition to the service they provide to the Wind Farm the tracks will enhance the access for farming activities in the area. It may be necessary, as for the wind turbines themselves, for some micro-siting of the path or positioning of the on-site access tracks. This will be kept to a minimum and it is proposed to adopt +/- 30 m as the maximum allowable change to any point on the track. This may be essential in order, for example, to avoid unknown archaeological sites or to take account of previously unidentified environmental factors.

Material for building the on-site tracks, crane pads and any hard standing in the Site compound will be obtained from the identified borrow pits (see Volume 5, Figure 1). It is not expected that any road-building stone will be transported into the Site. The borrow pits are established quarried areas within the Site and photographs of them and their positions are shown on the map at Volume 5, Figure 1. The photo below, a close-up of borrow pit 3, shows the quality of material available on-site for road-building purposes.

The need for culverts has been kept to a minimum by careful planning of the access route to each of the turbines. The initial route design has been modified by associating the hydrology study completed at the Site with the proposed route and by site visits to take into consideration the detail of the access approach to a particular turbine location. In some cases, this has meant designing the access route to form a 'spiral' to follow the contour lines thereby avoiding the need to cross, or double cross, a water course. In addition, the design has taken into

account the need not to divide drainage basins by bisecting certain areas with the access track. The EA UK guidance on managing the water environment (The Water Environment, Chapter 11) has been taken into consideration. EA representatives attended the Site to review the ECOCAS proposals on the 20th January 2009 and minor modifications to the design were made to embrace suggestions made by them. A detailed peat mapping exercise will be required before construction begins on the Wind Farm to establish an accurate depth profile for the areas of peat across the Site. The survey will focus on those areas near the proposed turbines and access tracks to determine where floating tracks will be a more suitable alternative to dug tracks. A cross-section drawing of the 'Proposed Floating Track Construction' is shown in Volume 5, Figure 2. Natural drainage paths in these sensitive areas of peat will also help to avoid the isolating or drying out of any areas of the peat. Other drainage and possible mitigation measures to avoid the disturbance of peat is detailed within the Hydrological assessment that was also carried out by Entec and their report can be seen at Volume 4, Appendix 8.

3.7 Associated Facilities

In addition to the on-site access route, the map at Volume 5, Figure 1 identifies the position of the associated facilities, namely the electricity cabling route & substation, borrow pits, a site compound and a meteorological mast. These items are dealt with individually below.

3.7.1 Electricity Cabling and Substation

The Vestas V90 turbine will operate at 1000 volts. Each turbine will contain, within the turbine tower base, a transformer to increase the voltage to 33 kV for input into the site electrical substation from where it will be exported onto the Grid. The on-site electricity cable route is shown at Volume 5, Figure 1 and a typical cable trench, which is typically adjacent to the access track is shown at Volume 5, Figure 2. From the trench detailed drawing it can be seen that, in addition to the electricity cable, a fibre optic cable is included in the design for control and communications purposes. The initial design concept for the electrical cabling is for four rings of 11/33 kV cable, three rings each covering 4 turbines and 1 for 5 turbines; the reasoning underlying this is that in the event of cable failure or damage the risk of total loss of electrical

output is significantly reduced. Because of the compact nature of the ECOCAS Wind Farm wind turbine layout and the lack of contractual risk, normally associated with multiple landowner wind farm projects, it is not necessary to cable back each turbine independently to a central substation. It is estimated that some 23,300 m of cable will be used. The location and detailed design of the on-site substation is dependent on the location of the off-site connection point which has not yet been determined.

3.7.2 Connection to the Grid

At present there is insufficient electrical line capacity in the Carno area to export the estimated electricity output (51 MW) of the ECOCAS Wind Farm onto the grid. Enquiries were made of Scottish Power (SP) as to the capacity available and the only line capacity available (30 MW), for wind farm development in the area of land under consideration, had already been taken up by another developer in relation to their proposed wind farm above Carno. Offers were made to this developer to share this capacity, such that both parties could commence to exploit the wind resource above Carno, however this was rejected by them.

As a result of the lack of electrical line capacity, SP proposed that all parties intending to undertake wind farm development in the area which includes that north of Carno were invited to subscribe to a study to be undertaken by SP to evaluate the prospect of installing new major electrical infrastructure capacity. Messrs Watkins and Jones contributed their share of the Study and as a result received an invitation by SP to sign an agreement to subscribe to a connection, together with all other contributors to the Study. In practice, this Agreement was incapable of being signed by any of the contributors to the SP study as the contractual obligations were so onerous that no individual developer could have signed the document. In particular it required that each party undertake 'joint and several liability' for the whole connection. It is evident that each signatory could not be exposed to such a risk, as the individual liability could ultimately have been for tens of millions of pounds – an impossible proposal. It is evident that intervention is needed at either WAG or National Government level, in order to 'unblock the chicken and egg' situation that exists in the Powys Area regarding wind farm developments. For example, if approvals for wind farms are not given because of the lack of Grid capacity then the Grid will not be constructed, because of the risk of providing an electrical outlet with no developments in place. The 'gridlock' therefore needs to be broken

such that wind turbine developments can proceed with the sure knowledge that the electricity generated can be put onto the Grid. It would appear that Government intervention is almost certainly needed.

3.7.3 Borrow Pits

The four borrow pits identified in the on-site track layout map at Volume 5, Figure 1 will have dimensions approximately 80 m long by 40 m wide with an average depth of 3 m. Grading of exposed pit faces will be under strict control in order to produce a safe working environment. Based on the pit dimensions, which are able to be modified as detailed design progresses, the total material available from them is estimated at up to 38,000 cubic metres. With cut and fill materials for the on-site tracks being in the order of 10,000 cubic metres and allowing for additional materials for the construction compound and crane pads, possible back-fill of wind turbine foundations, the volumes available from the borrow pits are completely adequate. This, together with the ability to 'swap' unsuitable materials from the tracks to the borrow pits, means that all on-site rock needs can be met without the need to resort to any external rock supplies. To the extent that a quantity of some specialist materials e.g. soft or sharp sand will be required, then a small number of deliveries would be required, but would only represent a small proportion of total lorry or earthmoving volumes taking place within the Site boundaries. This means that there will be no local highway journeys needed for delivery of bulk stone as it will all be sourced and graded, as necessary, on-site. As far as possible, fine grade materials, resulting from rock grading at the borrow pits, will be used as a substitute for sand to backfill the cable trenches, however, this will be determined at the detailed design stage with the agreement of the electrical infrastructure contractor. Any top-soil that is removed in excavations will be retained separately for reuse as determined for 'capping' or for restoration of, for example, some or all of the construction compound back to agricultural use.

3.7.4 Site Construction Compound

Local management and control of the Site, including control of staff and vehicles entering and leaving, will take place within the construction compound. Planned for minimum environmental

and visual impact, but suitably located for operational and safety requirements. As shown on the map at Volume 5, Figure 1, it will be situated adjacent to Site entrance, near borrow pits 3 and 4 from which material will be directly extracted to form an area of hard standing (unless the underlying strata is adequate); its dimensions are some 150 m in length and variable width, from 40 m on one side to 80 m on the other. Suitable channels and soak-aways will be constructed such that there is not an uncontrolled flow of surface water across or from the Compound. The complete Compound will be surrounded by a bund wall of earth, with lockable vehicle wide access gates. The Compound will be manned at all times by suitable personnel in order to guarantee site security and of the Compound itself. The movement of vehicles will be controlled by a security cabin at the Site entrance and vehicles will be split into two flows – in and out of the Site – in order to protect both the site security and traffic flow at the most critical part of the Site. All the personnel will be required to wear an identification badge which will be signed for and obtained at the security cabin. Permanent staff that is, for example, the site manager and engineers, will be provided with permanent identification badges. Smoking will only be allowed in an area specifically designated for the purpose and excluded everywhere else on the Site. The provision of power and communications facilities will also be required to be included in the detailed design process.

The Compound will comprise a laydown area for storage of materials, a vehicle parking area (for both operational and employee vehicles) will be required as will a vehicle turning circle and refuelling station. If deemed necessary, in detailed design consultation, wheel washing facilities including water settlement tanks and bunding will be provided. Also within the facility will be 'Portakabin' type office accommodation with messing and toilet facilities adequate for the numbers of people employed on the Site at any time. Secure storage containers will also be required to be located in the Compound, as will a number of portable toilet units for placing at appropriate locations around the area of construction operations e.g. some of the planned wind turbine locations.

It will be the responsibility of the construction contractor (or contractors) to determine the detail of the layout of the facilities within the area designated and agreed for the Compound location.

3.7.5 Anemometry Mast

It is proposed to install an anemometry mast, as indicated on the map at Volume 5, Figure 1. The purpose of the mast is to continuously make data available for off-site evaluation in order to monitor the performance of each turbine in the prevailing wind conditions, against the manufacturers' design performance and compared with the original viability assessments for the Wind Farm.

It is proposed that the micro-siting of the mast will be under the supervision of an ecologist on the Site such that the foot of the mast does not affect the ecology of the area or impinge upon any wildlife habitat or hydrological feature.

The mast will be a lattice-type mast, 70 m high and with a triangular base as shown in Volume 5, Figure 11. The sensors, attached to booms at agreed heights, comprise anemometers and wind vanes, while a data logger will provide the data acquisition facility and the wireless connection to a base station. The lattice mast access ladder will be located such that anyone accessing the mast for maintenance or installation purposes will, for health and safety purposes, be looking away from the sun, that is facing north. Notwithstanding that the Site is intended to be under continuous security monitoring, the lattice mast will be enclosed within its own secure area comprising anti-climbing fence and lockable gate. Because of its lattice-type structure, no anchors/stabilising ropes will be needed for the mast, and its base will cover about 49 m^2, thus giving minimum disturbance in terms of footprint.

4 Construction, Operation and Decommissioning

4.1 On-site Activities and Construction Programme

4.1.1 Construction Programme

It is estimated that the ECOCAS Wind Farm will take 12 months to construct. The early phases of the on-site works can be commenced before all delivery route road modifications are completed, for example the construction of and establishment of all facilities at the site construction compound can proceed as modifications to external roads are completed. A flow chart of the on-site construction programme is shown in Table 4.1.

Activity/Month	1	2	3	4	5	6	7	8	9	10	11	12
Build & Establish Construction Compound												
Construct Access Tracks												
Construct Drainage & Cable Channels												
Prepare Foundations & Erect Anemometry Mast												
Excavate & Build Wind Turbine Foundations												
Install Wind Turbines												
Install Electrical & Comm's. Cabling												
Build Substation												
Connect to Substation												
Commissioning												
Ongoing Site Restoration												

Table 4.1 Construction Programme

The intention would be to complete the Wind Farm within a 'phased' building programme such that the Site is brought into production as soon as generating capacity is available from each of

two sections of the Wind Farm, comprising 8 and 9 wind turbines respectively. As can be seen from the above programme, after seven months, it is expected that approximately 50% (8 of 17) of the wind turbines will have been erected and all services, including electrical connections to the substation completed, such that commissioning of these can take place. The intention of a phased programme is to achieve two main objectives, namely to seek to minimise both the traffic impact on the highways and ecological impact on the Site. At the same time this produces a significant benefit both to the WAG target for renewable energy production as early as possible.

Each turbine will take no more than four days to assemble and erect, depending on weather conditions, including there being sufficiently low wind speeds for safe handling and lifting. The detailed timing of delivery and construction of the turbines will depend upon the manufacturing and delivery programme of the wind turbine company selected as the supplier. The timetable of deliveries can be influenced by many factors, including the total numbers of wind turbines on order and the manufacturing capacity of the selected supplier, all which will need to be taken into consideration within the overall selection process and detailed project development programme.

4.1.2 Working Hours

It is proposed that construction will only take place over the 12 hours 7am to 7pm on weekdays, Saturdays from 7am to 2pm, with no construction taking place on either Sundays or Bank Holidays. If it is considered essential to operate outside of these hours because particular operations once started having to be completed, for example, the lifting and securing of wind turbine components into position, then advanced authority will be sought from the local authority - Powys Planning Department.

4.1.3 Procurement

The Developers and their Contractors will ensure that, wherever feasible, they will seek to obtain supply from local sources. Local suppliers and contractors will be invited to indicate their interest in being included on a list of suppliers who wish to be approached for supply of materials and services to the Site.

4.1.4 Personnel and Training

The number of permanent staff on the Site will vary according to the activities in progress but would not be expected to exceed 30 people at any time. Adequate facilities will be provided for such a number. However, there will be a 'core' staffing level at the Site in order to maintain security and to provide basic services relating to the management and safe operation of the Site. The basic staffing will comprise the following (but may be varied as required in accordance with possible changed circumstances):

- Site General Manager
- Project/Administration Manager
- Environmental Manager
- Civil Engineer
- Electrical Engineer
- Commissioning Engineer
- Health and Safety Officer
- Security Officer
- Office Administrators
- Catering and Cleaning Staff

The above Managers and Officers will be responsible for control of their particular function at the Site and their responsibilities and authority will be defined in writing with them before they undertake any of their duties. Also, each of them could be expected to have at least one member of staff directly responsible to them and, for the Security Officer, the number of staff required will be determined by the shift patterns that are agreed and the degree that patrols may operate over the Site. The above does not include Contractors employees who will attend the Site as and when their particular expertise and work input is required; these would include, but not necessarily be limited to the following:

- Supervisors and Foremen
- Lorry Drivers
- Earthmoving Operatives
- Crane Operators
- Welders
- Steelwork Fitters
- Electrical Fitters (LV and HV capabilities)
- Bricklayers/Plasterers
- Labourers
- Joiners

All personnel and contractors who enter the Site will be required to undertake an induction process before they commence working (and may be undertaken some days before they enter the Site). The induction process will be made up of two basic elements, the first, an overall briefing on the rules and regulations under which all personnel will operate on the Site, including Health and Safety requirements, environmental obligations and their conduct while on the Site. Secondly, specific personnel will receive briefings related to their particular functions for which they have responsibility, for example, crane operators will be briefed by suitably qualified staff on the Site/Contractor's requirements regarding safe load handling and lifting; catering staff on food handling and hygiene; lorry drivers on the Site rules for loading, unloading and manoeuvring, etc. of vehicles. Furthermore, all the drivers accessing the Site will receive laminated pocket size maps of the Site identifying danger areas or requiring specific instructions for vehicle movements. Certain of the permanent personnel will be selected to receive additional training (unless already certificated) on First Aid and suitable contacts will be established with local doctors and hospital such that they are aware of the activities taking place on the Site and the maximum number of personnel likely to be working at any time. The need for any specialist medical facilities at the Site will be addressed by the Health and Safety Officer and the equipment (e.g. defibrillator) and location, made known to all personnel. In

order to facilitate helicopter evacuation or rescue, an area at each end of the Site will be identified where a helicopter could land, weather permitting.

4.1.5 Construction Method Statement

Prior to construction commencing, the main contractor together with the Sponsors, or any engineering and management representatives appointed by them, will produce the required series of Construction Method Statements. These Statements will contain outline methods and procedures that are intended to be used during all phases of the construction of the ECOCAS Wind Farm. The Statements will be prepared taking full account of the matters determined in preparing the Environmental Management Plan (see Section 4.2.2 below), Construction Site Safety Plan and the requirements of the Construction Design and Management Regulations (see Section 4.1.7 below). It is proposed to present to Powys County Council (PCC) the Construction Method Statements for approval prior to construction work commencing.

4.1.6 Environmental Management Plan (EMP)

As for the subsequent operational phase of the project it will be necessary to have in place an EMP. It is acknowledged that it will be primary to the formulation of the EMP that any conditions placed on the approval of the ECOCAS Wind Farm will be embraced within the EMP during the construction period. Further, all statutory requirements, guidelines and good practice will also be embraced by the EMP such that the construction of the Wind Farm is managed, operated and maintained under strict control. Full collaboration with the local authority will take place regarding the EMP proposed to be put in place and the need for its continuous revision, in order to embrace any changes relating to statutory amendments, changes in working practices or guidelines, reassessment of risks and possible mitigation measures.

Further, all construction personnel will be required to comply with the EMP and will be trained accordingly. An official will be appointed and will be responsible for the Environmental Management of the Site and for the implementation of the EMP during the construction period.

4.1.7 Safety

It is the intention to put in place comprehensive management of Safety issues on the ECOCAS Wind Farm Site in the form of a Construction Site Safety Plan (CSSP) using suitably qualified safety specialists to prepare the Plan, in order to meet the highest standards of safety and good working practices during construction and continuing into the operational phase of the Project.

In addition, the Construction (Design & Management) (CDM) Regulations 2007 will also be fully implemented on the Site in order that the health and safety requirements are fully met for the life of the Project. The CDM will be a comprehensive document and a summary of the requirements that will be covered by it are given below. The Regulations define the Parties to the CDM and identify their roles within it. Further, standard documentation is also defined in the Regulations. The main sections of the CDM are:

- Project description and timetable
- Client considerations and management requirements
- Environmental restrictions and existing on-site risks
- Significant design and construction hazards
- The health and safety file

Within the above broad headings the document will be required to give detailed information as required by the Regulations. An example of the content that it is intended to include in a CDM for the ECOCAS Wind Farm is as follows:

- Project description and timetable
- Location, project description, key dates
- Duty Holders: Client, Designers (including possibly the Developer themselves, Principle Contractor, e.g. Vestas and other significant contractors with design input)
- CDM Co-ordinator
- Existing records (including maps, layouts, etc.)
- Client considerations and management requirements

- Arrangements for planning and managing construction work, including safety goals for the Project (No construction to commence until it is confirmed that a Construction Phase Plan is sufficiently developed)
- A communications and liaison representative will be nominated for contacts between the Developer and others
- Security of the whole Site will be defined and put in place
- Welfare provisions will be made, e.g. clean toilets, potable water, welfare facilities
- Health and Safety requirements including prevention of unauthorised access, control of access by signing in and identity badges at all times while on-site, induction procedures for all personnel
- Permit to Work procedures to be in place, including lock out procedures relating to sensitive areas including medium and high voltage locations
- Fire precautions including a Fire Action Plan to be in place, e.g. including muster points and roll call procedures
- Emergency procedures and means of escape should include nearest hospital details, route from Site to hospital and first aid personnel and kit
- Site rules will be defined including, for example, Site working hours, no smoking areas, parking restrictions, control of noise and dust, exclusion of radios and mobile phones (other than authorised), no lone working, no impeding of fire access routes, need for weekly liaison meetings of Site staff supervisors
- Environmental restrictions and existing on-site risks
- Safety hazards to be identified including showing on the Site layout maps, boundaries, access and hazardous terrain or ground conditions; method of checking delivery vehicles for Site suitability, weight, height, length, width; also, waste collection, handling and storage restrictions, methods of storage of hazardous materials and equipment including bunding of structures (e.g. integral wind turbine transformers) and oil and fuel storage tanks

- Health hazards to be identified including storage of hazardous materials, contaminated land, Site activities e.g. traffic and pedestrian movements
- Significant design and construction hazards
- Design assumptions and control measures will be such that they conform with the Developers requirements, all electrical connections will be undertaken by specialist personnel who will follow lock out/tag out procedures and carry relevant competency cards
- Weights of equipment will be identified and safe handling systems applied with minimum manual handling
- Working at heights to be kept to a minimum and where unavoidable, safe working systems to be put in place
- Safe systems of working to be put in place relating to plant installation and future maintenance
- Hot works, including steel cutting and welding to be minimised and where unavoidable, safe working practices determined
- Materials and actions that require particular precautions relate to HV and MV electrics, steel erection, craneage of wind turbine components including tower, nacelle and blades

4.1.7.1 The Health and Safety File

The 2007 CDM Regulations require that the Principal Contractor, in association with the CDM co-ordinator identifies the input required of all of the contractors engaged on the Site for inclusion in the Health and Safety File and implements an effective management system by which such information is promptly provided to the CDM co-ordinator for preparation of the overall Health and Safety File. This will include:

- A brief description of the work carried out
- Residual hazards and how they have been dealt with
- Key structural principles incorporated in the design of Site structures
- Any hazards associated with materials used

- Information regarding the removal or dismantling of installed plant and equipment, for example lifting arrangements
- Health and safety information about equipment provided for cleaning or maintaining the structures
- The nature, location and markings of significant services, including fire fighting services
- Information and as-built drawings of the structures, plant and equipment
- Disposal of waste materials for either recycling or removal to a licensed waste management site and detailed handling and storage requirements of hazardous waste.

4.1.8 Vehicle Movements

As detailed in the Outline Traffic Management Plan (OTMP) contained in Volume 4, Appendix 3A, a comprehensive Traffic Management Plan (TMP) will be compiled based on discussions with PCC and other interested bodies, including Powys Police Authority.

Typically the TMP will give details and seek approval of a proposed route of travel for abnormal loads accessing the Site. When considering the most suitable route, the contractor will be required to refer to the Off-Site Access Study and Outline Traffic Management Plan (see Volume 4, Appendix 3A), where route by route investigation for abnormal loads has been carried out. The same Study also shows instances where highway improvement works and traffic management are likely to be required.

The TMP will also include details of preferred routes to be used for general construction traffic travelling to and from the Site. To enable these discussions to be carried out, the contractor will need to have a clear understanding from where materials, other than those available on Site, are to be sourced.

As discussed in the ES, the impact of the timing of deliveries has been evaluated. However this will require revisiting when all elements of the development and input from all interested parties are known. In particular, consideration will need to be given to wide load movements and the need for temporary road closures.

Dilapidation surveys should be required at the start and end of the construction programme and

at quarterly intervals during the construction phase, to assess any damage to the highway on the access routes caused by development traffic. This would be carried out by an independent engineering consultant in conjunction with PCC. Any damage to the highway considered to be of an unreasonable level would be repaired by or funded by the developer.

A passing places/lay-bys study has been undertaken and is shown in Volume 4, Appendix 3A, Figure 4. It would be necessary to embrace these detailed assessments in the evaluation of traffic movements as to be contained in the TMP.

4.2 Operational Period

4.2.1 Introduction

It is expected that operation and monitoring of the ECOCAS Wind Farm will be undertaken remotely. However, with the sophisticated monitoring systems that are now available, assurances can be given that no aspect of the operation or control of the Wind Farm will be neglected. In addition to the continuous monitoring, there will be periodic visits by qualified supervision and maintenance staff who are expected to be under contract from the wind turbine suppliers. Before operations commence, an Environmental Management Plan (EMP) and Safety Plan (SP) will be put in place.

4.2.2 Environmental Management Plan (EMP)

It is acknowledged that it will be primary to the formulation of the EMP that any conditions placed on the approval of the ECOCAS Wind Farm will be embraced within the EMP and within the operating, control, monitoring and reporting structures contained within it. Further, all statutory requirements, guidelines and good practice will also be embraced by the EMP such that the operation of the Wind Farm is managed, operated and maintained under strict control. Full collaboration with the local authority will take place regarding the EMP proposed to be put in place and the need for its continuous revision, in order to embrace any changes relating to statutory amendments, changes in working practices or guidelines, reassessment of risks and possible mitigation measures.

4.2.3 Safety

Safe operation of the Wind Farm, the safety of its personnel, visitors and the general public are of primary importance. Key to management of safety will be:

Preparation of a Safety Plan (SP);

The undertaking of a Health and Safety Risk Assessment; and

Identification of personnel training needs and implementation.

The above will include, but not be limited to:

Monitoring and management of personnel and vehicles on the Site;

Electrical safety throughout the Site including strict management of personnel accessing High Voltage equipment (a permit to work system will be employed for all maintenance staff);

Fire control methods and equipment availability, including fire service consultation;

Security systems, processes and equipment, including locking of all electrical infrastructure buildings and turbine towers, in order to protect the integrity of the Site and anyone on it; and

Determination as to whether any of the wind turbines are likely to overfly public footpaths or bridleways and remedial micro siting as necessary.

In addition, it is now accepted that all industrial sized wind turbines will be fitted with fail-safe braking, blade icing monitoring and stop mechanisms, together with over-speed and high wind speed protection. Also, as mentioned earlier, the wind turbines will be continuously monitored and controlled remotely but with an engineer attending the Site as required, to oversee any actions that may require physical intervention.

4.2.4 Personnel

As stated above, the Wind Farm will be remotely monitored and there will only be a small compliment of staff visiting the Site under normal operation. However, routine maintenance functions will be required to be undertaken throughout the life of the Wind Farm and some technical input, together with environmental issues that arise will need specialist input. It is therefore expected that there will be some employment created for:

Site general maintenance and upkeep, e.g. on-site access tracks, culvert and drains cleaning, etc.;

Lorry Drivers, for general transport and deliveries;

Mechanical, Electrical and Instrumentation Engineers, for wind turbines and electrical infrastructure maintenance; and

Ecological/Environmental Experts for monitoring and control.

4.3 Decommissioning

The ECOCAS Wind Farm is planned to have an operational life of 25 years. After this period, either the turbines will be decommissioned, dismantled, removed, and the Site reinstated, or a further Section 36 (or such application as is then required) be submitted in order to retain or replace the wind turbines. Because of the lead-time on this it could reasonably be expected that consultation would need to commence some 2 years before the end of the 25 years of operation.

The full costs of decommissioning and reinstatement will be met by the owner of the Site and it would be normal for them to provide an independent financial instrument (e.g. bond) in order to ensure that funds are available to undertake the actions required.

As for the operational period, the decommissioning will take place with full consultation on the environmental and safety issues with the appropriate Authority.

The decommissioning of a wind farm is not normally regarded as onerous, either in terms of the physical removal of the equipment or its impact on the environment or traffic flows. After reinstatement it is not expected that the presence of a wind farm would be evident, as all above-ground equipment would be removed, ground reinstated and reseeded as is agreed. The equipment used in the demolition of the wind turbines, etc. is only likely to be present for a relatively short period, about 3 months, and the impact relatively low and temporary. However, a decommissioning plan would be cleared with the Authority before any decommissioning took place.

It is expected that after 25 years the wind turbines will require scrapping. They will be cut up and sent for recycling for as much as possible to be recovered. It is expected that almost all of

the materials will be capable of recycling, however, the small proportion that cannot, will be sent for disposal at a licensed waste disposal facility.

It is likely that the landowners of the Site would wish to retain the access tracks for continued use, for agricultural purposes. It is expected that the underground cables, which are readily accessible from the tracks, will be recovered and recycled.

5 Site Access and Transport

5.1 Introduction

The construction delivery route options for the ECOCAS development were determined by detailed map evaluation and prospective route inspections. These were carried out by Entec in association with Independent Power Systems Limited and local knowledge input by the Project Sponsors. These initial appraisals took place over some 18 months and embraced every possible entry to the proposed Site, including the possibility of bringing all wind turbine equipment in by rail to Carno. The discussions and evaluations that took place on the rail option are discussed in detail below. After detailed consideration, in association with the officials responsible for the railways running to and through Carno, the rail option had to be dismissed for a number of reasons. Firstly, the clearance required to carry the 'H' frames could not be met by the many bridges along the possible routes; bridge modification would mean numerous major road realignments and would not be feasible. Secondly, the bogies on which the wind turbine components would be carried would have to sit too low and would not conform to the rail clearances required. Thirdly, the length of the turbine blades, relative to the radius of the bends in the rail track, would mean that the train load would project into the path of oncoming trains or trackside infrastructure and therefore could not meet railway safety requirements.

As a result of rejection of the rail option, road delivery was determined as the only feasible option and detailed evaluation was undertaken which comprised three individual studies namely:

- Port of delivery (Ellsmere Port or Newport Docks) to Carno (including alternative routes and pinch point analysis)
- Carno to Site (including options and pinch point analysis)
- Mitigation of traffic flow (laybys and passing places)

As detailed in the maps shown in Volume 4, Appendix 3A & 3B the delivery route of wind turbines to the Site will be from Ellesmere Port, south to the Site via Ruabon, Oswestry, Welshpool, Newtown, Carno and north to the Site.

5.2 Consultation

During the route determination process and in the generation of the detailed route plan, discussions took place between Entec and Independent Power Systems Limited with officials of Powys County Council (PCC), including their Abnormal Loads team, in order to clarify the main issues in preparing the site access and transport arrangements. All roads included in the route appraisals (and many that had to be rejected at an early stage of the process, because they were evidently not feasible) were visited and observed. In addition, for example, where pinch points were evident, photographs were taken for later further appraisal and consideration. Some of these photographs are included within the Off-Site Access Study at Volume 4, Appendix 3A & 3B of the Environmental Statement (ES).

Further, as stated in the Off-Site Access Study, a Working Group had been set up to help identify a preferred route for the delivery of turbine equipment into the Mid Wales area. The Working Group includes the British Wind Energy Association, Welsh Assembly Group, Colletts Transport, Mid Wales Trunk Road Agency and Powys Council representatives, amongst others. However following Entec's initial discussion with Colletts Transport and Mid Wales Trunk Road Agency the view was formed that the discussions in the Working Group were at an early stage and that no decision had yet been made to identify a preferred route. Therefore, the routes identified in the Entec study and report are deemed to be the best suited for accommodating the size and nature of the wind turbines proposed for the ECOCAS Wind Farm.

As Entec state in their report "Although it is recognised that there is no single 'risk free' solution, which has been acknowledged by the Mid Wales Trunk Road Agency, every effort has been made to try and minimise the impact on key receptors such as topography and road layout, avoidance of physical constraints/structures where possible, and minimising disruption to services and local road users etc.".

Also included in the Off-Site Access Study, is an outline Traffic Management Plan (TMP) where it is stated that it is intended that the main contractors to the ECOCAS Wind Farm submit a more

comprehensive TMP in association with more detailed discussions with PCC. Also, it is acknowledged that in preparing the comprehensive TMP the detailed design will need to include the provision of appropriately sized laybys and passing places with, for example, design of pavement construction and drainage requirements, in order to mitigate the possible impact of additional movements of heavy goods vehicles and abnormal loads. These proposed modifications to the highway infrastructure will require agreement with the PCC Highways Department and with the Powys Police such that they are located in the most appropriate places in regard to traffic safety, the free flow of traffic and public amenity together with the imperative of road safety for pedestrians and other road users.

5.3 Routes to Carno

5.3.1 Introduction

This evaluation resulted in three possible routes being considered. They are included in the Off-Site Access Study at Volume 4, Appendix 3A. The Study and Report were completed by Entec who are experts in the field of transportation logistics and evaluation. The three access routes considered worthy of further evaluation are:

Route 1: From Ellesmere Port to Site: M53 → A55 → A483 → A5 → A483 → B4568 → A470 → Un-named Road at Plas Llysyn → Site

Route 2: From Ellesmere Port to Site: M53 → A55 → A483 → A5 → A483 → A489 → A470 → Un-named Road at Plas Llysyn → Site

Route 3: From Newport Docks to Site: M4 → A470 → A40 → A470 → A483 → A4081 → A470 → Un-named Road at Plas Llysyn → Site

After detailed evaluation, including a desk based study and visual inspection along the route, it was decided that the preferred route to the Site would be Route 1. Detailed consideration of the route selection is dealt with at Section 5.3.2.5 which includes methods of assessment for

each of the three routes and an in-depth swept path analysis for the feasible Routes 1 and 2. After careful consideration Route 3, was rejected for the following reasons.

A visual analysis of Route 3 concluded that the feasibility of this route would not be enhanced by carrying out further detailed analysis. This was due to the number of pinch points which would have required improvement works on highway land and third party land acquisition. In particular, the most significant restrictions were considered to be the A470 at Builth Wells and the narrow (slightly staggered) crossroads at Rhayader where loads would continue straight ahead.

5.3.2 Selected Routes 1 & 2

The route from Ellesmere Port to Newtown is common to both Routes 1 & 2 see Section 5.3.2.1. At Newtown the route splits into two options, Route 1 which can take both the blades and nacelle, see Sections 5.3.2.2 and 5.3.2.3 or Route 2 which can only take the blades see Section 5.3.2.4.

5.3.2.1 Routes 1 & 2 Ellesmere Port to Newtown (Blades & Nacelle)

The following is an extract from the report prepared by Entec which is shown in full at Volume 4, Appendix 3A. The vehicles leaving Ellesmere Port will not encounter any difficulties of movement as the Port is structured to enable movement of large vehicles on a day-to-day basis. The first identified point that needs specifically addressing is the A5/A483 Halton Roundabout and each affected point along the route is also addressed below.

A5/A483 Halton Roundabout

As shown in drawing no. 24317-01, there will be a requirement at this location for construction of a hard standing over-run area. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

A5/B5070 Gledrid Roundabout

Drawing no. 24317-02 shows that the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

A5/B5069 Five Crosses Roundabout

As shown in drawing no. 24317-03, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required. However, temporary rolling road blocks will be required to allow the abnormal loads to safely contraflow the roundabout.

A5/A495/B4580 Roundabout

Drawing no. 24317-04 shows that there will be a requirement at this location for construction of a hard standing over-run area at two locations. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc, or any other obstructions.

A5/A483/B4579 Roundabout

Drawing no. 24317-05 shows that there will be a requirement at this location for construction of a hard standing over-run. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions. In addition, temporary rolling road blocks will be required to allow the abnormal loads to safely contraflow the roundabout.

A483 Four Crosses

As shown in drawing no. 24317-06, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

A480/A458 Roundabout near Welshpool

Drawing no. 24317-07 shows that there may be a requirement at this location for construction of a hard standing over-run, although vehicles may be able to make use of the existing over-run area of the central island. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions. In addition, temporary rolling road blocks will be required to allow the abnormal loads to safely contraflow the roundabout.

A483/B4381 Welshpool Roundabout

As shown in drawing no. 24317-08, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

A483/A458/A490 Roundabout

As shown in drawing no. 24317-09, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

5.3.2.2 Route 1 Newtown to Carno (Blades)

A483/B4568 Newtown Roundabout

Drawing 24317-10 shows the blade transporter performing a three-point turn in order to carry out the least impacting method of carrying out this manoeuvre. Works required involve removal of the over-run and chevroned areas of the central island (not identified by the OS baseline data). In addition, temporary rolling road blocks will be required to allow the abnormal loads to safely contraflow the roundabout and perform the turn.

B4568 Cambrian Way, Newtown

As shown in drawing no. 24317-11, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

B4568 Commercial Street/Milford Road, Newtown

Drawing no. 24317-12 shows that there will be a requirement at this location for construction of a hard standing over-run area at this location. Works required will involve the removal of a section of the central island. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc, or any other obstructions.

B4568 Milford Road, Newtown

As shown in drawing no. 24317-13, there may be a requirement for some light tree/hedge trimming at this location. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 near Milford

Drawing no. 24317-14 shows that there will be a requirement at this location for construction of a hard standing over-run area and the need for a new bridge structure or culvert modifications

as necessary. Part of the area required for this is considered to be owned by a third-party. Land ownership plans should be obtained to determine the extent of third party land required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 near Aberhafesp

As shown in drawing no. 24317-15, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

B4568 Aberhafesp (Section 1)

Drawing no. 24317-16 shows that there will be a requirement at this location for construction of a hard standing over-run area, whilst some trimming of trees/hedging may be necessary to accommodate blade and vehicle overhang. It is predicted that the works required could be accommodated within the highway and verge, although this should be confirmed by obtaining land ownership plans from the highway authority. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc, or any other obstructions.

B4568 Aberhafesp (Section 2)

As shown in drawing no. 24317-17, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 Aberhafesp (Section 3)

As shown in drawing no. 24317-18, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 Rhdlydan

As shown in drawing no. 24317-19, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

B4568 near Llanwnog (Section 1)

Drawing no. 24317-20 shows that there will be a requirement at this location for construction of a hard standing over-run area, whilst some trimming of hedging may be necessary to accommodate blade and vehicle overhang. It is predicted that the works required could be accommodated within the highway and verge, although this should be confirmed by obtaining land ownership plans from the highway authority. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 near Llanwnog (Section 2)

Drawing no. 24317-21 shows that there may be a requirement at this location for construction of a hard standing over-run area, whilst some trimming of hedging may be necessary to accommodate blade and vehicle overhang. It is predicted that the works required could be accommodated within the highway and verge, although this should be confirmed by obtaining land ownership plans from the highway authority. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

B4568 Llanwnog

As shown in drawing no. 24317-22, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc, or any other obstructions.

A470/B4568 Pontdolgoch

Drawing no. 24317-23 shows that there may be a requirement at this location for construction of a hard standing over-run area, whilst some trimming of hedging may be necessary to accommodate blade and vehicle overhang. It is predicted that the works required could be accommodated within the highway and verge, although this should be confirmed by obtaining land ownership plans from the highway authority. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc, or any other obstructions.

A470 Pontdolgoch

Due to the horizontal alignment of the carriageway at this location, the blade transporter requires careful driving in order to successfully navigate the 's' bend under the rail bridge. The need for some minor modifications to the bridge abutment may also be needed. The vertical clearance issues associated with this bridge (i.e. potentially 300 mm clearance with the blade transporter) may either require the tyres to be deflated or localised road lowering to be carried out. The transporter would then continue along the carriageway as shown on drawing no. 24317-24a and 24317-24b.

A470 near Carno

As shown in drawing no. 24317-25, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

A470/Unnamed Road, near Carno

Drawing no. 24317-26 shows that there will be a requirement at this location for the blade transporter to travel over a disused car park (owned by a third party) and an adjacent footway in order for the manoeuvre to be carried out. As a result, accommodation works may be required to count for the difference in level between the car park and the footway. Land ownership plans should be obtained to determine the extent of third party land required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

5.3.2.3 Route 1 Newtown to Carno (Nacelle)

A483/A489/B4568 Newtown Roundabout

As shown on drawing no. 24317-32, no further works are required to those identified as necessary for the V90 Blade transporter.

B4568 Milford Road, Newtown

As shown on drawing no. 24317-33, no further works are required to those identified as necessary for the V90 Blade transporter.

B4568 Aberhafesp

Drawing no. 24317-34 shows that no further works are required to those identified as necessary for the V90 Blade transporter.

A470/B4568 Pontdolgoch

Drawing no. 24317-35 shows that no further works are required to those identified as necessary for the V90 Blade transporter.

A470 Pontdolgoch

The vertical clearance issues associated with this bridge (i.e. potentially 50 mm clearance with the nacelle transporter) may either require the tyres to be deflated on the transporters or localised road lowering to be carried out. Drawing no. 24317-36 shows how the nacelle carrier can negotiate this pinch point.

A470/Unnamed Road, Carno

Drawing no. 24317-37 shows that no further works are required to those identified as necessary for the V90 Blade transporter.

5.3.2.4 Route 2 Newtown to Carno (Blades)

A483/A489/B4568 Newtown Roundabout

As shown in drawing no. 24317-27, the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required.

A489/Rail bridge, Newtown

In terms of horizontal alignment, drawing no. 24317-28 shows that the blade transporter is predicted to be able to perform this manoeuvre with no improvements works being required. However, there is a 15′ 3″ height restriction at the rail over-bridge. Whilst the height of the tallest load would be less than the bridge height restriction (at 14′ 3″), the vertical alignment of the carriageway at this location is such that abnormal loads would be approaching the bridge at a gradient, resulting in the likely effective height of the vehicle at this point being higher than 15′ 3″. A topographical survey and associated vertical analysis would confirm this to be the

case, and assist in determining whether any localised improvements (such as road re-profiling) would enable the vehicle to travel under the bridge.

A489/Mochdre Lane

As shown in drawing no. 24317-29, there will be a requirement at this location for construction of a hard standing over-run area. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

A489/A470 Caersws

Drawing no. 24317-30 shows that there will be a requirement at this location for construction of a hard standing over-run area. Part of the area required for this is considered to be owned by a third-party. Land ownership plans should be obtained to determine the extent of third party land required. Areas where the vehicle or blade overhangs outside of the carriageway should be kept clear of street furniture such as bollards, signing and street lighting etc., or any other obstructions.

A470 (Bridge Street) Caersws

Drawing no. 24317-31 shows that in order to bypass the listed bridge (due to an unposted 100,000 kg weight limit), significant works are required. The drawing shows that part of the parapet will be required to be removed, whilst a new track and temporary bridge crossing across the River Severn will be required. The transporter will then require to rejoin the A470 adjacent the Unicorn Hotel.

5.3.2.5 Assessment

The swept-path assessments for Routes 1 and 2 have shown that in order to deliver a turbine blade of 45 m in length and a nacelle to the Site it will be necessary to undertake various improvement works within the highway and within some third party land.

After Newtown there are two possible constraints on each of the routes. These are the length of the blades in relation to the Pontdolgoch Rail Bridge and the weight of nacelle in relation to the weight restriction on the bridge over the Avon, at Milford. Later investigations indicated that in spite of there being a tight bend under the Pontdolgoch Rail Bridge, careful driving

together with some slight modification to the bridge abutment would almost certainly alleviate any problems for delivering the blades. In regard to the weight restriction at Milford it would be possible to construct a Bailey Bridge over the River Avon adjacent to the present bridge, of sufficient load bearing capacity to carry the vehicle transporting the nacelle.

It therefore follows that if Route 1 is considered to be the most suitable to carry both the blades and the nacelle then this would be our preferred route. The Local Authority may also wish to consider the possibility of delivering the blades via Route 2 while the nacelle is transported along Route 1.

It is evident that all off-site works and modifications to roads and road furnishings will need to be completed before the delivery of any wind turbines can take place. Some of the road modifications will be permanent and will add to the amenity and value of the road system along the proposed route, while other modifications will be of a temporary nature and will be restored to their previous configurations either immediately following delivery of equipment (say within 24 hours, for example, street signs) or following the completion of all deliveries to the Site (with restoration within an agreed period) of, for example, traffic island furnishings).

The modifications required to the highways along which the vehicles will pass are defined on each of the maps shown in Volume 4, Appendix 3A & 3B. No vehicle movements will be allowed to be made (other than agreed 'dry-runs') until all works have been identified and agreed with the Local Authorities involved.

5.4 Carno to Site

All turbine component deliveries will be brought along the A470 from the direction of Caersws to Carno where the vehicles will turn off the main highway and proceed north easterly towards the Site. A complete assessment of the route between Carno and the Site was undertaken by Entec and any constraints along the route were identified as pinch points. Detailed consideration was given as to how the various pinch point issues would be addressed and these are summarised below. Full details of the pinch points, modifications and gradients along the route are shown on the maps in Volume 4, Appendix 3A & 3B.

Pinch Point 1

Only small amounts of modification will be required at this point including some widening of the carriageway involving some 100 m^2 of earthworks and the removal of some 35 m of barbed wire fencing.

Pinch Point 2

The steepness of the gradient of the road at this point is the reason that this point has been included as a pinch point. Detailed assessment indicates that the delivery vehicles will have no problems with negotiating this part of the road with little or no modification required.

Pinch Point 3: Option 1

Part 1

It is at pinch point 3 that the delivery route swings into an almost easterly direction dropping down towards the river. Photograph A clearly shows the junction at which this manoeuvre will take place. Some works will be required between the junction and the river involving some hedge and tree removal and excavation of embankment. In addition some relocation of telegraph poles may be required and some tree trimming may also be necessary. It is possible that in order for the nacelle to pass over the bridge which spans the river mentioned above, some bridge widening works may be required. This bridge was visited during the Site visit on the 20th January 2009 and the Environment Agency (EA) were made aware of the issues associated with this river crossing. It will be necessary to acquire some third party land in order to complete these above modifications.

Part 2

Following clearance of the bridge the road swings right and it will be necessary to widen the sweep of the road at this point to accommodate the vehicles. Some removal of hedges and strengthening of ducting may also be required. The road then proceeds to swing left and uphill. Some minor modifications to the road will be required including the possible removal of a tree, however every effort will be made to minimise any disturbance. Where this occurs, if necessary, suitable tree planting will be undertaken in consultation with those affected and the Countryside Council for Wales (CCW). It will be necessary to acquire some third party land regarding the above modifications.

Pinch Point 3: Option 2

Part 1 & 2

This option has been determined in consultation with the sponsors and landowners such that the present bridge over the river can be bypassed and the road diverted across open fields. It will be necessary to construct a temporary bridge over the river in the field and this will be undertaken in consultation with and in agreement of the EA and Local Authority. The design and positioning of the temporary bridge to meet the requirements of the EA will be undertaken under guidance from the EA and Local Authority. It will be necessary to acquire some third party land regarding the above modifications.

Pinch Point 4

This section of the road will require some vegetation and tree clearance and some ditch back-filling, otherwise this section of the road is not expected to cause any major difficulty.

Pinch Point 5

There is a natural sweep as clearly shown in photographs A and B and little modification will be required. This section of road goes through Forestry Commission land and this route has been used over many years for the commercial exploitation of coniferous trees. Over the years there has been encroachment of the side vegetation in to the fringes of the road and this will require minimal grading works. The sponsors have discussed the proposals with the Forestry Commission and the indications are that they would welcome the road improvements as it will benefit the movement of all vehicles associated with forestry activities. Further, the Forestry Commission supports the approach of siting turbines, with the largest possible power output, within and adjacent to the woodlands it manages.

Pinch Point 6

The only major works involved in this section of road are the removal of some commercially planted coniferous trees (evident in photographs A, B and C) and the possible strengthening of a culvert. The EA will be consulted as appropriate regarding the culverting at this point.

Pinch Point 7

This area of the road, through Forestry Commission land, is the final section before it enters the Site. The only modifications required will be the removal of some commercial, small, coniferous trees (see photographs A and B). There will also be some minor removal of gate and posts at the Site entrance although these will be replaced as part of the Wind Farm development.

Pinch Point 8

Although this pinch point is sequentially numbered as after Pinch Point 7 it in fact relates to a section of road which required further evaluation because of the gradients. The road climbs to a high point which may require some regrading such that the long vehicles will clear the roadway. Some roadway widening and minor trimming back of ground and hedging will be required. Also a relatively small amount of earthworks and culverting of an existing ditch will be required. The EA will be consulted as appropriate regarding the culverting at this point.

5.4.1 Assessment

Although some road works will be required at various points along the route between Carno and the Site none are considered of such significance as to interfere with the delivery of the necessary equipment or to impinge on the habitat, ecology or environment. The one exception that requires to be addressed in detail in collaboration with the EA and Local Authority before any works are commenced is the bridge crossing at pinch point 3.

5.5 Traffic Movement

5.5.1 Introduction

This Section of the traffic and transport chapter assesses the possible road traffic impacts that may result from the proposed development of the ECOCAS Wind Farm. It is planned to include 17 wind turbines, a site substation and electrical infrastructure, construction compound and internal site access tracks, all involving construction works and traffic movements, to some

extent. The assessment is made under three main categories with which traffic movements are associated, namely;

- The project construction phase
- The 25 year operating period
- Decommissioning of the project

In order to fully appreciate the contents of this Section it will be necessary to refer to the general mapping of the Site, site layout maps, development programme and detailed drawings of the construction works. There will also be references to other basic elements of traffic movements including estimates of vehicle sizes and capacities, frequency of movements, time of day, traffic control and management and methods of mitigation, as appropriate.

The largest volume of traffic movements will occur during the construction phase of the project and detailed consideration has been given to the possible impact that traffic movements may have on the major highways, the overall traffic system, local roads and effects on the community through which vehicles pass or operate. Notwithstanding that construction traffic movements associated with the proposed development will be mainly Heavy Goods Vehicles (HGVs) the assessment of impact includes all vehicle movements to and from the Site including the personal vehicles of employees, contractors and official visitors.

As stated above, any major impact of traffic movements will mainly relate to the construction phase; the operation period will not materially affect either the highways network or the interests of the community who could be potentially affected. Also, the level of effect of decommissioning at the end of 25 years will not be as great as that during the construction phase. As a result, any conclusions drawn on the impact regarding construction can be regarded as being significantly in excess of those of the decommissioning phase, and detailed evaluation of that phase has not been undertaken. However, it should be noted that even if a detailed evaluation of the decommissioning is justified, the baseline of traffic movements some 25 years hence are not possible to predict with any degree of accuracy that would make any conclusions of value.

5.5.2 Guidance

This traffic assessment (the 'Assessment') has followed the guidelines laid down in:

- Guidelines for the Environmental Assessment of Road Traffic, Institute of Environmental Assessment (now Institute of Environmental Management and Assessment) (IEMA), 1993.
- Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation (IHT) 1994.

Independent Power Systems Limited has discussed with the two Institutes referred to above the continuing relevance of the Guidance issued by them in 1993 and 1994. It was confirmed that the Guidance is in the process of being updated but no decision is yet available as to when this will occur and as a result the principles contained within the existing Guidance have been used to determine environmental impact of road traffic resulting from proposed development activity.

The IEMA Guidelines, 1993, are specifically designed to cover the aspects of road traffic associated with major new developments, in order to improve the standard of environmental assessments and their associated statements, including use of best current practice. The main categories of possible environmental effects can be summarised as follows:

- Noise
- Vibration
- Visual Impact
- Severance
- Driver delay
- Pedestrian delay
- Pedestrian amenity
- Accidents and safety
- Hazardous loads
- Air pollution, dust and dirt

- Ecological impact
- Heritage and conservation areas

It is acknowledged in the Guidelines that the list above may not be applicable to all developments but where they do not apply it is appropriate to state why a particular heading is not appropriate.

The guidelines also identify particular groups or locations which may be sensitive to changes in traffic conditions. The following check-list identifies these, but suggests that others may be added if the assessor considers it appropriate:

- People at home
- People in work places
- Sensitive groups including children, elderly and disabled
- Hospitals, churches, schools, historical buildings
- People cycling/walking
- Open spaces, recreational sites, shopping areas
- Sites of ecological/nature conservation value
- Sites of tourist/visitor attraction

It is proposed that, wherever possible, maps should be used to convey information succinctly and clearly. The Assessment should identify the 'worst' environmental impact that might reasonably be expected, in addition to average or typical conditions. The 'worst' environmental impact should include the effect of 'greatest change' and 'highest impact' and include how frequently the 'worst' conditions are likely to occur. If potential impacts are small or non-existent the Assessment should say so rather than ignore them.

The following factors are considered to influence the impact of traffic:

- Volume
- Speeds and operational characteristics
- Composition, e.g. proportion of HGVs

Factors which affect people's perception of traffic impact include:

- Existing traffic levels
- Location of traffic movements
- Time of day and season
- Road design/layout
- Adjacent land use

The Guidelines also indicate, in order to assist the assessment, some generally accepted parameters i.e. accuracies of greater than 10% are not achievable and day-to-day variations can be at least + or – 10% and propose that the following general rules be used in order to delimit the scale and extent of the assessment:

- Include where traffic flows, or number of HGVs, increase by more than 30%
- Include any other specifically sensitive areas where traffic flows have increased by 10% or more
- Changes in traffic of less than 10% can be regarded as creating no discernable environmental impact
- That 30%, 60% and 90% changes in traffic levels could be regarded as 'slight', 'moderate' and substantial impacts respectively

These guidelines normally relate to developments which have a permanent impact on road networks, for example, major retail and residential infrastructure changes. However, the

guidelines have been taken as being those which most closely represent the intentions of Local Authorities relating to the possible impact that any major developments may have on the traffic network and on the community generally, albeit that the period of potential impact will mainly relate to the construction and decommissioning of the development.

5.5.3 Methodology

If there is less than a 30% increase in traffic flow from that identified in the baseline data, the environmental impacts with traffic generated by the proposed development will be classed as 'insignificant', providing that the increase does not lead to disruption; no mitigation measures will be required. If the increase is above 30% but still does not cause disruption, the impact will be classed as 'slight'; no mitigation measures will be required. When the increase is above 30% and is expected to lead to disruption, then the classification will be deemed to be 'moderate' or 'major', depending on the level of increase identified and whether any disruption is likely to be temporary or permanent. In the latter two circumstances then either temporary or permanent mitigation may be necessary in order to alleviate or reduce the predicted impact.

It is acknowledged that determining 'impact' is, to a large extent, subjective but general rules can be applied, in addition to those above, which will further define the extent of the possible traffic effects. These can be defined as 'sensitive' areas, for example schools, residential care homes or where housing is in close proximity to the highway. In these circumstances, an increase in predicted traffic volumes of more than 10% are included within the scope of possible impacts.

5.5.4 Assessment Elements

The main elements that contribute to or form part of the assessment methodology are as follows:

- The decisions and processes that resulted in the chosen site access and equipment delivery route
- The wind turbine delivery route evaluation, swept path analysis and environmental constraints

- Preparation of delivery and construction programme for wind turbines, on-site access tracks, on-site infrastructure works
- Maximisation of use of on-site materials where environmentally appropriate
- Calculations relating to material volumes to be handled and installed, vehicle types, capacities and staffing needs
- Acquisition from Local Authorities of relevant traffic flow and accident data
- Preparation of data using the information above and evaluation of the impact significance
- Assessment

5.5.5 Existing Traffic

Statistics on existing traffic has been used as a baseline for an analysis of the likely effects of traffic movements on receptors (e.g. schools, hospitals, pedestrian crossing points) along the main routes affected by the ECOCAS Wind Farm project (see Volume 4, Appendix 3C, Figure 1). A map showing the receptors identified by IPS along the two possible delivery routes is shown in Volume 4, Appendix 3C, Figure 2.

Statistics on existing traffic flow has been provided by Alan Davies of the Highways Department at PCC. These statistics cover eight traffic sensors along the routes previously described and their locations are:

- Four Crosses on the A483, Grid Reference (311089, 291803), one set of data covering both directions of travel, collected between 1st January 2007 and 31st December 2007 and provided as hourly averages over seven days
- Buttington Cross on the A483, Grid Reference (324129, 308590), two sets of data covering the two directions of travel, collected between 1st January 2007 and 31st December 2007 and provided as hourly averages over seven days
- Newtown on A483, Grid Reference (311222, 291492), two sets of data covering the two directions of travel, collected between 1st January 2007 and 31st December 2007 and provided as hourly averages over seven days

- Caersws on A470, Grid Reference (303571, 291374), two sets of data covering the two directions of travel, collected between 1st January 2006 and 31st December 2006 and provided as hourly averages over seven days
- Cambrian Way on B4568, Grid Reference (311089, 291803), one set of data covering both directions of travel, collected between 4th May 2007 and 14th May 2007 and provided as hourly averages over seven days, with one set covering both directions of travel
- Milford Road on B4568, Grid Reference (310618, 291876), one set of data covering both directions of travel, collected between 9th July 2008 and 24th July 2008 and provided as hourly averages over seven days
- Aberhafesp on B4568, Grid Reference (306567, 292566), one set of data covering both directions of travel, collected between 14th March 2008 and 27th March 2008 and provided as hourly averages over seven days
- Llanwnog on B4568, Grid Reference (302129, 293732), one set of data covering both directions of travel, collected between 15th September 2006 and 26th September 2006 and provided as hourly averages over seven days

Some of the sensors, such as the ones at Four Crosses, Buttington and Aberhafesp, are located relatively far from any public places identified by IPS along the main delivery route and for this reason any traffic impact on these sensors is regarded as of limited potential impact on local communities. On the other hand, the sensors in the Newtown area are located at short distance from a number of public places along the A470 and B4568, as can be seen comparing Figure 2 and Figure 3 of Appendix 3C. In particular, at walking distance from the sensors at Newtown, Cambrian Way and Milford Road there are 4 schools, 6 crossing points and 3 hospitals/clinics. Because of the groups using those facilities and public places, such sensor locations can be considered particularly sensitive to the impact of the ECOCAS related traffic, and the potential effects can include social aspects such as severance, pedestrian amenity and fear and intimidation.

5.5.6 Construction Traffic

The delivery route details and maps are included at Volume 4, Appendix 3A & 3B of the EIA. The delivery route, coupled with the information provided at Section 4.1.1 for the proposed construction programme, provides the basic information against which the construction traffic movement numbers and potential effect is assessed. The full period of construction is estimated at 12 months. The programme has been designed in order to accomplish two basic requirements, the first is to seek to minimise disturbance by planning to complete the necessary activities within a well defined framework. The second, is to bring the ECOCAS Wind Farm on stream as a 'sequential' operation; this would be achieved by programming the works to allow generation to be brought on-stream in two phases with some 50% of the wind turbines coming on stream as work is progressing on the remainder of the Wind Farm. This can be seen to be beneficial to all stakeholders; it will reduce the concentration of activity, allowing phased delivery of materials and plant and at the same time ensure earlier electricity generation than would be achievable by waiting until all 17 wind turbines have been installed. The effects of the ECOCAS Wind Farm during its anticipated 25 years of normal operation are not expected to impact in any significant way on traffic movements and as a result, it is only the effects of the construction and decommissioning periods that have been addressed in detail in this assessment.

5.5.6.1 Construction Activities and Vehicle Types and Capacities

The construction activities, vehicle types and numbers required to undertake those activities have been determined using basic assumptions as to what needs to be done and what vehicles can best be deployed to most effectively undertake the work.

It is not proposed to use any rock or road stone from off-site sources. There will be four borrow pits and these have been identified as being able to provide all road stone, hard-standing and in-fill/back-fill materials for all construction on the Site requiring such materials. The rock will be graded on site and the finest grade material will be utilised as a 'sand substitute' for example to back-fill cable trenches, when the cables have been installed; this will require agreement of the electrical contractors to the project but it is not anticipated that there will be a problem with this. By maximising the use of materials available on-site, always subject

to preservation of the environment and ecology, it will keep to a minimum the number of vehicle journeys required on public roads.

The deliveries of vehicles themselves, vehicles required for materials and personnel can be readily identified with the specific construction programme as shown at Section 4.1.1 in the main body of the ES. Each of the main construction activities is shown below and, identified with each, are the vehicles that will be required in support of completion of the activity.

It is only the movement of construction vehicles themselves that have been included in this section; the vehicles required to deliver materials and to transport staff and visitors to and from the Site have been included in a separate section below.

5.5.6.2 Construction Vehicles & Plant

Construction Compound

The construction compound, incorporating secure access, traffic separation and security check temporary parking bays, is planned to be just within the Site boundary, as shown on the Site layout map in Volume 5, Figure 1. The area proposed for the construction compound is a level grassland area and minimum clearance is expected. Topsoil and grass removed in the Compound area will be used to form a natural 'bund' wall around the Compound of sufficient height to secure the area but with minimum visual or ecological impact. This stored material will eventually be utilised to restore the Compound area to its original condition. The area has been visually inspected, together with the Landowners (Sponsors) who are familiar with the structure of their land, and it is anticipated that when the topsoil is removed it will reveal 'weathered rock' which can either be left in situ to form hard standing, or where of sufficient depth, spread to completely level the Compound area. It is expected that minimum volumes of rock will need to be transported from the adjacent borrow pits to complete this activity. No external traffic movements will be required other than initial delivery of the vehicles and Compound facilities and equipment.

The materials required to construct the compound are some 250 m from it at borrow pits nos. 3 and 4. It is planned that only one earthmover will be required in order to establish a 'bridgehead' into the Site and this, together with a 10 tonne lorry will be able to establish the initial facilities, ready to receive the initial staff compliment. It is they who will then take charge

of the full planned development of the Site. It is not anticipated that any of the traffic movements associated with this initial phase of work will impinge on the local roadway infrastructure. Any traffic movements will be undertaken at off-peak times and careful consideration will be given to keeping the traffic movements within 10% of those normally taking place. It is emphasised that it is only the vehicles themselves that will be required for use at the Site that will be using local highways and it is expected that only very small quantities of materials (e.g. sand and cement) will be transported at that time. A Portakabin type office will be required on the Site for initial management personnel but the movement of this would be undertaken in conjunction with the Powys Highways Department to the extent that the load may be regarded as abnormal; in any event, full consultation will be undertaken on any traffic proposals that may be considered to be in any way outside of normal traffic movements.

Vehicle Compliment

Full development of the Compound, establishment of offices, messing facilities, refuelling depot, tools and equipment storage facilities, etc. will require the following vehicles:

Earthmoving vehicle (Bulldozer delivered on flat-bed vehicle)

20 tonne Lorry (for transport of stone from borrow pits, as necessary)

Overall, it is anticipated that the following vehicle movements may be required:

Month 1: Flat-bed vehicle with Bulldozer to Site and return : 2 journeys

Month 12 : Flat-bed vehicle to Site, collect Bulldozer and return : 2 journeys

Month 1: 20 tonne Lorry to Site: 1 journey

Month 12: 20 tonne Lorry from Site; 1 journey

Month 1: Flat-bed vehicles for delivery of Portakabin Units, shipping containers, portable generator, water storage, fuel storage, etc.: 8 journeys

5.5.6.3 Construct Access Tracks, Drainage and Cable Channels

The total on-site access tracks are estimated to be 8,800 m long, with drainage and cable channels running parallel with them. Because of the existing rock based tracks, and the evaluation of the routes to the 17 turbines, it is expected that any road building materials will be accessed from the four borrow pits identified on the Site. Notwithstanding this, it is expected that very little material will need to be moved from the borrow pits because the excavated 'high-spots' on the proposed access routes are expected to provide a significant amount of material to infill the 'low-spots', thereby reducing the need to use borrow pit material to a minimum. It therefore follows that only delivery and return of vehicles will affect the public highways. The need for reinforcing materials for the access tracks is dealt with in materials deliveries below.

Vehicle Compliment

Some of the vehicles will be wheeled and capable of being driven to the Site, however, for clarity, it is presumed that all earthmoving and heavy equipment will be transported by flat-bed vehicles. The overall movements should be reduced by this assumption, because some smaller units can be transported as one load. It is estimated that the following vehicles will be required to construct the on-site access tracks and associated drainage and cable channels:

- Month 2 : Flat-bed vehicles, etc. with earthmoving equipment, including Excavators/Scrapper-Levellers/Dumpers/Bulldozers/Loading Shovels/Consolidators/Rock Crushers and Graders, to Site and return : 50 journeys
- Month 5 : Flat-bed vehicles, etc., to Site to collect earthmoving equipment, not required following completion of the access tracks, drainage and cable channels. Some equipment will be retained for use on the anemometry mast foundations, wind turbine foundations/hard standing and preparation of the Substation site : 20 journeys

5.5.6.4 Prepare Foundations and Erect Anemometry Mast

Unlike a guy-rope supported anemometry mast, the proposed 70 m lattice anemometry mast (selected for minimum ecological impact) will require a concrete foundation, as it is self-supporting. In addition to the earthmoving equipment already on the Site required to excavate and move any surplus material, a crane will be required in order to lift the lattice mast sections

into position. For health and safety reasons, the mast access ladder will be secured in order to prohibit unauthorised access to the mast. Also, the access ladder will be positioned on the north-facing side of the mast so that the sun does not shine into the eyes of anyone required to access it for maintenance purposes.

Vehicle Compliment

Earthmoving equipment, already delivered for use on the access tracks, etc. will be utilised for excavation of the foundations and removal of surplus materials. A 25 tonne wheeled, self propelled crane will be required for constructing the 10 m sections of mast and a 200 tonne crane for lifting the fully constructed mast into position on the prepared foundations.

Month 4 : 25 tonne Crane to site and return : 2 journeys.

Month 4 : 200 tonne Crane, including ballast : 6 journeys.

5.5.6.5 Excavate and Construct Wind Turbine Foundations (First Phase)

Although some earthmoving vehicles and equipment will still be on site, mainly from the access tracks construction, it is anticipated that the excavation of the first 8 wind turbine foundations will require a further compliment of vehicles.

Vehicle Compliment

A further excavator, bulldozer, loading shovels, lorries and a mobile crane, for lifting the base rings into position on the foundations, will be required and the following additional journeys are estimated.

Month 4 : Excavator, bulldozer, loading shovels, lorries and crane to site : 10 journeys.

Month 5 : Flat-bed vehicles to Site to collect earthmoving equipment plus the crane, not required following completion of the wind turbine foundations (First Phase) : 10 journeys

5.5.6.6 Install Wind Turbines (First Phase)

For delivery and erection of the first 8 wind turbines at the Site, a crawler crane will be used. The crane will be carried as separate units and the axle weight of the transporting vehicle will conform to current legislation.

Vehicle Compliment

Month 6: 500 tonne crawler crane to Site; the crane will be mobilised on the Site after delivery of the individual units. All units will be approximately 3 m in width and no longer than 24 m, with the overall vehicle length being approximately 35 m. The crane is comprised of 12 units including the crane body, 2 tracks, 200 tonnes of ballast, a luffing jib and boom, plus 3 escort vehicles: 17 journeys (one of the escort vehicles remains on site and the other two return immediately).

Month 6 : 120 tonne mobile crane to Site to assist in erection of the main lifting Crane : 1 Journey

Month 7 : After the first 8 wind turbines have been installed the 500 tonne crawler crane will be demobilised and individual units transported off Site in a similar way to their delivery described above : 17 journeys

Month 7 : 120 tonne crane taken off the Site : 1 journey

5.5.6.7 Build Substation

There will be sufficient earthmoving vehicles and plant already delivered to the Site to meet all of the requirements to clear, prepare and construct the Substation.

5.5.6.8 Excavate and Build Wind Turbine Foundations (Second Phase)

As for the First Phase of the wind turbine foundations and installation, the Second Phase of 9 turbines will require an identical compliment of earthmoving equipment to be delivered to the Site.

Vehicle Compliment

A further excavator, bulldozer, loading shovels, lorries and a mobile crane, for lifting the base rings into position on the foundations, will be required and the following additional journeys are estimated.

Month 8 : Excavator, bulldozer, loading shovels, lorries and crane to site : 10 journeys.

Month 9 : Flat-bed vehicles to Site to collect surplus earthmoving equipment from previous phases of work (5 of 15 units left on site), plus the equipment delivered in month 8 above, not required following completion of the wind turbine foundations (Second Phase) : 20 journeys

5.5.6.9 Install Wind Turbines (Second Phase)

Following completion of the Second Phase of the wind turbine foundations for 9 wind turbines, the individual sections of the wind turbine will be delivered to the Site in the same way as for the First Phase (see above).

Vehicle Compliment

Month 10 : 500 tonne crawler crane to Site; the crane will be mobilised on the Site after delivery of the individual units. All units will be approximately 3 m in width and no longer than 24 m, with the overall vehicle length being approximately 35 m. The crane is comprised of 12 units including the crane body, 2 tracks, 200 tonnes of ballast, a luffing jib and boom, plus 3 escort vehicles: 17 journeys (one of the escort vehicles remains on site and the other two return immediately).

Month 10 : 120 tonne mobile crane to Site to assist in erection of the main lifting Crane : 1 Journey

Month 11 : After the 9 wind turbines have been installed the 500 tonne crawler crane will be demobilised and individual units transported off Site in a similar way to their delivery described above : 17 journeys

Month 11 : 120 tonne crane taken off the Site : 1 journey

5.5.6.10 Site Restoration

Following completion of installation of all 17 wind turbines, the Site will be restored back to an acceptable condition during the period between months 8 and 12 using the remaining equipment from previous operations which will be removed from the Site at the end of month 12.

Vehicle Compliment

Month 12 : Removal of remaining 10 units of plant.

5.5.7 Potential Construction Traffic Effects (Staff and Visitors)

The number of permanent staff on the Site will vary according to the activities in progress but would not be expected to exceed 25 people at any time. However, there will be auxiliary staff, e.g. lorry drivers and crane operators as described in Section 4.1.4, who will also be employed on the Site. It is intended that most staff will be transported to the Site using site-owned mini-buses in order to keep vehicle movements to a minimum. Where individuals cannot use the mini-buses provided and use their own vehicles, they will be encouraged to car share. For the purposes of calculating the average monthly movements, it is assumed that each month has 26 working days.

Vehicle Compliment

Month 1 : The initial staff will be relatively low compared with months when activity on the Site is at its highest level. Based on the assumptions above, we estimate the following journeys: 12 daily journeys x 26 days per month = 312 journeys.

Months 2 to 12 : Estimated total daily journeys: 20 daily journeys x 26 days per month = 520 journeys.

5.5.8 Potential Construction Traffic Effects (Materials)

It is only the movement of vehicles that are delivering materials from off-site locations that are shown below.

5.5.8.1 Materials Delivery

5.5.8.1.1 Build and Establish Construction Compound

It is expected that the Construction Compound will be developed using only rock material that is available on-site and will not involve any external journeys. However, consolidation of the ground may require geogrid material and we estimate its delivery as below.

Vehicle Compliment

Month 1 : 1 trailer load of geogrid: 2 journeys

5.5.8.1.2 Construct Access Tracks, Drainage and Cable Channels

As already explained above, it is not expected that any significant off-site movements of materials relating to the construction of the access tracks, drainage and cable channels will take place. The only materials that will be required to be accessed off-site are for construction of five water crossings, agreed with the EA during their Site visit with Council officials on the 20th January 2009. These materials will be culverting materials and reinforcing materials (geogrid) for the access tracks. It is expected that all deliveries of culverting materials will be in Month 2 and stocked in the construction compound for use as work progresses.

In addition, several loads of geogrid will be required, depending on the quality of the underlying ground and the rock material used for any track infilling. Geogrid comes in rolls of varying quality for use depending on the materials forming the track. Track created through underlying rock will not require geogrid, whereas soft ground will require high grade geogrid material. However, for the purposes of delivery requirements, it can be taken that all geogrid rolls weigh 69 kg and are 75 m in length by 4 m width. We therefore estimate that, assuming all ground is unconsolidated, we need two layers of two widths and additional material where the track is widest (e.g. at any corner). The result is that we require to use 540 rolls of geogrid. Each trailer can carry 105 rolls, therefore some five deliveries are required.

Vehicle Compliment

Month 2 : Trailers for geogrid delivery: 10 journeys

Month 2 : 2 lorries delivering culverting materials: 4 journeys

5.5.8.1.3 Prepare Foundations and Erect Anemometry Mast

The foundations for the lattice Anemometry Mast will be of reinforced concrete which is estimated to be approximately 7 m square and be 1.8 m deep. The reinforcing steel will be transported on a flat-bed vehicle and concrete deliveries will be by 6 cu.m. capacity vehicles. As far as possible, all concrete supplies (this and for the wind turbine foundations) will be sourced locally. As a result, it is expected that the main highways may not be used at all, or will be kept to a minimum. For commercial reasons, we cannot be specific about the potential concrete supplier but if the source of supply cannot be agreed with local suppliers then further consultation will be required regarding the delivery route.

Vehicle Compliment

Month 4 : Flat-bed vehicle carrying reinforcing steel : 2 journeys

Month 4 : 88 cu.m. of concrete using 6 cu.m. capacity vehicles : 30 journeys

Month 4 : Flat-bed vehicle carrying the mast sections: 2 journeys

5.5.8.1.4 Excavate and Build Wind Turbine Foundations (First Phase)

It is estimated that each turbine will require 400 cu.m of concrete plus formwork and reinforcing steel. Therefore, the first phase of 8 wind turbines will take some 3,200 cu.m. of concrete and between one and two deliveries of steel per wind turbine. No off-site movements of vehicles are expected for the crane hard standing or laydown areas as all rock requirements will be met from the four on-site borrow pits. In addition, each wind turbine is attached to its foundation by a base ring and it is estimated that a total of up to four loads may be required (assuming two or three rings per vehicle).

Vehicle Compliment

Months 4 & 5 : Assuming a concrete delivery vehicle capacity of 6 cu.m it will take some 534 loads for the 8 wind turbine foundations and up to 12 loads of steel : 1092 journeys.

Months 4 & 5 : Base rings : 8 journeys

5.5.8.1.5 Install Wind Turbines (First Phase)

Following completion of the First Phase of the wind turbine foundations, (8 turbines) the individual sections of the wind turbine will be delivered to the Site on specially designed Turbine Delivery Vehicles (TDV's) in preparation for their installation. The major items are 4 steel sections between 2.8 and 4.2 m in diameter and up to 24 m long and weighing up to 52 tonnes (which are joined to become the turbine tower), and the nacelle, which includes a gearbox and a generator. In addition, there will be a rotor and three blades for each wind turbine, each 44 m long and weighing approximately seven tonnes. The heaviest piece of the wind turbine is the nacelle which, for the selected model, is 83 tonnes. It is assumed that the 8 blade hubs, to which the blades are attached on-site, can be delivered on three vehicles. Again, because the units will be transported on vehicles that have been designed for the purpose of transporting

large items of equipment, the weight distribution will be such that it will conform to current legislation, which will permit the loads to be transported on the public highway.

Vehicle Compliment

Months 6 & 7 : As described above, each wind turbine is comprised of 9 sections; four tower sections; three blades; the nacelle and the rotor. Therefore, for the 8 wind turbines, to be installed in the First Phase, 72 deliveries will be required, all to be transported via the preferred route as detailed at Section 5.3.1 to the ES. In addition, three deliveries are needed for transporting the 8 hubs : 150 journeys.

5.5.8.1.6 Install Electrical & Communications Cabling (First Phase)

Underground cables will be installed connecting each of the turbines in the First Phase to the electrical substation. The point of connection to the Grid is as yet undecided (as explained at Section 3.7.2 to the ES), however it is considered appropriate for completeness of traffic effect to include three deliveries (six nominal journeys) for the cable and equipment required for connection to the grid.

Vehicle Compliment

Months 6 & 7 : Cable for connection of the first phase of the project to the substation is estimated to require 5 deliveries : 10 journeys.

Month 8 : Cable for connection to the Grid is estimated at 3 deliveries : 6 journeys.

5.5.8.1.7 Build Substation

Although the detailed design of the substation cannot be completed until the details of the connection to the Grid have been provided, it is estimated that some 300 cu.m. of concrete will be required involving 50 deliveries. In addition, a nominal 12 deliveries has been allowed for transporting equipment for installation at the substation.

Vehicle Compliment

Months 4 & 5 : Concrete delivery vehicles of 6 cu.m. capacity : 100 journeys.

Month 6 : Flat-bed vehicles for substation equipment : 24 journeys.

5.5.8.1.8 Excavate and Build Wind Turbine Foundations (Second Phase)

As for the First Phase, it is estimated that each turbine will require 400 cu.m of concrete plus formwork and reinforcing steel. Therefore, the second phase of 9 wind turbines will take some 3,600 cu.m. of concrete and between one and two deliveries of steel per wind turbine. No off-site movements of vehicles are expected for the crane hard standing or laydown areas as all rock requirements will be met from the four on-site borrow pits. In addition, each wind turbine is attached to its foundation by a base ring and it is estimated that a total of up to four loads may be required (assuming two or three rings per vehicle).

Vehicle Compliment

Months 8 & 9 : Assuming a concrete delivery vehicle capacity of 6 cu.m it will take some 600 loads for the 9 wind turbine foundations and up to 12 loads of steel : 1224 journeys.

Months 8 & 9 : Base rings : 8 journeys

5.5.8.1.9 Install Wind Turbines (Second Phase)

Following completion of the Second Phase of the wind turbine foundations, (9 wind turbines) the individual sections of the wind turbine will be delivered to the Site on specially designed Turbine Delivery Vehicles (TDV's) in preparation for their installation. The detailed description of the units to be transported, transport methods, etc. are not repeated here but shown at Section 5.5.8.1.5 above.

Vehicle Compliment

Months 10 & 11 : As described earlier, each wind turbine is comprised of 9 sections; 4 tower sections; 3 blades; the nacelle and the rotor. Therefore, for the 9 wind turbines, to be installed in the Second Phase, 81 deliveries will be required, all to be transported via the preferred route as detailed at Section 5.3.1 to the ES. In addition, 3 deliveries are needed for transporting the 9 hubs : 168 journeys.

5.5.8.1.10 Install Electrical & Communications Cabling (Second Phase)

As for the First Phase, underground cables will be installed connecting each of the turbines in the Second Phase to the electrical substation. The point of connection to the Grid is as yet undecided (as explained at Section 2.4.4 to the ES) but an estimate of the cable required has

been included within the completion of the First Phase of the project and is not required again here.

Vehicle Compliment

Months 10 & 11 : Cable for connection of the Second Phase of the project to the substation is estimated to require seven deliveries : 14 journeys.

5.5.9 Effect on Sensors

A simple approach to estimate the effect on sensors, which is often used, is to take the hourly averages at each traffic sensor over a typical day (computed by averaging the existing traffic flow statistics over the period between 12pm on Sunday night and 2pm on Saturday afternoon, thereby excluding non-representative periods) and extrapolate this to cover a one month period. The resulting monthly amount of vehicles would then be compared to the total amount of vehicles involved in a project development over each of the monthly construction periods, and the percentage increase is used as a measure of the likely impact on the affected roads.

However, for the analysis of the impact of the ECOCAS-generated traffic movements, a more accurate assessment has been determined, and the difference can be seen by comparing the Table 5.4 and Table 5.6 (the detailed results are available in Volume 4, Appendix 3C, Pages 7-17).

For a correct application of any of the methods, the statistics of the baseline traffic flow at each traffic sensor needs to be projected to the year of wind farm construction, assumed here to be 2011. Based on the National Road Traffic Forecast 1997 published by the Department of Transport in 2005, the traffic growth central estimates (for all motor vehicles excluding motorcycles) between 2006 and 2011 are assumed to be 1.5% per year. Therefore, as all the baseline traffic statistics have been recorded between 2006 and 2007, this growth factor is used to compute the projected baseline traffic statistics at each of the sensors in 2011. The results, assuming a 26-day month, of the initial two-way traffic flows and their projections are shown in Table 5.1.

Traffic Volume / Traffic sensor	Daily Total	Monthly Total	Monthly Projected Total in 2011
A483 – Four Crosses	9,835	255,710	271,401
A483 – Buttington	17,937	466,362	494,980
A483 – Newtown	18,216	473,616	502,679
A470 – Caersws	4,130	107,380	115,679
B4568 – Cambrian Way	7,620	198,120	210,277
B4568 – Milford Road	4,036	104,936	109,729
B4568 – Aberhafesp	2,139	55,614	58,154
B4568 – Llanwnog	1,062	27,612	29,746

Table 5.1 Projected baseline traffic statistics

The two-ways traffic flow generated by the ECOCAS Wind Farm can be calculated by adding up all the journeys listed in Section 5.5.6, 5.5.7 and 5.5.8, and the month-by-month results over the whole ECOCAS construction period are shown in Tables 5.2 and 5.3.

Month / Project Phase	1	2	3	4	5	6	7	8	9	10	11	12	Total
Build/Establish Construction Compound	11											3	14
Access Tracks, Drainage and Cable Channels		50			20								70
Foundation/Erection Anemometry Mast				8									8
Excavate/Build Wind Turbine Foundations (1st phase)				10	10								20
Installation Wind Turbines (1st phase)						18	18						36
Installation Electrical and Communication Cables (1st phase)													0
Build Substation													0
Excavate/Build Wind Turbine Foundations (2nd phase)								10	20				30
Installation Wind Turbines (2nd phase)										18	18		36
Installation Electrical and Communication Cables (2nd phase)													0
Site Restoration												20	20
Site personnel vehicles	312	520	520	520	520	520	520	520	520	520	520	520	6,032
Total Construction and Personnel Vehicles	323	570	520	538	550	538	538	530	540	538	538	543	6,266

Table 5.2 Traffic flow generated by construction vehicles and personnel

Month / Project Phase	1	2	3	4	5	6	7	8	9	10	11	12	Total
Build/Establish Construction Compound	2												2
Access Tracks, Drainage and Cable Channels		14											14
Foundation/Erection Anemometry Mast				34									34
Excavate/Build Wind Turbine Foundations (1st phase)				550	550								1,100
Installation Wind Turbines (1st phase)						76	74						150
Installation Electrical and Communication Cables (1st phase)						6	4	6					16
Build Substation				50	50	24							124
Excavate/Build Wind Turbine Foundations (2nd phase)								684	548				1,232
Installation Wind Turbines (2nd phase)										94	74		168
Installation Electrical and Communication Cables (2nd phase)										8	6		14
Site Restoration													0
Total Vehicles from Delivery of Material	2	14	0	634	600	106	78	690	548	102	80	0	2,854
Total Construction and Personnel Vehicles	323	570	520	538	550	538	538	530	540	538	538	543	6,266
Total vehicles	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543	9,120

Table 5.3 Traffic flow generated by delivery of material and total number of vehicles

In Table 5.4 the total number of vehicles generated by the ECOCAS Wind Farm project at each sensor on a monthly basis is compared to the projected baseline traffic flow. The entries in this table are computed assuming a worst case scenario, as if all the sensors are equally affected by all the traffic generated by the ECOCAS Wind Farm project (as reported in Table 5.3).

Month / Sensor		1	2	3	4	5	6	7	8	9	10	11	12
Four Crosses	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	271,401	271,401	271,401	271,401	271,401	271,401	271,401	271,401	271,401	271,401	271,401	271,401
	% increase	0.1%	0.2%	0.2%	0.4%	0.4%	0.2%	0.2%	0.4%	0.4%	0.2%	0.2%	0.2%
Buttington	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	494,980	494,980	494,980	494,980	494,980	494,980	494,980	494,980	494,980	494,980	494,980	494,980
	% increase	0.1%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.1%
Newtown	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	502,679	502,679	502,679	502,679	502,679	502,679	502,679	502,679	502,679	502,679	502,679	502,679
	% increase	0.1%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.1%
Caersws	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	115,679	115,679	115,679	115,679	115,679	115,679	115,679	115,679	115,679	115,679	115,679	115,679
	% increase	0.3%	0.5%	0.4%	1.0%	1.0%	0.6%	0.5%	1.1%	0.9%	0.6%	0.5%	0.5%
Cambrian Way	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	210,277	210,277	210,277	210,277	210,277	210,277	210,277	210,277	210,277	210,277	210,277	210,277
	% increase	0.2%	0.3%	0.2%	0.6%	0.5%	0.3%	0.3%	0.6%	0.5%	0.3%	0.3%	0.3%
Milford Road	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	109,729	109,729	109,729	109,729	109,729	109,729	109,729	109,729	109,729	109,729	109,729	109,729
	% increase	0.3%	0.5%	0.5%	1.1%	1.0%	0.6%	0.6%	1.1%	1.0%	0.6%	0.6%	0.5%
Aberhafesp	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	58,154	58,154	58,154	58,154	58,154	58,154	58,154	58,154	58,154	58,154	58,154	58,154
	% increase	0.6%	1.0%	0.9%	2.0%	2.0%	1.1%	1.1%	2.1%	1.9%	1.1%	1.1%	0.9%
Llanwnog	ECOCAS traffic	325	584	520	1,172	1,150	644	616	1,220	1,088	640	618	543
	Baseline	29,746	29,746	29,746	29,746	29,746	29,746	29,746	29,746	29,746	29,746	29,746	29,746
	% increase	1.1%	2.0%	1.7%	3.9%	3.9%	2.2%	2.1%	4.1%	3.7%	2.2%	2.1%	1.8%

Table 5.4 Number of vehicles generated by the project at each sensor

Table 5.4 above shows that the maximum percentage increase never exceeds 5% at any of the sensors, with the maximum of 4.1% at the Llanwnog traffic sensor in month 8, when the second phase of the wind turbine installation takes place.

From these results it appears that the traffic generated by the ECOCAS project will have a non discernable environmental impact in accordance with the scale reported in Section 5.5.2.

However, the analysis makes a number of assumptions that might have a significant effect on the final results, such as the hour of the day being ignored or all the traffic generated by the ECOCAS project affecting in equal measure all the traffic sensors.

To obtain a better picture of the likely impact of the ECOCAS Wind Farm project on the traffic flow, a second analysis has been undertaken which takes into account the time of day impact of the movements from the Wind Farm. The detailed list of assumptions is as follows:

- The hourly averages have been computed in the same way used for the calculation of monthly averages used above.
- Where the data for a traffic sensor is provided separately for the two directions of travel, the effect of the ECOCAS generated traffic has been considered separately for the two directions of travel.
- The conditions on the traffic generated by particular phases of the ECOCAS project (such as the delivery route of the turbine sections, or the delivery of concrete for their foundations) has been taken into account on a sensor-by-sensor basis.
- The personnel accessing the Site are assumed to travel between 6am and 8am, when they enter the Site, and between 5pm and 7pm, when they leave the Site. The traffic generated by non-regular visitors during the day has been included within the total traffic generated by Site personnel.
- That 70% of personnel accessing the Site are assumed to use the feasible routes previously described, with the remaining 30% accessing and leaving the Site using routes not covered by the above traffic sensors. Moreover, of the 70% of the personnel assumed to use the feasible routes, 70% is assumed to use the A470 through Caersws to join the A483 towards Newtown, and the remaining 30% is assumed to use the route through the B4568 to join the A483 in Newtown. These proportions are chosen in order

to match those of the existing traffic flow along the two routes. Also, all the personnel using one of these two routes are assumed to continue along the A483 towards Oswestry.

- To avoid peak traffic times, the delivery of construction vehicles, plants and material is assumed to occur between 10am and 12am, when accessing the Site, and between 2pm and 4pm, when leaving the Site. The traffic is assumed to be uniformly spread over these periods, and the quantities used in the analysis are the hourly traffic averages. A particular case is introduced for the delivery of concrete used to build the turbine, anemometry mast and substation foundations : because of the technical aspects of the task such delivery is assumed to occur continuously between 7am and 5pm.

With these assumptions the way each sensor is affected is summarised in Table 5.5.

Activity / Traffic Sensor	Turbine delivery	Concrete delivery	Delivery of Construction Vehicles, Plant and Material	Personnel (% of the total)
Four Crosses	x		x	70
Buttington	x		x	70
Newtown			x	49
Caersws		x	x	49
Cambrian Way	x		x	21
Milford Road	x		x	21
Aberhafesp	x		x	21
Llanwnog	x		x	21

Table 5.5 Effect of activities on sensors

Two entries in Table 5.5 need an explanation. The first is related to the delivery of concrete, which is assumed to affect only the traffic sensor at Caersws. This is because of the presence of a possible supplier along the A483 between Newtown and the junction with the A470.

However, other suppliers have been taken into consideration, but being located outside the two main delivery routes their traffic impact has been ignored in this analysis.

As mentioned in Section 5.5.8.1.3, for commercial reasons it is important that at this time a decision has not been made for the supply of concrete mainly for the foundation of the turbines and other foundation works related to the anemometry mast and substation. However, we have used a worst-case scenario in determining the impact that HGVs, including cement deliveries, would have on current traffic flows. Any change from this would be beneficial in the sense that the supplies could be obtained very locally to the Site without using any of the major delivery routes identified.

The second fact evident from the table above is that the turbine delivery does not affect the traffic sensors in Newtown and Caersws. This is because the delivery route for the turbines is assumed to be the preferred delivery route described in Section 5.3.1, while the delivery of equipment and other material, not bound to use a specific route, is assumed to equally affect all of the sensors.

The detailed model of the traffic generated by the ECOCAS Wind Farm during the construction period at each of the traffic sensors is shown in Volume 4, Appendix 3C, Tables 1-6, while the analysis on a sensor-by-sensor basis is shown in Volume 4, Appendix 3C, Pages 7-17.

The results of the increase in traffic due to the ECOCAS Wind Farm project are summarised in Table 5.6.

Sensor \ Month	1	2	3	4	5	6	7	8	9	10	11	12
Four Crosses - Total traffic	0.8%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
Buttington – south west direction	1.1%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Buttington – north east direction	0.4%	0.7%	0.7%	0.8%	0.7%	0.9%	0.8%	0.7%	0.7%	0.7%	0.9%	0.7%
Newtown - west direction	1.0%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Newtown - east direction	0.3%	0.5%	0.5%	0.7%	0.6%	0.5%	0.5%	0.6%	0.5%	0.5%	0.5%	0.5%
Cambrian way - total traffic	0.7%	1.2%	1.2%	1.2%	1.2%	1.3%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%
Milford Rd - total traffic	1.4%	2.3%	2.3%	2.3%	2.3%	2.8%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
Aberhafesp - total traffic	4.2%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%	7.1%
Llanwnog - total traffic	7.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%	12.4%
Caersws - north direction	4.4%	7.3%	7.3%	10.3%	10.3%	7.3%	7.3%	10.3%	10.3%	7.3%	7.3%	7.3%
Caersws - south direction	1.0%	1.9%	1.6%	5.0%	5.0%	2.2%	1.9%	4.4%	4.4%	1.6%	2.2%	1.6%

Table 5.6 Effect of ECOCAS generated traffic on the traffic sensors

In the analysis the effect of the ECOCAS-related traffic is represented in terms of the likely number of movements on the busiest days (LJOBD – Likely Journeys On Busiest Days). This quantity is defined as the number of journeys likely to occur during days of peak ECOCAS-related traffic movement, and the percentage traffic increase over the baseline data is done using this quantity. This choice has been made because we are of the opinion that the average data does not convey a reliable picture of the likely impact of the ECOCAS-related traffic.

The analysis of the various traffic sensors shows that the most affected is the one in Llanwnog, whose traffic flow increases in months 2 to 12 due to the likely addition of one vehicle between 6am and 7am to the existing average traffic of 8.5 vehicles. It is evident that this level of traffic movement is insignificant in every respect and therefore if we ignore this case the second largest impact occurs on the Caersws traffic sensor, north direction of travel, in months 4 and 5. In this case the traffic flow increases by 10.3% between 7am and 8am, due to the likely addition of 9 vehicles to the existing average of 88 vehicles. From these results it is evident that, even though the traffic flow is marginally greater than the 10% threshold, the absolute numbers show a very limited effect. In periods where the existing traffic flow is made up of a

larger number of vehicles the effect of the ECOCAS Wind Farm never exceeds the 10% threshold of possible environmental impact on sensitive receptors or the 10% accuracy threshold defined in Section 5.5.2, and as a result no effects are anticipated in regard to any of the possible environmental effects or potentially affected groups identified in Section 5.5.2.

Moreover, the increase in traffic at the sensors in Newtown, Milford Road and Cambrian Way never exceeds 3%, and the likely impact of traffic on social aspects like severance, pedestrian amenity and fear and intimidation can be regarded as not significant.

5.5.10 Accidents Statistics

With regards to the accident statistics along the main delivery routes, the number of accidents involving pedestrians along the A483, the B4568 and the A470 in the period between 1st January 2006 and 20th May 2009 have been 5, 9 and 0, respectively. These numbers correspond approximately to 1 and 3 accidents per year along the A483 and the B4568, respectively, and the potential increase in these numbers due to the ECOCAS-generated traffic during the wind farm construction period can be considered as statistically not significant.

If we consider all the accidents that occurred along the A483, the B4568 and the A470 in the period between 1st January 2006 and 20th May 2009 independently of the vehicle and class of the people involved, there have been a total of 142 accidents, or about 42 per year, that is 3.5 per month. Even considering a traffic increase of 10% along those roads due to the presence of ECOCAS-related traffic, the variation in the number of accidents is likely to be not as large as the traffic increase. In fact, the statistics shows that about half of all accidents are due to lack of attention or loss of vehicle control, which are independent of the number of vehicles on the roads, while overtaking manoeuvres and accidents in queues account for about 25% of the total accidents. Therefore the effect of the ECOCAS-related traffic is likely to affect only about 25% of the accidents, and even considering the busiest days, a traffic increase larger than 10% is very unlikely. Assuming a proportional relation between the traffic increase and the number of accidents associated to overtaking manoeuvres and presence of queues, the overall increase in traffic accidents can be computed by (25% x 10%) = 2.5%, which correspond to about 0.1 accidents per month if the baseline is 3.5. For this reason, the effect is considered not significant.

5.5.11 Site Operational Effects

The main traffic activity associated with the project is during its construction and to a lesser degree during the decommissioning, which in any event at 25 years distance is undetermined. However, during operation of the Wind Farm certain routine visits will be required, mainly associated with service activities including the turbines and general infrastructure maintenance, together with less frequent visits in relation to the substation and anemometry mast. We estimate that for a 12 months period the total of these visits will not exceed on average one per day and as a result these numbers do not represent any material effect either in regard to the operation of the Site or even if this was considered as part of normal traffic flow. The operation traffic falls significantly below the threshold identified and the impact is therefore classified as 'not significant'.

6 Planning Policy

6.1 Introduction

This section of the Environmental Statement (ES) details the extent to which the proposed ECOCAS Wind Farm accords with the principal County and local policies. A separate Planning Statement has been provided to accompany the ES and highlights those planning policies which will be given consideration when assessing the ECOCAS planning application.

6.2 The Development Plan

6.2.1 Planning Documents

Within Powys there are currently a number of relevant planning documents including the Powys Unitary Development Plan (UDP), Deposit Draft which has been adopted in plan, the Powys County Structure Plan (Replacement) (1996) and the Montgomeryshire Local Plan (Deposit Version October 1995 and Subsequent Modifications). As the Montgomeryshire Local Plan was never formally adopted and the UDP will eventually replace the Powys County Structure Plan the consideration on strategic planning, development control and other land use planning and regeneration purposes should lie with the UDP as amended by the Proposed Modifications, November 2007 & May 2008, which have been approved by the County Council for the purpose of determining planning applications.

6.2.2 Powys County Structure Plan

The Powys County Structure Plan (Replacement) was adopted by Powys County Council (PCC) on the 1st February 1996. This plan sets out strategic land use policies for the whole of Powys for the period mid-1991 to mid-2006. Although this plan is due to be replaced by the UDP it is still given consideration when determining planning applications. The specific policy relating to the generation of renewables details the conditions relating to any proposed development.

"Proposals for development designed to generate or capture energy from naturally sustainable sources most notably wind power and hydro-electric power, will be permitted provided that:

a. There are no unacceptable planning, access, service or amenity problems, with particular reference to new roads and accesses required both on and off sites and the impact of large construction and maintenance vehicles on minor rural roads and the environment;

b. Adverse effects upon agriculture, forestry and other existing land uses or activities are minimised;

c. The proposals are not situated in or close by National Nature Reserves, SSSI's, or other nationally important conservation sites;

d. The proposals would have any unacceptable adverse effects on other sites of conservation interest.

e. The proposals would not have any unacceptable adverse effects upon the special landscape areas, especially the National Park, where large scale developments are unacceptable; and

f. The proposals are not situated on or along migration flyways or significant flight paths for birds nor on or near heavily populated wintering/staging areas for birds, especially waterfowl.

All such proposals should be accompanied by full environmental appraisals or assessments where appropriate, including consideration of:

- The impact of turbines, access roads, powerlines, buildings and other structures;

- The impact upon the landscape, natural environment, vegetation, ecology, natural habitats, hydrology, drainage, electromagnetic environment;

- The impact on all other conservation issues;

- Noise and health and safety matters; and

- Measures to ameliorate any of these adverse impacts.

Special consideration should be given to landscape issues including siting, aspect, visual impact of structures from afar, cumulative effects of wind farm proposals, size, design, and colour of the proposed structures and screening.

Any proposals for associated developments which are not directly related to the generation, storage or distribution of energy, and the maintenance of such plant and machinery, will be considered independently in the context of the appropriate policies relating to that type of development. Any temporary equipment or structures used during construction should be removed as soon as possible and redundant equipment or structures should be dismantled and made safe after use ceases.".

The Council also stated in this policy that the environment of Montgomeryshire was best protected by installing a smaller number of large wind farms as opposed to many small projects spread around the area. The policy also considers that developments should maximise their full potential by making maximum use of the wind resource. The rationale behind this policy was that the Council wished to see the impact of wind farms limited to a restricted area of the District and therefore leave the majority of Montgomeryshire free from the visual impact of turbines. The specific policies within the Powys County Structure Plan are detailed further.

"POLICY ENV 24

The Council will approve the development of wind farms in Montgomeryshire up to a combined maximum declared net capacity of 52.5 megawatts, subject to individual sites having no overriding adverse environmental impacts. Wind farm proposals will generally be refused where they would, in combination with all other existing or approved Montgomeryshire wind farms, lead to a total declared net capacity which significantly exceeds 52.5 megawatts.

POLICY ENV 25

In making its 52.5 megawatts contribution to wind energy, the Council will favour the development of a small number of large wind farms (those with 50 or more wind turbine generators) and will oppose the proliferation of small wind farms (less than 50 wind turbine generators).

POLICY ENV 26

In assessing the visual impact of wind farm developments, the Council will take particular account of the cumulative visual impact of proposals in combination with the impact of other existing or approved wind farms wherever zones of visibility overlap. Proposals will be refused in cases where the cumulative visual impact would be significantly detrimental to overall environmental quality.

POLICY ENV 27

In assessing the impact of wind farms on amenity, the Council will seek to minimise any adverse effects from noise, shadow flicker, or reflections. Where such effects would be significantly detrimental to residential amenity or overall environmental quality, they will be refused.

POLICY ENV 28

The Council will seek to ensure that within any acceptable wind farm site, maximum use of the wind resource is achieved by maximising the number of turbines subject to there being no adverse environmental impacts arising therefrom.

POLICY ENV 29

The Council will refuse or oppose proposals which would detrimentally affect the optimum operation of any wind turbine generator which provides power to the grid.

POLICY ENV 30

Wind farm proposals will be refused in cases where they require the erection of new or upgraded electricity transmission lines which would have a significantly detrimental impact upon the environment.

POLICY ENV 31

The Council will seek planning obligations or other appropriate legally binding agreements to ensure the implementation of off-site works where these are necessary in order to facilitate wind turbine development proposals or to ameliorate their impact.

POLICY ENV 32

The Council will require, as part of planning permissions for wind turbine developments, that wind turbine generators and ancillary equipment will be removed and the land restored to permit agricultural grazing should the turbines subsequently cease operation. The operation of any turbine will be deemed to have ceased if it has not been producing electricity for supply to the grid for a continuous period of 6 months.".

6.2.3 Powys Unitary Development Plan

The Development Plan within the area of Esgair Cwmowen is the Powys Unitary Development Plan (UDP) which is the basis for determining planning applications and replaces the Powys County Structure Plan and the Montgomeryshire Local Plan. The UDP provides a policy framework for positive planning, proposals and allocations for future developments.

The specific policy relating to renewable energy within the Development Plan states that proposed developments that capture energy from naturally sustainable sources will be permitted, provided that they match a number of criteria. The policy that relates to wind power sets out the criteria that should be met including taking into account the landscape, cultural

heritage, habitat and ecology, noise and shadow flicker, access including public rights of way and mitigation measures. It also details the need for assessment of cumulative impacts.

"The council will approve applications for wind farms including extensions to existing sites and individual wind turbine generators where:

They do not unacceptably compromise the environmental and landscape quality of Powys, either in an individual basis or in combination with other proposed or existing similar developments.

They do not compromise or threaten wildlife habitats or species that are of international, national or local importance.

They do not significantly threaten the health or amenities enjoyed by the occupants or users of sensitive properties by reason of noise, vibration, shadow flicker or reflected light.

They do not unacceptably impact upon any buildings or features of conservation or archaeological interest.

They do not compromise the enjoyment and safe use of highways and the public rights of way network, especially bridleways.

They would be capable of being served by an acceptable means of highways access and any new roads and access required would not have unacceptable environmental impacts.

Applicants are able to demonstrate through land management schemes that there would be adequate mitigation or compensation for any adverse impact on environmental quality, wildlife habitats or heritage features.

Any ancillary structures or buildings are so sited and designed so as to adequately blend into their setting.".

The specific policies within the UDP relating to the ECOCAS Wind Farm development are detailed further.

6.2.4 Strategic Part One Policies

SP3 - Natural, Historic and Built Heritage

According to SP3, proposals are expected to conserve and protect those features of importance in terms of their ecology, geology, scientific value and aesthetic quality. This policy outlines the Council's commitment to maintain and conserve the environment, historical and archaeological assets. The ECOCAS ES details clearly the importance of mitigation where possible and provides a proposal that aims to conserve and protect those features of importance as determined in the SP3 policy.

SP12 – Energy Conservation & Generation

SP12 sets out proposals for energy generation from renewable sources which will be approved providing that they meet the criteria set out in the accompanying policies. The ECOCAS Wind Farm will generate up to 51 MW of renewable energy and therefore supports this policy as the minimum disruption to the environment has been made with the maximum output available.

6.2.5 Generic Environmental Policies

Policy GP1 Development Control

Policy GP1 details how the design of the development should, wherever possible, take into account the landscape, ecology and historical context whilst also safeguarding wildlife habitats. The criteria also indicates that transport, highways access, soil and water quality, drainage and flood risk should also be included when determining the design and layout of the development. The design and access statement that accompanies the ES takes into account the design and layout of the development for the ECOCAS Wind Farm including taking into account other issues that determine the layout as detailed in the GP 1 policy.

Policy GP3 - Design and Energy Conservation

Policy GP3 states that all proposals for development should make a contribution to the local environment and community through the use of quality design, layout, materials and landscaping in accordance with the policies of the UDP. A design statement accompanies the ES as part of the submission for the ECOCAS Wind Farm with descriptions of the design and how it has subsequently been adapted to fit with the location.

6.2.6 Energy Policies

Policy E3: Wind Power

This policy specifically relates to wind farm developments and sets out the criteria that should be met including taking into account the landscape, cultural heritage, habitat and ecology, noise and shadow flicker, access including public rights of way and mitigation measures. It also details the need for assessment of cumulative impacts and that assessments should determine that the proposal does not unacceptably impact upon the environment and landscape quality. The ES conforms with this policy and includes all the assessments required from the relevant statutory bodies determined at the scoping stage.

Policy E4: Removal of Redundant Wind Turbines

As part of the planning application the removal of the turbines and restoration of the land back to an agreed standard should be detailed in the application. Decommissioning of the ECOCAS Wind Farm is detailed within the ES and the land will be restored back to its prior state.

Policy E5 - Off-site works

Off-site works, where necessary should be assessed to ensure the impact of the works are reduced. Off-site assessments of access routes have been determined and assessed in the ES, including alternatives.

6.2.7 Landscape and Visual Policies

Policy ENV 2: Safeguarding the Landscape

Policy ENV2 determines that proposals should take into account the high quality of the landscape and that proposals should be sensitive towards the character of the landscape. This should be done by seeking to conserve native trees and hedgerows and ensure integration of the development into the landscape. The ES assess the landscape within and surrounding the Site in the landscape and visual assessment. The assessment indicates that the proposed Wind Farm will fit in with the current landscape and is easily encompassed by the surroundings.

Policy RL6: Rights of Way and Access to the Countryside

Policy RL6 encourages appropriate proposals that improve access to the countryside for the public and the continued maintenance and enhancement of existing rights of way. The ES details that the existing rights of way across the Site will be utilised during construction as access tracks on the Site. By utilising the tracks the development will enhance the access on to the Site for the general public, where rights of way are disturbed these will be diverted and maintained throughout construction and operation of the Wind Farm.

6.2.8 Ecology and Ornithology Policies

Policy EC3: Special Landscape Areas

Policy EC3 sets out the need to maintain biodiversity and nature conservation of an area including the major importance for wild flora and fauna. It advises that wherever possible a development should seek to protect those species and maintain them. The ES has assessed the impact of the proposed ECOCAS Wind Farm on the habitat by undertaking a phase 1 habitat survey and an extended phase 1 habitat survey. The findings indicate that the proposal will not have a significant impact on the habitat as long as certain mitigation measures are adhered to.

Policy EC4: Environmental Impact

Policy EC4 is designed to protect special protection areas (SPAs) and potential SPAs, special areas of conservation (SACs) and candidate SACs from developments which may have a significant impact on them. Except for when there are reasons of overriding public interest for why the development should proceed. The ES confirms that there are no SPAs or SACs which would be significantly impacted upon by the ECOCAS Wind Farm.

Policy ENV 3: Safeguarding Biodiversity & Natural Habitats

Policy ENV3 recognises the need to protect the biodiversity and habitat through monitoring and protection of species worthy of conservation. Its primary aim is to safeguard and enhance biodiversity in Powys. The ES has included an assessment of the potential effects that the proposed ECOCAS Wind Farm will have on the ecology and ornithology of the Site. The chapters assessing these impacts conclude that the Wind Farm has been suitably laid out to

cause minimum disturbance to the existing ecology and that there will be a limited impact on birds and bats across the Site.

Policy ENV 5: Nationally Important Sites

Policy ENV5 seeks to protect areas of nature conservation interest, national nature reserves and sites of special scientific interest from developments that may have a direct or indirect impact. Developments that have a significant impact will only be permitted where the benefits clearly outweigh the nature conservation value of the Site. There are no nationally designated sites within the ECOCAS Wind Farm Site.

Policy ENV 6: Sites of Regional & Local Importance

Policy ENV6 seeks to protect areas of regional or local nature conservation, geological or geomorphological importance. Developments that have a significant impact will only be permitted where the benefits clearly outweigh the nature conservation value of the Site and where mitigation measures are incorporated to offset the impacts. There are no designated sites within the ECOCAS Wind Farm Site. The ES makes reference to those areas to Llyn Mwar SSSI and has concluded that there will be no significant impact on the designations.

Policy ENV 7: Protected Species

Policy ENV7 protects those species under European legislation and developments are only likely to be permitted where there is a clear benefit that outweighs the protection of the species. The assessment of protected species confirms that there will be no negative impact on protected species and that measures will be put in place to avoid detrimental disturbance.

6.2.9 Cultural Heritage Policies

Policy ENV 14: Listed Buildings

Policy ENV 14 protects listed buildings against proposals for development that may unacceptably affect the listed building or its setting. The Cultural Heritage assessment confirms that no protected listed buildings would be unacceptably affected by the proposed development.

Policy ENV 16: Landscapes, Parks and Gardens of Special Historic Interest

Policy ENV 16 protects the landscape, parks and gardens of historic interest from any development proposal which would unacceptably adversely affect the character, appearance or their setting. The proposed ECOCAS Wind Farm is likely to have a negligible to minor significance on the landscape, parks and gardens of special historic interest and will therefore not unacceptably affect the character or setting of these areas.

Policy ENV 17: Ancient Monuments & Archaeological Sites

The ENV 17 policy protects those scheduled ancient monuments and archaeological sites from developments which would unacceptably affect the Site or setting of a scheduled ancient monument or of an archaeological site of national importance. The Cultural Heritage assessment has determined that although there will be some impacts from the Wind Farm on the scheduled ancient monuments, this would not be unacceptable and would only be a short term impact.

Policy ENV 18: Development Proposals Affecting Archaeological Sites

Policy ENV 18 protects the archaeological sites and remains on-site that a proposed development may affect. The council advises that archaeological field evaluation should be undertaken before determining any planning application and where archaeological remains of importance are revealed their preservation should be carried out wherever possible. To conform to this policy an archaeological field evaluation was undertaken by Cambrian Archaeological Studies.

6.2.10 Hydrology and Hydrogeology Policies

Policy DC9: Protection of Water Resources

The protection of water resources advises that development proposals which impact on the water environment and associated land will only be permitted subject to the development not unacceptably impairing the quality, capacity or flow of surface or ground waters. The hydrology and hydrogeology chapter of the ES confirm that mitigation measures, where possible, have been implemented to reduce the impact of the proposal and site tracks on the hydrology of the

area. Additionally, river crossings and the use of box culverts have been planned to follow best practice as set out by the Environment Agency (EA).

6.2.11 Other Policies

Policy T2: Traffic Management

Policy T2 aims to reduce the level of unnecessary road traffic and its adverse impact upon the environment. The council encourages traffic management schemes which utilise the existing road networks and are sensitively designed. A formal outline traffic management scheme has been prepared in order to minimise the effects of additional traffic loads during construction of the project.

Policy MW6: Borrow Pits

Policy MW6 states that temporary excavations for the extraction of aggregates in relation to a development, remotely from a quarry will be allowed where significant environmental advantage would be achieved by the prevention of heavy vehicle traffic passing through settlements. The ECOCAS Site proposes to excavate stone suitable for the construction purposes of the development from borrow pits located on the Site. These would be restored following the completion of the project. The use of borrow pits on-site would reduce the number of vehicle loads travelling on the unclassified roads close to the Site.

6.3 Other Considerations

As part of this application TAN 8 and the Interim Development Control Guidance (IDCG) are also valuable planning documents. The TAN 8 and IDCG are covered in more detail within the Planning Policy, Design and Access Statement that accompanies this ES.

6.3.1 TAN 8

TAN 8 recognises that onshore wind power offers great potential for an increase in the generation of electricity from renewable energy in the short to medium term. In order to try to meet the targets that have been determined for onshore wind production the WAG has "…commissioned extensive technical work, which has led to the conclusion that, for efficiency

and environmental reasons amongst others, large scale (over 25 MW) onshore wind developments should be concentrated into particular areas defined as Strategic Search Areas (SSAs).". There are seven SSAs in Wales that have been identified as being suitable for wind farm developments. The ECOCAS Wind Farm currently lies within SSA B (Carno North) which has an installed capacity of 290 MW. The ECOCAS Wind Farm will help reach this installed target and is designed to cause the least amount of disturbance to the landscape and environment whilst gaining the maximum output of electricity generation.

6.3.2 Draft Interim Development Control Guidance

The IDCG is taken into account by the Local Planning Authority when determining planning applications and when responding to the Secretary of State for Business Enterprise & Regulatory Reform on proposed developments in excess of 50 MW. The first draft of the IDCG has already been authorised for development control and consultation purposes although additional drafts of the IDCG and further refinements are still in process for SSAs B (Carno North), C (Newtown South) and D (Nant y Moch). The Carno North and Newtown South SSAs fall wholly within the PCC administrative area.

The WAG addressed a letter to all chief planning officers in 2007 that stated more needed to be done in Wales to avoid dangerous climate change and to meet the targets set out in the Climate Change Bill. The letter detailed to local planning authorities that the SSA boundaries initially drawn up in TAN 8 were produced whilst taking considerable regard to expert advice. Whilst the WAG acknowledged that minor adjustments might be needed to account for local circumstances they commented that "*…it is essential that LPAs conclude the changes being made to the SSAs and press ahead so that planning applications can be determined and, subject to securing the appropriate consents, projects delivered on the ground without further delay.".* It is clear that onshore wind is the main way of meeting government targets and that the SSAs have been determined to identify those areas most suitable to this type of development. Whilst further refinements are continuously carried out on the SSAs the delivery of wind farms and the achievement of WAG targets are possibly being constrained by local planning issues. These refinements should be of concern to the WAG especially as cases such as the Wern Ddu application have already raised this issue in inquiries.

At the time of submission the IDCG is still under review and should be given little weight in light of all the issues that have been raised. National needs for renewable energy and 2010 targets should be the overriding determination. Therefore this proposal adopts the SSAs as specified in the TAN 8 of which the Site of the ECOCAS Wind Farm lies wholly within SSA B.

7 Scoping

7.1 Introduction

The scoping process is a critical component to the Environmental Impact Assessment (EIA) and involves the identification of all the significant impacts of the project on the environment. The scoping process identifies, through consultation with statutory bodies, the scope of those technical studies required to be undertaken during the EIA. The scoping process also recognises that some impacts will be more significant than others in terms of their impact on the environment and that some will have no significant impacts and will therefore not require further investigation.

7.1.1 Scoping Opinion

Scoping has been undertaken to determine any significant issues that needed to be considered and any information that should be included in the Environmental Statement (ES).

A letter (see Volume 4, Appendix 4, Pages 1.1-1.6) requesting a formal scoping opinion was sent to Gary Mohammed at the then Department of Trade and Industry (DTI) on the 28th September 2006. This request was also copied to Mr Thomas at Powys County Council (PCC), Mr Redmond at Welsh Assembly Government, Mr Revill at Environment Agency (EA), Ken Perry at Countryside Council for Wales (CCW), Mr Kevern at Cadw, Ms Allen at NATs and Mr Smailes at CAA.

In response to the letter to the DTI detailed comments were received from Rob Pridham at the DTI dated 2nd November 2008 (see Volume 4, Appendix 4, Pages 1.7-1.8) giving their opinion as to what information should be included in the Environmental Statement (ES). Comments were also received through the DTI from CCW, EA, and NATS. A summary of the matters received to the scoping opinion request under Regulation 7 of the Electricity Works (Environmental Impact Assessment) Regulations 2000 that should be covered are detailed below. Full correspondence can be found in Volume 4, Appendix 4, Pages 1.1-1.32.

	Scoping Opinion
DECC	Landscape and Visual assessments including capacity, character, quality and value. Cumulative visual assessment within a 30 km radius from the Site boundary. Noise assessments during construction and operation. Traffic and Transport. Site selection. Proposed electricity grid connection. Ecology including the impact on species protected under the Habitats Regulations or the Wildlife and Countryside Act 1981. Archaeology and Cultural Heritage assessment within 10 km from the boundary of the Site. Hydrology and Hydrogeology impacts. Telecommunications and Aviation. Construction materials. Impact on designated sites such as National Parks, SSSIs, SPAs. Cumulative impacts should be considered where applicable.
EA	Hydrology and Hydrogeology issues including flood risk and private extractions.
NATS	Preliminary findings suggested that the development did not conflict with the safeguarding criteria. "The proposed development has been examined by our technical and operational safeguarding teams and although the proposed development is likely to impact our infrastructure NATS (En Route) Plc ('NERL') has no safeguarding objection to the proposal.".
CCW	Landscape and Visual assessments at 30 km and cumulative assessment at 60 km. Ecological assessments. Ornithological and Bat assessments. Habitat. Site Hydrology.

Table 7.1 Scoping Opinions

The consultees commented on more specific aspects of the assessment and these are described further in the relevant sections of the ES.

7.2 Consultation

Further consultation has also been undertaken with the Civil Aviation Authority (CAA), Ministry of Defence (MOD), Ofcom, JRC, CSS, Cadw, Clwyd-Powys Archaeological Trust (CPAT) and non statutory consultees including the National Trust and Snowdonia National Park Authority. The consultation letters can be seen in Volume 4, Appendix 4, Pages 2.1-10.6. A summary is shown in Table 7.2.

CAA	"This Directorate has no observations.".
MOD	"I am writing to tell you that the MOD has no concerns with the proposal as set out in your pro-forma dated 26th September 2008.".
OFCOM	"Ofcom have found that within the assessed fixed link frequency bands, there are currently no fixed link end(s) within or fixed link paths that cross your requested coordination area. This assessment is based on the Ofcom fixed links database status as of 21st Sept 2008.".
JRC	"…the JRC does not foresee any potential problems based on known interference scenarios and the data you have provided.".
CSS	"I have been advised by our client that they have no objection to the proposed Wind Farm.".
Cadw	The following Scheduled Ancient Monuments fall within or directly adjacent to the Wind Farm boundary: MG278 – Nant Cwm Gerwyn Cairns MG179 – Y Capel Stone Circle MG279 – Blaen y Cwm Ring Cairn MG276 – Lluest Uchaf Cairns and Stone Row MG277 – Craig y Llyn Mawr Round Cairn Regarding comments on the proposed Wind Farm, Cadw's regional Inspector of Ancient Monuments customarily makes comment when a planning application is submitted.
CPAT	A detailed desktop study of the whole of the Wind Farm boundary area and any intended new access and electrification routes. A systematic field walkover survey of the whole Wind Farm boundary to locate and map both existing sites and any previously unrecorded archaeology. An assessment of the impact of the Wind Farm on the local TAN 8 SSA historic landscape character (HLC) areas within and adjacent to the Wind Farm. An assessment of the impact of the Wind Farm on any adjacent or distant Registered

	Historic Landscapes. An assessment of the visual and direct impacts of the Wind Farm on any statutorily protected archaeological sites within or adjacent to the development area including scheduled ancient monuments and listed buildings. An assessment of the impact of the Wind Farm on areas of paleo-environmental evidence within the Wind Farm boundary including blanket peats and other bog areas.
National Trust	We do not have any property in close proximity to the suggested Site: the nearest properties in our protective ownership are Powys Castle and Dolobran/Braich Melyn, both of which are about 20 km from the Site. In neither instance are the principle views in the direction of the proposed Wind Farm. I do not anticipate that the Wind Farm would have a significant impact on National Trust property.
Snowdonia National Park Authority	With regard to this proposal I note that it is some distance from the National Park boundary. However because of the size of the turbines (125 m to blade tip) and the proximity to other Wind Farm developments (and therefore the potential for a cumulative impact on views out with the Park) I consider that it would be useful to have the opportunity to view maps showing the ZTV, up to a radius of 35 km, of the proposed development.

Table 7.2 Summary of consultation responses

7.3 Conclusion

Detailed scoping has taken place and all the issues and concerns raised have been included within the EIA process. More detailed comments on areas where expertise were required are detailed in the relevant sections of the ES. In general, the proposed EIA scope was accepted by the statutory consultees although key additional points were raised and agreed to.

8 Habitat Assessment

8.1 Introduction

Chris Wells, Ornithological Services was commissioned by IPS to carry out a Phase 1 Habitat Survey at ECOCAS as part of an ecological assessment of the potential impact of the Wind Farm and track construction on the Site, see Volume 4, Appendix 5A.

8.2 Methodology

Plant communities were classified according to Phase 1 Habitat Survey methodology and the National Vegetation Classification (NVC) where appropriate. The Site was walked over and vegetation encountered in each area was assessed by eye, noting the frequency and abundance of plant species. The survey concentrated on seeking and identifying scarcer habitats and plant species which might be affected by construction works.

8.3 Results

All of the main vegetation and plant species of conservation value were intermingled, particularly on the wetter areas, forming mosaics with each other. The dominant habitats have been mapped and descriptions of the more significant or larger habitats within these mapped areas are discussed. The full assessment can be found at Volume 4, Appendix 5A of this Environmental Statement (ES) and below is a summary of the results from the Phase 1 Habitat Survey.

8.3.1 Improved grassland and semi-improved acid grassland

The areas marked as agriculturally improved grassland were mostly pasture of the NVC plant community MG6; the Perennial Rye-grass - Crested Dog's-tail grassland, and were of little conservation value for the vegetation itself. There were also areas of semi-improved acid grassland, which were either MG6 or species-poor U4 (Sheep's Fescue - Common Bent-grass - Heath Bedstraw grassland). These were also of little conservation value for their vegetation.

8.3.2 Unimproved acid grassland, marshy grassland and heath

There was also fairly species-poor unimproved acid grassland, mostly of the NVC community U5 (Mat Grass - Heath Bedstraw grassland) but also some U4 (Sheep's Fescue - Common Bent-grass - Heath Bedstraw grassland). In places it was heathier, with frequent Bilberry and Wavy hair-grass. This is of local conservation importance. Occasional small patches were dominated by Heather or Cross-leaved, but were not on deep peat. These are classified as heath, but were mostly small and included within the mire boundaries drawn on the map (see mire section below). There were also areas of species-poor marshy grassland, dominated by rushes or Purple Moor-grass, of local conservation importance.

8.3.3 Steeper slopes

The steeper slopes often held unimproved or semi-improved acid grassland, with patches of dense or scattered bracken, acid flush and occasionally Western Gorse. Together this could be classified as ffridd, which is a mosaic of habitats which occurs on upland fringes and is listed as a priority habitat in the Powys Local Biodiversity Action Plan (BAP). At the western edge were areas of dry upland heath, which is a priority habitat in the UK BAP, dominated by Bilberry or Heather, with some in a mosaic with acid grassland. Western Gorse is also classified as heath vegetation. Although the ffridd and heath were not of the highest quality, being somewhat limited in species and habitats, the ffridd is nonetheless of at least local conservation importance and the heath of county importance.

8.3.4 Watercourses

There were a number of small streams. The main ones were already marked on the map as shown at Volume 4, Appendix 5A. They also ran through areas of mire. Aquatic and marginal vegetation of the streams was generally fairly sparse, being typical upland watercourses, particularly where they ran through areas of more improved land. Within the peatland areas, they often marked the central channels of wetter areas of mire. Any works that may affect watercourses should be avoided, particularly regarding run-off and pollution.

8.3.5 Mire

Many areas of the plateau were covered with peat, most of which was deep (over half a metre in depth). In Phase 1 vegetation classification this is defined as mire. Mire is split into a number of habitats, often depending on the geography as much as the vegetation.

There was a mosaic of habitats in these areas, which has mostly been mapped with the dominant habitat code only, of blanket bog; a habitat defined as receiving no input of water from the surrounding land. However, some of the peatland present on the survey area ran along shallow depressions bordering streams or seepages, which could be classified as valley or basin mire, or flushes, particularly where the peat is shallow. On their own these other types can be classified as a type of mire, or peatland, called fen.

In terms of the conservation value, all of these are priority habitats in the UK Biodiversity Action Plan (BAP), so they are all of significant UK conservation importance.

The mosaics had wetter, more species-rich vegetation, particularly in the depressions and drier or more species-poor vegetation especially at the edges, often dominated by rushes or Purple Moor-grass. Less modified acid mire is distinguished from modified mire, by the presence of abundant bog-mosses. Most areas of deep peat held abundant bog-mosses. This unmodified mire is more significant in conservation value than modified mire.

The more species-rich areas contain the following species, cotton-grasses, Bog Asphodel, Cross-leaved Heath and sedges, Heather, and occasionally Round-leaved Sundew or Bottle Sedge. In some places there were also sedge-rich flushes, which are probably more base-rich. Most areas were still somewhat degraded, however, with Purple Moor-grass or Rushes often abundant. Functioning drainage channels were present in many areas and in places there were areas of wet modified mire dominated by Purple Moor-grass or Heather, with little or no bog-mosses, particularly on mire edges.

This mire is the most important habitat on the survey area and construction work should be avoided in these areas. The mire is susceptible to changes in hydrology; the construction of turbine bases and additional tracks in these areas are likely to cause their degeneration.

8.3.6 Conifer Plantation / Felled Conifer Plantation

Amongst the mire were areas of young conifers and also areas that were recently felled; some had since been ploughed and reseeded. This work appeared to be ongoing, so no attempt was made to distinguish between the two. Beneath the conifers was mixed vegetation, most often semi-improved neutral or acid grassland, grading into degraded mire at the edges of the plantations. These habitats were of limited botanical conservation importance.

8.3.7 Boundaries and tracks

Most boundaries were fenced. There are some hard surfaced tracks in the survey area, these should be used wherever possible, to avoid further track construction. Some of these tracks are not marked on the map.

8.4 Mitigation

The mire vegetation, including bog pools, is a UK priority habitat within the UK Biodiversity Action Plan. Construction work in these areas has been limited to the use of existing surface tracks to avoid these sensitive areas. The turbine foundations have also been positioned, where other constraints have not intervened, on the areas of improved or semi-improved acid grassland as these areas will cause the least amount of damage to the habitat. A 20 m buffer around all watercourses has also been implemented which means that all watercourses are left as undisturbed as possible, this is further detailed in Section 12.5.7 of this report.

Mitigation through habitat enhancement may also include reduced grazing and blocking the water flow in any functioning drains, to increase the wetness of the mire. Vegetation monitoring would be needed to confirm the improvement of the mire vegetation over the period of operation of the Wind Farm as these are complex habitats.

8.5 Conclusion

No rare or scarce plants, or plant species noted as priority species in the Powys or UK Biodiversity Action Plans, were found on the survey area.

Following the assessment it is considered that there will be a minimal impact on the habitat and that the ECOCAS development provides an acceptable level of mitigation to protect important areas of habitat.

9 Protected Species Survey

9.1 Introduction

The Badger Consultancy Environmental Ltd was commissioned by IPS to undertake a protected species survey to determine the presence of mammals and reptiles at the ECOCAS Site (see Volume 4, Appendix 6). The survey was completed through desktop study and field surveys using standard survey methodologies appropriate to a range of protected species. The approach indentifies the presence or absence of protected species based on field signs or direct observations, and/or the potential for protected species to be present/absent based upon the suitability of the habitat.

9.2 Guidance

Planning Policy Wales 2002 and Technical Advice Note 5 (TAN 5) provide the National Planning Policy approach to conserve, enhance and restore the diversity of wildlife by sustaining, and where possible improving, the quality and extent of natural habitats and the populations of naturally occurring species that they support. Local planning authorities have a statutory duty to have regard for the conservation of biodiversity under the Natural Environment and Rural Communities (NERC) Act 2006.

Reptiles and nesting birds are protected under the Wildlife and Countryside Act, (1981) as are British birds, their nests, and eggs (with certain exceptions) under Section 1 of the Act. This makes it an offence to intentionally kill, injure or take any wild bird, intentionally damage or destroy the nest of any wild bird while that nest is in use or being built. Within the Powys Biodiversity Action Plan, there are also 'species action plans' for water vole, otter, dormouse, and brown hare (UK BAP species) and for red squirrel (a local BAP species).

9.3 Methodology

The desktop study involved reviewing information regarding mammal and reptile species from records, whilst also drawing upon the MAGIC (a web based interactive map of environmental schemes and designations) and NBN (National Biodiversity Network) websites.

An initial field survey was carried out on 4th September 2008. Evening surveys were carried out on the 4th September, 9th and 16th October 2008 and day time surveys were carried out on the 9th and 16th December 2008. The field surveys incorporated assessments of all of the water courses and areas of suitable habitat for protected mammal and reptile species within and surrounding the Site.

9.3.1 Badger Survey

Detailed visual surveys were undertaken on the Site and at areas of up to 30 m from the Site boundary. Holes were examined to determine whether they had been or were being used as badger setts. If setts were present then the number of entrances and the level of use was recorded. Setts were classified according to the criteria used in the National Badger Surveys. The presence of hairs, footprints, pathways, dung pits and feeding signs were also used to plot the patterns of movement of badgers across or around the Site.

9.3.2 Dormouse & Red Squirrel Survey

A visual survey for the presence of any suitable habitat within the Site and up to 1 km from the boundary was assessed. If dormice were present, fallen hazel nuts were gathered to look for evidence of feeding signs according to the standard methodology Bright et al 1994. Woodland around the Site was also assessed for habitat deemed to be suitable for red squirrel and for evidence of squirrel field signs.

9.3.3 Water Vole & Otter Survey

All water course banks and ditches were checked visually for signs of activity, holes, latrines and feeding signs according to the standard methodology from Strachan and Moorhouse

(2006). The banks were also checked visually for signs of otter activity including, footprints, spraint and feeding signs according to methodology given in RSPB, NRA and RSNC (1994).

9.3.4 BAP Mammal Survey

Visual surveys for the presence of suitable habitat for BAP mammal species (brown hare, polecat, pine marten, hedgehog and harvest mouse) were carried out on the Site. Three evening surveys for bats were also carried out in September and October 2008, offering the opportunity to record nocturnal mammal species at the same time.

9.3.5 Reptiles

A visual survey for the presence of suitable habitat was carried out according to criteria in Herpetofauna Workers' Manual (Gent & Gibson, 1998) and the National Amphibian and Reptile Recording Scheme (HCT, 2008). The assessment is ranked in terms of the likelihood of occurrence. See Table 9.1.

Negligible	Site includes limited or poor quality habitat for species. No local returns from a data search.
Low	Site habitat is poor to moderate quality for species. Few or no returns from a data search.
Medium	Habitat of moderate quality providing most of the known key requirements for species. Local returns from data search indicate area is suitable habitat.
High	Habitat on-site of high quality for species. Good quality surrounding habitat and good connectivity.
Present	Presence of species confirmed from survey or by recent records.

Table 9.1 Terms for the likelihood of species occurrence

9.4 Results

9.4.1 Badger Survey

No setts were found on the Site and there was no evidence of badger activity within the study area. Therefore, the potential for badgers to be present on the Site is considered to be low.

9.4.2 Dormouse & Red Squirrel Survey

No suitable habitat for dormice was found on the Site. The young conifer plantation to the west of the Site did not offer good habitat for dormice and there was no connectivity with the wider landscape. Areas suitable for dormice were present to the south and west of the Bryn yr Ysbyty and Yr Alt conifer plantations, although the closest record for dormice was some 6 km from the Site. Dormice may therefore be present within 2 km of the Site but the likelihood of dormice being present in the woodland adjacent to the Site is low.

Red squirrel has not been recorded near the Site since 1974 and therefore there the likelihood of red squirrel being present is low as the remaining populations in mid Wales are limited to Tywi Forest.

9.4.3 Water Vole & Otter Survey

No recent records or evidence of water vole were found to be present within the Site. The water bodies present on the Site were also deemed to be unsuitable for burrowing due to the stony material. Therefore the potential for water vole to be present on the Site is low.

No evidence of otter was found on the Site as there were no suitable holt sites and limited foraging potential for otters within the Site. The potential for otter to be present is therefore low.

9.4.4 BAP Mammal Survey

The Site offers little foraging habitat for hedgehogs although the adjacent conifer woodland offers some suitable nesting sites. The potential for hedgehogs to be present on the Site is low but within the surrounding area, low to medium.

Polecat has been recorded nearby although the records were dated. Although the Site offered limited habitat the dense conifer plantations adjacent to the Site would be suitable for dens. The potential for polecat to be present on or near to the Site is considered to be medium.

There was no suitable habitat on the Site for pine martin and therefore the potential for pine martin is considered to be low.

Brown hare has been recorded nearby and the conditions on the Site offers suitable habitat. A brown hare was observed on the Site adjacent to one of the conifer plantations which may offer good foraging and suitable lying grounds. Brown hare has been recorded nearby, therefore the potential for brown hare to be present on the Site is considered to be high.

Harvest mice are unlikely to be present on the Site due to the poor habitat and intensively grazed land.

9.4.5 Reptiles

Grass snake, adder and slow worm have been recorded adjacent to the Site and surveys indicate that the Site offers areas of suitable habitat for these species. The presence of the conifer woodland also offers good foraging and undisturbed basking areas, therefore the potential for these species to be present is considered to be high.

9.5 Assessment of the Potential Impacts

9.5.1 Polecat

Polecat is considered to be present on the Site in the southern and western areas. During construction there would be a risk of injury during site clearance and disturbance would occur during construction. The extent of permanent habitat loss is limited to the bases of the turbines, access tracks and other infrastructure which are unlikely to have any impact on the density or distribution of the species in the future. It should also be noted that the forestry adjacent to the Site is a conifer plantation that is only temporary and is due to be cut down in the coming years. Therefore much of what has been said will be irrelevant as the felling of the conifer trees will create more disturbance to these species than the site clearance.

9.5.2 Brown hare

The Site offers suitable foraging and lying up sites, and could be used for breeding and mating by a number of brown hare. During the construction period, there may be a risk of injury to hares due to the site clearance work, and disturbance may occur due to human activity. The extent of permanent habitat loss due to the proposed development will be limited to the bases of the turbines, access tracks and other infrastructure, which are unlikely to have an impact on the density or distribution of hares in the future.

9.5.3 Reptiles

Reptiles such as adder, slow worm and grass snake may be present on the Site. During the construction period, there may be a risk of injury to reptiles due to the construction traffic, and during the site clearance work. The clearance of rubble, soil piles, associated vegetation, and the removal of mammal burrows may result in the loss of refuges used by reptiles. Therefore, this may have a negative impact on reptiles within the Site, displacing individuals into surrounding areas. The areas of habitat most suitable for reptiles were present in the southern and western parts of the Site, although the extent of permanent habitat loss due to the proposed development will be limited to the bases of the turbines, access tracks and other infrastructure, which are unlikely to have an impact on the density or distribution of reptiles.

9.6 Mitigation

Clearance of vegetation should be conducted outside of the breeding season (March-August) to avoid disturbance to brown hares and polecats. Following the completion of the construction phase, re-instatement and future management of the Site will aim to maintain a greater diversity of habitats, in order to enhance the Site for mammal species. This may include fencing off areas of the Site to prevent grazing by sheep, in particular, areas of species rich habitat (flushes, gorse scrub, unimproved grassland), to provide cover and foraging. Site preparation and vegetation removal in areas containing rabbit burrows or potential refuges such as piles of stone and soil should not take place during the hibernation period (October to April), when reptiles may be present. During clearance work, any potential refuges, burrows and areas of habitat likely to be used by reptiles will be dismantled and vegetation cleared carefully

by hand under the supervision of a qualified ecologist. Any reptiles found during the work will be carefully removed by a qualified individual and placed in a receptor site. Areas of new ffridd habitat will be established to replace areas lost to the proposed development, and these will be extended to link with existing areas of ffridd habitat, to ensure that reptiles are able to disperse into and away from the Site. Replacement refuges (piles of logs, rubble and vegetation) will also be constructed in designated 'safe areas' within areas of suitable habitat.

9.7 Conclusion

A precautionary approach is recommended when carrying out site works to ensure that all species are conserved. Following the assessment it is considered that there will be a minimal impact on mammals and reptiles.

10 Bat Surveys

10.1 Introduction

The Badger Consultancy Environmental Ltd was commissioned by IPS to undertake bat assessment and activity surveys at the proposed ECOCAS Wind Farm during Autumn 2008 and Spring/Summer 2009. The report is based on a desktop study and field surveys using standard methodologies appropriate to bat species.

10.2 Methodology

A request for information regarding records of bats within the area was made to the Biodiversity Information Service (BIS) for Powys and Brecon Beacons National Park. Record requests were made within a 4 km radius of four separate grid references within the Site boundary. The MAGIC (a web based interactive map of environmental schemes and designations) and NBN (National Biodiversity Network) websites were also reviewed as part of the assessment regarding information on nature conservation designations and species records. The Countryside Council for Wales (CCW) were consulted on the scope of the bat surveys and regarding the initial survey findings. Jonathan Gilpin of CCW confirmed that surveys should continue over spring and summer and comprise of two detector surveys per season, supplemented by static surveys. During talks with The Badger Consultancy it was also confirmed that the surveys should extend to an assessment of roosts within 1 km of the Site.

10.3 Legislation and Guidance

All species of bat and their breeding sites are protected under Section 9 of the Wildlife and Countryside Act 1981 (as amended) and they are also listed under Schedule 5 of the Act. All bat species are also cited in Annex IV of the Habitats Regulations. Under Regulation 39 of this Act it is an offence to deliberately capture, kill or disturb a bat.

10.4 Bat Survey

A survey of the buildings within the Site was carried out on the 4th September 2008. Buildings within 1 km from the Site boundary were also assessed for potential roosts on 9th and 16th December 2008. The area and buildings within 4 km of the Site were assessed for habitat features likely to be favoured by bats for roosting and foraging according to the criteria in Bat Survey guidelines (BCT, 2008).

10.4.1 Bat Roost Survey

Buildings on Site were surveyed during the 4th September 2008 internally and externally using binoculars and torches to check for entry points and for any evidence of bat activity including staining, droppings and feeding remains according to the criteria set out in Bat Mitigation Guidelines (Mitchell-Jones, 2004) and Bat Survey Guidelines (BCT, 2008). Buildings outside of the Site were surveyed on the 9th December 2008 externally for features likely to be suitable for roosting bats and were classified into buildings with high, low or no potential for bats. Within a radius of 1-4 km of the Site, on the 16th December 2008, trees and other buildings were also assessed for habitat features favourable for roosts.

10.4.2 Manual Bat Surveys

The first survey took place on the 4th September 2008 from 20:10 to 22:20. The ecologists drove a transect through the Site stopping to record for periods of between five and ten minutes at a total of 9 locations using a hand held Peterson D-240x time expansion detector connected to a Roland Edirol digital recorder and a Duet frequency decision detector linked to a minidisk recorder. During all the surveys weather conditions, temperature, humidity, wind speed, cloud cover, altitude and grid references were recorded. The second survey took place on the 10th October 2008 from 18:40 to 19:10 stopping at three locations along a transect before abandoning the survey due to poor weather conditions. The third activity survey took place on the 16th October 2008 from 18:30 to 20:30 at a total of six locations along a transect before this was also abandoned due to poor weather conditions. Two more activity surveys were undertaken in 2009 on the 4th June (22:15 to 23:40) and the 29th June (22:40 to 00:05). In addition to the transects, an Anabat (SD1a) static detector was positioned on a rocky ridge in

the centre of the Site facing north to capture bat activity during the surveying period. The data recorded from detectors was analysed using BatSound Standard Sound analysis v.3.31.

10.4.3 Static Bat Surveys

Two Anabats linked to a compact flash card recorder were positioned on the Site and left to record bat activity over four consecutive nights from the 4th to the 7th September 2008 and over six consecutive nights from the 10th to the 15th October 2008. During the recordings the Anabat II was positioned on a tripod within a small section of woodland near the western boundary of the Site facing east. The Anabat SD1 detector was positioned at the base of a dry stone wall towards the eastern end of the Site facing east towards Barn B.

Three Anabats were positioned on the Site and left to record bat activity over ten consecutive nights from the 14th to the 23rd April 2009 and over eight consecutive nights from the 28th May to the 4th June 2009. The Anabat II was positioned on a tripod within a small section of woodland near the western boundary of the Site facing east. An SD1 Anabat detector was located near a dry stone wall towards the east of the Site facing east. The second Anabat SD1 was positioned towards the northern part of the Site on a rocky outcrop facing south east. Locations of the detectors can be found in Volume 4, Appendix 7.

The Anabat recordings were transferred to a computer and analysed using AnalookW v3.3f. Species identification was made on the basis of the characteristics of the call (peak frequency, minimum and maximum frequency, call duration and inter pulse interval). The different species identified were noted for each minute of the survey.

10.4.4 Emergence Bat Activity

Three Anabats were positioned on the edge of the Site closest to those barns that were not accessible for surveys on Mynydd Cerrigilwydion, Leustuchaf and Blaen-y-Cwm, see Volume 4, Appendix 7 for locations. The detectors were left to record over four consecutive nights from 29th June to the 2nd July 2009.

Manual surveys were carried out through June 2009 at Cwm-Yr-Avel, the old Chapel at Ty-newydd, the derelict farm house at Pen-y-Ffridd, the barn at Ty-uchaf and Wins Barn. All

aspects of the buildings were covered and hand held detectors were used to record any bat activity.

10.5 Results

10.5.1 Desktop Survey

Information regarding the present and historical ecology from the Biodiversity Information Service (BIS) covers four standard 4 km radius search areas that cover the Site. Twenty one records of bats were returned from 1983 to 2003 and comprised individual bats and colonies of Pipistrelle sp., brown long-eared bat and 'unidentified' bat. The majority of records were recorded from locations to the south and west of the Site. The National Biodiversity Network (NBN) website was consulted with regard to bat records in the area surrounding the Site and returned the results in Table 10.1.

Common name	Scientific name	Distance from the nearest Site boundary
Pipistrelle	*Pipistrellus sp.*	<1 km to South
Brown long-eared	*Plecotus auritus*	<2 km to South and South West
Daubenton's	*Myotis daubentonii*	<2 km to South West

Table 10.1 Summary of bat records in the surrounding area

10.5.2 Habitat Survey

The majority of the Site is defined as being exposed with upland grazed pasture and moorland. The Site has a rocky ridge that runs roughly north to south through the middle of the Site. The watershed has created areas of wet flushes and small water courses across the Site. There are areas of immature conifer plantations to the west of the Site and large areas of mature conifers to the south western boundary of the Site. A detailed habitat assessment is further discussed in Chapter 8 of this ES.

10.5.3 Bat Roost Survey

Three barns within the Site were assessed for potential bat roosts. All three barns were determined as having low potential for bat roosts.

Eight buildings within 1 km of the Site were assessed for their bat roost potential. They were classified as having either a high, medium or low potential according to their age, material and design. A number of buildings and trees were also assessed as having the potential for bat roosts. Seven of those barns were described as having either a high or moderate/high potential for bat roosts, whilst one barn had a low/moderate potential for bat roosts. See Volume 4, Appendix 7 for details.

10.5.4 Bat Activity Surveys

Bat activity surveys were carried out in September and October 2008, details of the transects and results are summarised in Volume 4, Appendix 7.

10.5.4.1 Bat Activity Survey 4th September 2008

On the 4th September 2008 nine transect points were carried out across the Site. The first and second points both picked up a noctule bat *(Nyctalus noctula)* which was noted by its recordings rather than being observed. During the third transect point a soprano pipistrelle *(Pipistrellus pygmaeus)* was recorded on the Duet/Minidisc detector and at 20:34 a Mytois species bat was recorded. This bat was most likely a Natter's *(Mytois nattereri)* or Daubenton's (*Mytois daubentonii*) bat as the calls finished below 25 KHz. Common pipistrelle *(Pipistrellus pipistrellus)* were recorded a number of times during the fourth transect point. A soprano pipistrelle was also recorded during this transect point at 20:42 after which no bats were observed. During the fifth transect point a common pipistrelle was recorded at 21:05 and two *Myotis* species were also recorded although these passes were too faint to identify to species level. Another bat pass was recorded at 21:06 with a much fainter call than those before. It was most likely to have been a Mytois species bat although this could not be confirmed. Many bat passes were recorded during transect point six with all recordings being clear enough to identify the bats as common pipistrelle. During transect point seven a common pipistrelle was recorded at 21:54, a faint pass by either a pipistrelle or a *Myotis* species was recorded at 21:57

and a common pipistrelle was recorded at 21:58 although there is a possibility this pass may have been made by a Nathusius' pipistrelle *(Pipistrellus nathusii)* although the chance of this is very small. No bats were recorded at transect point eight. Three different bat species were recorded at transect point nine although none of these were observed. Both common pipistrelles and Soprano pipistrelles were picked up and were clearly identifiable. The other specie recorded on the transect was recorded as a faint pass by either a Leisler's bat *(Nycatalus leisleri)* or a serotine *(Eptesicus sertinus)*. The calls were identified as being more characteristic of a serotine although as the call was so faint it was not possible to properly identify it.

10.5.4.2 Bat Activity Survey 10th October 2008

No bats were observed or recorded at any of the transect points and the survey was abandoned at point five due to the weather conditions.

10.5.4.3 Bat Activity Survey 16th October 2008

No bats were observed or recorded at any of the transect points and the survey was abandoned at point six. One pass was recorded on the Anabat SD1a at 19:00 although the low frequency meant that it could not be identified even to the genus level.

10.5.4.4 Bat Activity Survey 4th June 2009

On the 4th June 2009 six transect points were carried out on Site from 21:15 until 23:45. During the first and second transect points no bats were recorded or seen although four passes by common pipistrelle were recorded during the emergence surveys. On the third transect point four passes were noted at 22:40 although these could not be identified. During the last three transect points no bats were recorded or seen.

10.5.4.5 Bat Activity Survey 29th June 2009

Seven transect points were carried out on the Site from 22:40 to 00:15 with five corresponding to transect points carried out in 2008. The first two transect points returned no results. The first transect point, corresponding to those carried out in 2008, returned one common pipistrelle pass at 23:11 and later on, three passes by common pipistrelle and one soprano pipistrelle.

The second transect point returned no results. Four passes by common pipistrelle were recorded at 23:35 at transect point three. At transect point four a common pipistrelle and a soprano pipistrelle were recorded at 23:39. Between 23:41 and 23:45 fourteen passes by common pipistrelle were recorded and a further pass was noted at 23:48. At transect point five common pipistrelle bats and Myotid bat were recorded although the Myotid bat could not be confirmed but was likely to be Daubenton's.

10.5.5 Static Bat Surveys

Static bat surveys were carried out throughout September and October 2008 using two Anabat detectors. Three Anabat detectors were used during the surveys through April and July. The full results can be found in Volume 4, Appendix 7.

10.5.5.1 Survey Period 4th - 7th September 2008

SD1 – Barn B

An Anabat SD1 detector was placed at the base of a dry stone wall towards the eastern edge of the Site facing east towards Barn B. Bats were recorded on all nights over this survey period with the number of recordings varying from one to twenty. Common pipistrelle bats were the most commonly recorded species during the survey whilst Soprano pipistrelle bats were also present but less frequently recorded. During the night on the 4th September 2008 a pipistrelle pass was recorded that fitted a Nathusius' pipistrelle, however as bats often lower the frequency of their calls in open spaces it is more likely that this bat was a common pipistrelle. Several passes by *Myotis* species bats were also recorded with one call identified as a Natter's call and others that had the same characteristics of Natter's calls although this could not be confirmed. A single pass by either a serotine or Leisler's bat was also recorded although it could not be identified more precisely.

Anabat II – Barn C

An Anabat II was positioned on a tripod near the western boundary of the Site facing east towards Barn C. Common pipistrelle bats were recorded every night during this survey, from 74 passes on the 5th September to 206 passes on the 7th September. In both cases the peak of activity occurred between 23:20 and 00:20. Soprano pipistrelle passes were also recorded on

Site in lower levels with more being recorded on the 6th September than common pipistrelle. A number of passes were also made by *Myotis* species bats on the Site. During the survey Brandt's, Daubenton's and Natterer's bats were thought to be identified although these could not be confirmed.

10.5.5.2 Survey Period 10th - 15th October 2008

SD1 – Barn B

An Anabat SD1 detector was placed at the base of a dry stone wall towards the eastern edge of the Site facing east towards Barn B. Although common pipistrelle bats were only recorded on two nights they were the most frequently recorded species during the October surveys. Soprano pipistrelle bats were also present with four passes being recorded over two nights. During surveys on the 12th October a *Myotis* spp. bat pass was identified as a Natter's due to the end frequency that dropped to 20 kHz. Other *Myotis* calls were recorded but these could not be identified further. Three passes by noctule bat were also recorded on Site.

Anabat II – Barn C

An Anabat II was positioned on a tripod near the western boundary of the Site facing east towards Barn C. Common pipistrelle bats were the most active bat species on the one night recordings were made. No recordings were made after the 11th October suggesting that there may have been a technical fault with the recording equipment. Passes were also recorded for *Myotis* species bat and these calls had the characteristics of Daubenton's bat although this could not be confirmed.

10.5.5.3 Survey Period 14th - 23rd April 2009

SD1 (A) – Barn B

An Anabat SD1 detector was placed at the base of a dry stone wall towards the eastern edge of the Site facing east towards Barn B. Noctule bats were the most commonly recorded species with more than one being recorded on some nights. Calls with varying frequency, which indicates more than one bat flying at the same time, were recorded on 14th, 15th, 17th and 19th April 2009.

SD1 (D) – Rock outcrop

Another SD1 detector was placed on a rocky outcrop north of Barn B facing south east. There was less activity at this location than at the other two locations. Common pipistrelle, noctule and *Myotis* bat species were recorded although it was not possible to identify the *Myotis* bat to species level due to the faint call.

Anabat II – Barn C

An Anabat II was positioned on a tripod near the western boundary of the Site facing east towards Barn C. The device did not record; therefore there are no results for this location.

10.5.5.4 Survey Period 18th May - 4th June 2009

SD1 (A) – Barn B

An Anabat SD1 detector was placed at the base of a dry stone wall towards the eastern edge of the Site facing east towards Barn B. Bats were recorded on seven out of the eight nights of recording. Pipistrelle bats were the most common species present on all but one of the nights. Low numbers of *Myotis* bats were also recorded.

SD1 (D) – Rock outcrop

Another SD1 detector was placed on a rocky outcrop north of Barn B facing south east. Bats were recorded on six out of the seven nights; on one night a *Myotis* species was the only bat to be recorded. The majority of passes were made by common pipistrelle especially on the 29th May 2009 when 29 passes were recorded.

Anabat II – Barn C

An Anabat II was positioned on a tripod near the western boundary of the Site facing east towards Barn C. Bats were recorded on six out of the eight nights of recording at the Site and the majority of bats recorded were pipistrelle species with 12 passes from *Myotis* species.

10.5.5.5 Survey Period 29th June – 2nd July 2009

SD1 (A) – Gully on Y-Gloncc

An Anabat SD1 detector was positioned on a fence post in a vegetated gully facing north east. There were high levels of activity at this Site with five species being identified. There were a number of pipistrelle calls which were most likely to be soprano pipistrelle as the calls were at 50 kHz. Five *Myotis* species calls were recorded but were unable to be identified any further than genus level.

SD1 (C) – South East corner of Site

An Anabat SD1 (device C) was placed facing south west on a mound on the Site. There were very high levels of activity at this location with the same bat species as those recorded at location A.

SD1 (D) – Gully in South West corner

An Anabat detector was located on a post near to a stream on the Site at the bottom of a steep track. The detector faced south away from the Site. The activity at this location was less than other areas of the Site recorded at the same time. Four species were identified including common and soprano pipistrelle, Daubenton's bat and Natter's bat. A number of pipistrelle calls were identified that could not be assigned to either species.

10.5.6 Emergence Bat Activity Surveys

Cwm-yr-Annel - 4th June 2009

Three buildings, a house and two barns, were located at Cwm-yr-Annel. No bats were recorded emerging from the house although a soprano pipistrelle was observed leaving one of the barns. Four passes by common pipistrelle were also recorded in the area.

Old Chapel at Ty-Newydd – 16th June 2009

No bats were observed emerging from the building although a Barn Owl was observed emerging from a broken window with another owl observed flying inside. Bats were observed commuting along a hedgerow near to the building with calls from common pipistrelle, soprano pipistrelle and noctule bats being recorded on an Anabat II.

Pen-Y-Ffridd – 16th June 2009

No bats were observed emerging from the building but one soprano pipistrelle bat was recorded flying over the building at 22:15 and a common pipistrelle was recorded near Ty Hir at 22:45.

Ty Uchaf – 16th June 2009

A common pipistrelle bat was observed emerging from the building as were three brown long-eared bats at this location.

Wins Barn – 29th June 2009

No bats were observed emerging from this barn although there were two Barn Owl boxes inside the barn that have been used for several years. A Nightjar was also observed flying from the undergrowth at this location.

10.6 Assessment

10.6.1 Bat Roosts

No bat roosts, or structures likely to be used as bat roosts, were identified within the Site, therefore there will be no direct impact on any bat roosts from the development. Seven buildings were identified within 1 km of the Site as having high potential for roosting. Emergence surveys carried out in June 2009 confirmed that individual common pipistrelle bats roosted over summer at Cym-yr-Annel (813 m from the Site) and in the barn at Ty-Uchaf (320 m from the Site). A survey on an adjacent proposed wind farm site also identified a bat roost at Blaen-y-Cwm (510 m from the Site). Due to the distances between the roosts identified and the edge of the Site (over 300 m) there would not be any indirect impact on the roosts. A number of trees and buildings with high bat roost potential were noted around the peripheral landscape. Ancillary works associated with the development, particularly the access route could affect bat roosts. However, as the access route comes up through the coniferous forest that is regularly cut down and re planted it is unlikely that the access route would be of any greater disturbance than the clearing and felling of the trees.

10.6.2 Bat Foraging and Commuting

Bats were recorded foraging during the activity surveys carried out between 4th September 2008 and 2nd July 2009. At least six and possibly seven different bat species were identified on the Site (see Table 10. 2) with two further species which could not be conclusively identified.

Bat species present	
Common pipistrelle	*Pipistrellus pipistrellus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Natter's bat	*Myotis nattereri*
Daubenton's bat	*Myotis daubentonii*
Noctule bat	*Nyctalus noctula*
Leisler's bat	*Nyctalus Leisleri*
Serotine bat	*Eptesicus serotinus*
Bat species that may be present	
Nathusius' pipistrelle	*Pipistrellus nathusii*
Whiskered/ Brandt's bat	*Myotis mystacinus/brantii*

Table 10.2 Bat species identified at ECOCAS

Local records indicate a presence of brown long-eared bat *(Plecotus auritus)* close to the Site. During the emergence survey at Ty-Uchaf three brown long-eared bats were observed using the barn as a summer roost. Since these bats have very quiet calls it is possible they were missed during the activity surveys within the Site. However, these bats do tend to forage within 1-2 km of their roosts within woodland habitat. The habitat on the Site is not suitable for these bats and the nearest known brown long-eared roost is more than 2 km from the Site, therefore, they are unlikely to be present on the Site.

Common pipistrelle bat was the most frequently recorded bat species during the static and transect surveys. The bats were recorded at all of the static detector locations and in the centre of the Site (transect points P4 & P9), on the forestry track to the west of the Site

(transect point P6), as well as in the gully leading to the south western part of the Site (transect point P5).

Soprano pipistrelle bats were less active on the Site, but were recorded at several locations. Soprano pipistrelle bats were recorded by the static detectors near Barns B and C, as well as over the more exposed central parts of the Site (P3 & P9). This indicates that both pipistrelle species use the Site in similar ways, almost certainly foraging around the conifer plantations and wet flushes.

The presence of a Nathusius' pipistrelle on Site is possible due to the low frequency calls that were recorded. However, the Site is a considerable distance from the Nathusius' pipistrelle bat's known geographical range in Britain. It was considered that the low frequency calls were due to the common pipistrelle low frequency echolocation calls in open habitats. *Myotis* spp. bats were recorded on a number of occasions with faint short calls making identification to species level difficult. Natterer's and Daubenton's bat were confirmed as being present whilst other calls were more characteristic of whiskered/Brandt's bat. *Myotis* species bats were recorded near the centre of the Site at transect point 4 and in the gully near the southern most point of the Site (P5).

The recordings of *Myotis* spp. passes showed no regular pattern of activity except that they tend to occur through the middle of the night (22:00-03:00). It is likely that noctule, Leisler's and serotine bat are also commuting over the Site to forage elsewhere as the habitat on the Site is unlikely to suit these species.

The wet flushes and moorland habitat on the Site provide a good habitat for flying insects especially in late summer and early autumn. These insects will provide an attractive food source for bat species including common pipistrelle, soprano pipistrelle and *Myotis* species. The exposed nature of the Site, however, means that poor weather usually experienced in this area would suppress the insects. Whilst the smaller bat species forage across the Site it is likely that the majority of the foraging is located in the lower lying woodlands and river corridors present to the south, west and north east of the Site.

Two noctule bat passes were recorded during the activity survey on 4th September 2008. These were both in the valley east of Y Glonc on the eastern boundary of the Site. Noctules were also recorded by the Anabat II on the western boundary on the 7th September and on

two days during mid October 2008. The low number of single passes suggested the bats were commuting across the Site. Between 14th and 21st April 2009, noctule bat passes were recorded on all the static detectors. The increased activity by noctule bat in spring could be due to bats migrating across the Site.

During the summer surveys, single passes by noctule bat were recorded on all the static detectors on 29th May 2009, at different times of the night (22.00 and 22.40 at Barn B, 22.45 at the rocky outcrop and then at 02.55 at Barn C). No further recordings of noctule bat crossing the Site were made after 3rd June 2009, although single passes at the beginning and end of the night continued to be recorded along the eastern edge of the Site (valley east of Y Glonc) and on the south eastern corner of the Site during 29th June to 3rd July 2009. This suggests those noctule bats are roosting to the south of the Site during the summer and commute along the valley on the eastern edge of the Site to forage to the north of the Site.

Two Leisler's bat or serotine bat passes were recorded, although both were faint making it impossible to be certain of which species were present. Both recordings were made on the 4th September 2008, one by the Anabat SD1 near Barn A at 01.20 and earlier by the ecologists at transect point 9. No further recordings of these species were made.

Noctule, Leisler's and serotine bat forage over pasture, parkland, water and deciduous woodland, but can commute long distances from roosts (>10 km). The habitats within the Site would be unlikely to suit these species, but the more sheltered woodlands and river corridor habitats present to the south, west and north east of the Site would be suitable. Therefore, none of these species were considered likely to be foraging on the Site, but individual noctule bats clearly commute regularly along the valley to the east of Y Glonc during summer, and this route may be used by a number of individuals during early spring, possibly during migration between hibernation and summer roosts.

The proposed development may have a negative impact upon bats through the following:

- Loss of habitat during construction of the turbines
- The presence of rotating turbine blades could disrupt bat flight through injury to the bats
- By indirect impact through ultrasound emissions, altered air pressures and/or air flows in the vicinity of the turbine

Those bat species foraging on the Site appear to be the smaller more agile species, which are likely to forage closer to the ground (<5 m). In the southern and western parts of the Site the level of bat foraging activity was recorded as being higher than elsewhere on Site. During construction there will be some disturbance due to habitat loss although the negative impact on those species foraging on the Site is deemed to be low, although for turbine 3 the impact on bats is likely to be moderate to high. The `knock-on' effect could be increased competition for foraging habitat in the surrounding area, but the overall impact on bat populations within the local area is likely to be low. Noctule bats were recorded commuting across the Site, and were regularly recorded using the valley on the eastern edge of the Site in the vicinity of turbine 16. These bats fly and forage at higher levels (>10 m), and so therefore the proposed turbines may disrupt their flight paths or commuting routes during operation. The larger Nyctalus and Eptesicus species can commute long distances between summer and hibernation roosts, which could have an effect on the population if the Wind Farm is on a traditional migratory route. Since these bats forage over a wide area, displacement would have a minor negative impact on those individuals resident near the Site. However, displacement of larger numbers of bats during migration could have a negative impact at the local or national level.

10.7 Cumulative Effects

At the time of this assessment four proposed and four operational wind farms within a 20 km radius of the ECOCAS Site have been identified. Many of the operational wind farms do not appear to have conducted any bat surveys prior to construction because the effect of wind farms on bats was not fully understood. The four currently proposed wind farms, all within 5

km of each other, have completed the required bat surveys. Mynydd Waun Fawr assessed the buildings within the buffer zone for potential for bat roosts; none were identified. No transect surveys were completed on Site as the habitat was deemed unsuitable for foraging bats. It is therefore difficult to assess the cumulative impact of this proposal. Tirgwynt is immediately adjacent to ECOCAS, the southern portion of the application boundary is separated by the north west portion of ECOCAS. Four turbines are proposed in the southern portion within 300 m from ECOCAS turbines. They identified potential roosts and completed stratified random point surveys. One definite roost was identified at Blaen-y-cwm, close to the western edge of ECOCAS. Several other potential roosts were identified in the northern part of the Site. Point surveys identified low numbers of common and soprano pipistrelles using the Site for foraging, mostly around features (such as gullies, woodland and buildings) and potential roosts. Mynydd Clogau has had 17 operational turbines since 2006. An extension is proposed for a further 19 turbines. The application boundaries are approximately 300 m apart and the closest turbines approximately 750 m apart. Buildings were assessed for roosts and an emergence survey was conducted at the most likely Site, although no bats were seen emerging it was still thought likely to be a roost for pipistrelle bats. Mynydd Clogau also completed walked transects across their site. These returned results of low numbers of common and soprano pipistrelles foraging on site.

In comparison with these surveys The Badger Consultancy has identified at least four species of bats not recorded by other consultancies. The majority of these calls were identified on the Anabat static recorders not used at any other site. These static recorders also picked up much higher levels of activity than were picked up by the transect surveys.

It is agreed throughout the surveys that the boundaries of the sites provide much better foraging and roosting opportunities than the exposed uplands. However these upland areas are used during late summer and early autumn for foraging, and by bats commuting from one valley system to another. The most risk is for high flying bats such as noctule, but as these were not recorded in other surveys it is difficult to assess the extent of use in the area.

There are no identified maternity roosts within 500 m of any turbines and the amount of foraging land lost will be minimal. The cumulative impact is therefore expected to be low.

10.8 Mitigation

It is recommended that bat surveys are conducted in the years following construction, to monitor the impact of the Wind Farm. It is suggested that monitoring takes places in years 1, 2, 3, 5, 10 and 15 of the operational years of the Wind Farm, and two reports should be created using the collated results, in years 3 and 15. All species records from all surveys and monitoring should be given to the local records centre and the results of reports made widely available to enable further research and understanding.

No roost sites have been identified on the Site, so no mitigation for roost sites will be required.

The proposed locations of turbines already avoid the areas of wet flushes as do the majority of the access routes which have purposefully been aligned with the tracks already on the Site.

Works on the Site will be conducted in such a way as to minimise the impact on the environment, without unnecessary disturbance or damage. The Site will be cleared of all construction materials and associated debris on completion.

10.8.1 Post Construction

It is recommended that the woodland close to turbine 3 be managed to ensure a gap of 200 m between the turbine and any mature trees after construction. As the woodland close to the turbine is forestry commission woodland used for the Christmas trees this woodland will be well managed and frequently re-planted and removed.

Noctule bats use the valley to the east of Y Glonc as a commuting route and as a probable migration route. Monitoring of bat movements during and post-construction will be undertaken, and if monitoring demonstrates an unacceptable impact, particularly during migration, consideration will be given to finding a suitable solution that will be agreed with the local council and an ecologist.

Presently, the wetter areas, particularly those in sheltered gullies or valleys, offer the best foraging and commuting opportunities for bats. It is proposed that management of the Site and the areas immediately adjacent to the Site will aim to maintain existing wet flushes, and create or increase habitat diversity in gullies with poor species diversity. The planting of native woodland/scrub areas to enhance foraging for bats will also be carried out with areas of new

planting being sited strategically in order to link existing woodland and re-establish poor hedges and other linear features likely to be used by bats. New roosting opportunities will also be offered by erecting bat boxes in areas of woodland, and where possible, by siting boxes in buildings and farms adjacent to the Site.

10.8.2 Cumulative Impacts

Arrangements to share an access route to and from sites, and for electricity connections, would greatly reduce the cumulative impact of adjacent schemes. Attempts have been made to date by IPS, without success, to share common access routes where this was considered possible.

10.9 Habitat Regulations Licences

As no bat roosts have been identified on the Site there will be no requirement for a licence.

10.10 Conclusion

Following the assessment it is considered that there will be a minimal impact on the bat species and that the ECOCAS development provides an acceptable level of mitigation to protect those bat species.

11 Ornithology Assessment

11.1 Introduction

Chris Wells, Ornithological Services was commissioned in 2007 by IPS to undertake a study to understand the impact on ornithological species reliant on the area of the proposed ECOCAS Wind Farm. The Site was surveyed for breeding birds and flight lines of birds throughout the year to evaluate the dependency of avian species on the Site (see Volume 4, Appendix 5A). An additional breeding bird survey was undertaken by The Badger Consultancy in 2009 to supplement the original breeding bird study, this was due to poor weather conditions that adversely influenced the 2007 breeding birds survey results (see Volume 4, Appendix 5B).

11.2 Vantage Point Surveys

11.2.1 Methodology

Static observations were undertaken in order to quantify the number of birds flying over the Site. This method is used to assess the potential collision risk to protected and threatened bird species. Two vantage points were located at carefully selected positions from where an observer could overlook large areas of the Site with the combination giving coverage over the vast majority of the proposed Wind Farm. Vantage point surveys also identify any Site dependency for particular avian activity such as feeding or roosting during the winter period.

The points chosen for the vantage point surveys were V.P.1 / A: SO 000 988 in the vicinity of Y Glonc overlooking the eastern aspect of the Site and V.P.2 / B: SN 994 997 close to Carneddau observing the western area of the Site.

Birds were recorded in three height categories (estimated by the observer) low (below 30 m), medium (30-100 m) and high (over 100 m), approximately to indicate heights above and below the turbine blades. The amount of time in the air over the Site was evidenced to the nearest five seconds and flight lines where recorded onto maps.

11.2.2 Consultation

Consultation was undertaken by Penny Lewns of The Badger Consultancy with Ken Perry of CCW to determine to extent of surveying required for the extended surveys. It was determined that the original vantage point surveys carried out by Chris Wells, Ornithological Services were sufficient and that only additional breeding surveys would be required. Ken Perry of CCW also suggested that targeted surveys of Curlew and Snipe should be considered.

11.2.3 Results

Two vantage points were used for this survey, located so that the whole Site could be surveyed. A total of 72 hours of observation was undertaken at each of the vantage points in periods of three hours duration resulting in a total of 144 hours surveying. During the breeding season (April to the end of July) 36 hours was spent at each of the vantage points with the remaining balance being spread throughout the year.

In 8,640 minutes (144 hours) of vantage point observation all birds of conservation interest were recorded. Birds were recorded flying over the Site for a total of 1116 minutes (12.9% of the total observation period) and seven species were recorded including Buzzard, Raven, Red Kite, Kestrel, Hen Harrier, Golden Plover and Snipe. During this time birds were recorded as flying at the 'medium' height, for 936 minutes (83.8% of the total flying time and 10.8% of total recording time). This is the height when the birds are considered to be most vulnerable to collision (depending on the type of turbine selected). The full results of the assessment can be found in Volume 4, Appendix 5A.

11.2.4 Assessment

According to the results, birds appeared to be randomly distributed over the Site, with no obvious regular flight lines noted. Vantage point surveys, along with records of over flying birds noted during the walk-through surveys indicated fairly low levels of aerial activity by birds considered to be vulnerable and are therefore a low collision risk.

11.3 Breeding Birds Survey

11.3.1 Methodology

The Site was surveyed in 2007 and 2009 using an extended version of the method outlined in Brown and Shepherd (1993) which is the standard methodology for breeding bird surveys of upland sites. Whilst it recommends two site visits should be undertaken to detect breeding waders, three visits were intended but the adverse weather late in the breeding season prevented this. The Badger Consultancy was commissioned in 2009 to undertake a supplementary survey of the Site for breeding birds. Transects were plotted after initial Site visits to cover as much of the Site as possible. The distance of the bird was estimated and recorded, or whether they were flying overhead, singing or perching. Incidental sightings were also recorded during the course of other surveys on Site, in particular bat surveys undertaken at dusk during May-June 2009. This gave the opportunity to observe nocturnal bird species such as Barn Owl and Nightjar.

11.3.2 Legislation

Under the Wildlife and Countryside Act 1981 all birds are protected during the breeding season and certain species listed on schedule 1 are protected throughout the year. Biodiversity Action Plans (BAP) are the UK Governments response to the 1992 Convention on Biological Diversity, which are detailed plans for the protection of species. In the UK there are three categories of conservation concern; red, amber and green. These categories are defined by the Royal Society for the Protection of Birds (RSPB) in Table 11.1. Those species that have unfavourable conservation status in Europe may also be on the Species of European Conservation Concern (SPEC) list. Whilst those species with unfavourable global status may be on the International Union for Conservation of Nature (IUCN) Red list.

Conservation Status	Definition
Red	Globally threatened species. Historical population decline in UK during 1800-1995. Severe (at least 50%) decline in the breeding population over the last 25 years. Severe contraction of UK breeding range over the last 25 years.
Amber	Species of European Conservation Concern (SPEC). Historical population decline 1800-1995 but recovering; population size has more than doubled over the last 25 years. Moderate (25-49%) decline in UK breeding population over the last 25 years. Moderate contraction of UK breeding range over the last 25 years. Moderate decline in UK non-breeding population over the last 25 years. Rare breeder; 1-300 breeding pairs in the UK Rare non-breeders; less than 90 individuals. Localised; at least 50% of UK breeding or non-breeding population in 10 or fewer sites (not applied to rare breeders and non-breeders). Internationally important; at least 20% of European breeding or non-breeding population in the UK.
Green	Species that occur in the UK but do not qualify under any of the criteria in Red or Amber list.

Table 11.1 Conservation status of birds

11.3.3 Results

During the surveys carried out by Chris Wells, Ornithological Services in 2007 a total of forty one species were recorded on the Site. Out of the forty one species recorded on Site twenty seven species were recorded breeding on the Site whilst another fourteen species were recorded on or passing over the Site but, without proof of breeding. Of the twenty seven species that were recorded as breeding on Site eight were red list species and thirteen were amber list species. A full list of all the species recorded, along with their status on the Site, and conservation status in Wales, is given in Volume 4, Appendix 5B. Chris Wells, Ornithological Services also carried out specific surveys for Merlin and Nightjar due to the suitable habitat on the Site for breeding. There was no evidence of either Nightjar or Merlin breeding on the Site.

The first survey carried out in April 2009 recorded twenty bird species across the Site including Merlin, which had not been recorded in the 2007 surveys. Of this twenty, one species was recorded on a national scale as 'red list' (Skylark) and eight were listed as 'amber list' (Curlew, Kestrel, Meadow Pipit, Merlin, Red Kite, Redstart, Swallow and Willow Warbler.) Red Kite and Curlew are both Powys BAP species and Curlew is also a UK BAP Priority species. These two species are of global concern and are both found on the IUCN Red List as 'near threatened'.

During the second survey in May 2009 twenty two species were recorded. Five species that were recorded in April were not recorded again and an additional seven species were observed in May that were not recorded in April. Of the additional seven species there were three with 'red status' (Cuckoo, Herring Gull and Song Thrush) and two species with 'amber status' (Lapwing and Stonechat). Lapwings are Powys BAP species, UK BAP Priority species and are also protected under the European SPEC Category 2.

Incidental sightings of birds were recorded throughout May to June of 2009. Barn Owl was confirmed as breeding in one location in the edge of the Site and two locations were recorded off-site. Evidence of Barn Owls was noted below the larger barn owl box and Barn Owls were also heard inside of the box in Barn A on the eastern edge of the Site. A pair of Barn Owls were observed in June hunting and returning to a nest in a ruined farmhouse at Pen-Y-Ffridd, 1.1 km north east of the Site. Also in June another pair of Barn Owls were observed emerging from an old chapel at Ty-newydd, 2.2 km north east of the Site.

A European Nightjar was recorded flying near Wins Barn (Barn A) during June and two shallow nests were noted at Barn B at Y Glonc.

In total forty five species were recorded during the two surveys in 2007 and 2009. Of these species twenty two are listed on Appendix II of the Bern Convention and in Annex I of the Birds Directive. Five species (Hen Harrier, Red Kite, Merlin and Barn Owl) are listed as schedule 1 of the Wildlife and Countryside Act 1981 which gives then further protection outside of the breeding season. The total list of species recorded in 2007 and 2009 along with their conservation status in Europe and the UK can be found in Volume 4, Appendix 5A. Twenty six bird species have been confirmed as breeding on Site. A summary of those species is given in Table 11.2.

Common Name	Scientific Name	Status
Barn Owl	Tyto alba	Amber
Blue Tit	Cyanistes caeruleus	Green
Blackbird	Turdus merula	Green
Carrion Crow	Corvus corone	Green
Chaffinch	Fringilla coelebs	Green
Great Tit	Parus major	Green
Meadow Pipit	Anthus pratensis	Amber
Raven	Corvus corax	Green
Redstart	Phoenicurus phoenicurus	Amber
Robin	Erithacus rubecula	Green
Skylark	Alauda arvensis	Red, SPEC 3
Wheatear	Oenanthe oenathe	Green, SPEC 3
Willow Warbler	Phylloscopus trochilus	Amber
Wren	Troglodytes troglodytes	Green
Song Thrush	Turdus philomelos	Red
Stonechat	Saxicola torquata	Amber
Dunnock	Prunella modularis	Amber
Grasshopper Warbler	Locusyella naevia	Red
Linnet	Carduelis cannabina	Red, SPEC 3
Pied Wagtail	Motacilla alba	Green
Reed Bunting	Emberiza schoeniculus	Red
Swallow	Hirundo rustica	Amber
Sedge Warbler	Acrocephalus schoenobaenus	Green
Whinchat	Saxicola rubetra	Green
Whitethroat	Sylvia communis	Green
Woodpigeon	Columba palumbus	Green

Table 11.2 Summary of species breeding on the ECOCAS site

Due to the habitat on Site it was deemed unsuitable breeding habitat for eight of the recorded species (Black-Headed Gull, Buzzard, Hen Harrier, Herring Gull, Mallard, Red Kite, Starling and Swift). These species most likely use the sight as foraging grounds or just pass over the Site. Eleven species (Chiffchaff, Cuckoo, Curlew, Golden Plover, Kestrel, Magpie, Merlin, Mistle Thrush, Nightjar, Pheasant and Snipe) were observed or heard on Site at least once during the surveys and are likely to be breeding close to the Site. In some cases it is possible that where there is suitable habitat these species may be breeding on Site but this has not been confirmed.

11.3.4 Assessment

The highest densities of bird species were located in the conifer plantation and areas of purple moor grass and wet flushed to the north and east of Y Glonc. The conifer plantation is a forestry commission plantation which is harvested to provide Christmas trees each year. The number and diversity of bird species would therefore reduce each year accordingly. The wet flushes and drainage ditches to the north and east of Y Glonc are particularly important for Skylarks which were recorded all over the Site.

Birds that are red or amber status in the UK or are in a designated SPEC category are considered to be of high conservation concern. The impact of the proposed ECOCAS Wind Farm has been assessed by taking into account the breeding status on Site, the suitability of the habitat and the type of impact the Wind Farm may have. The potential impact of the proposed ECOCAS Wind Farm is shown in Table 11.3.

Status	Common Name	Suitability of Site	Status on Site	Local Impact	National Impact
Red	Cuckoo	Low	Possible	Low	Negligible
	Grasshopper	Low	Breeding	Low	Negligible
	Hen Harrier	High	Foraging	Low	Negligible
	Herring gull	Low	Foraging	Negligible	Negligible
	Lapwing	Low	Off-site	Low	Negligible
	Nightjar	Medium	Possible	Low	Negligible
	Skylark	High	Breeding	Medium	Negligible
	Song Thrush	Medium	Breeding	Low	Negligible
	Starling	Low	Foraging	Negligible	Negligible
Amber	Barn Owl	Medium	Breeding	Low	Negligible
	Black-Headed Gull	Low	Foraging	Negligible	Negligible
	Curlew	High	Breeding	Medium	Negligible
	Dunnock	Medium	Breeding	Low	Negligible
	Kestrel	Medium	Breeding	Low	Negligible
	Meadow Pipit	High	Breeding	Medium	Negligible
	Merlin	High	Off-site	Low	Negligible
	Mistle Thrush	Medium	Possible	Low	Negligible
	Red Kite	Medium	Foraging	Low	Negligible
	Redstart	Medium	Possible	Low	Negligible
	Reed Bunting	Low	Breeding	Low	Negligible
	Snipe	Medium	Possible	Low	Negligible
	Stonechat	Medium	Breeding	Low	Negligible
	Swallow	Low	Foraging	Low	Negligible
	Willow Warbler	Medium	Breeding	Low	Negligible
SPEC	Wheatear	High	Breeding	Low	Negligible

Table 11.3 Summary of the potential impacts on birds at the ECOCAS Site

There are three species that could suffer a medium – negative impact from the proposed Wind Farm at a local scale (two passerine and one wader). For all the other species the impact is

likely to be low or negligible at the local scale. None of the species of conservation concern were considered likely to be impacted at a national scale.

Of the 'Red list' species breeding on the Site, Skylark were the most numerous, but present in lower densities than on some Welsh uplands (Green 2005), a previous study found wind farm construction (Dulas 1995) had no adverse effects on this species. The main impact of the proposed Wind Farm on Skylarks will be through the risk of collisions during the breeding season. Given the high number of birds and the habitat of the Site this is likely to have a medium impact at the local scale.

Two Curlews were heard calling on the Y Glonc hill during the surveys in April 2009 and are therefore likely to be breeding on Site. The calls heard in May 2009 were heard coming from off of the Site to the north on Mynydd Pistyll-du. Another wind farm development has been proposed for this area and breeding Curlews were identified in the ecological survey. Reliable studies have indicated that wind turbines may have a negative impact on Curlews for a distance of 600 m through displacement, disturbance and collision risk. Given the low number of birds present on the Site it was considered to have a medium impact at the local scale and a negligible impact at a national scale.

Meadow Pipit is the most abundant breeding bird in the British uplands. In 2007 Chris Wells, Ornithological Services recorded 47 breeding pairs on the Site. This species is important to the Site as it is the main prey of Hen Harriers which were also recorded on Site in 2007. Therefore a negative impact on Meadow Pipit could potentially have a knock on effect on other species. The main impact of the turbines on Meadow Pipit is through the risk of collision. This was deemed to have a medium impact due to the high number of birds and the habitat on Site.

Wheatears were found to be breeding on the Site and would be likely to be at risk of collision with the turbine blades. Given the location of the turbines in relation to the suitable habitat on the Site the risk for wheatear was considered to be low at a local scale and negligible at a national scale.

For the remaining breeding birds on Site the proposed ECOCAS Wind Farm would have little or no impact at a local level.

The Site has high potential for two nationally important species, Nightjar and Merlin. Targeted surveys in 2007 found no evidence of Nightjar, however during a bat survey on the eastern edge of the Site a Nightjar was observed. Nightjar have not been shown to be breeding on Site, although suitable habitat is present. Potentially Nightjar could be a risk from collision although given the location of the turbines in relation to the suitable habitat this is considered to have a low impact at a local scale and a negligible impact at the national scale. During the targeted surveys in 2007 for Merlin no evidence of their presence was observed. However, during the April 2009 surveys one male Merlin was observed. This was the only bird of its type observed and no plucking posts or evidence of nesting was found. Since Merlin have large ranges and fly up to 9 km from the nest it is more likely that the species is not breeding on the Site and therefore the ECOCAS Wind Farm would have a limited impact.

11.3.5 Impact of the ECOCAS Wind Farm on Non-Breeding Birds

There was no evidence of Lapwings breeding on the Site and the habitat on and surrounding the Site does not offer suitable habitat for breeding. Lapwings are wading birds and are affected by wind farms through displacement, disturbance or as a barrier to migration. It is possible that Lapwings are breeding near to the Site and therefore the impact is considered to be low at a local level.

Red Kites were recorded foraging over the entire Site during the surveys. There is no suitable breeding habitat for this species on the Site as Red Kites nest in tall trees mostly in oak woodland and are most likely to be found to the south of the Site. There is good habitat for foraging on the Site and therefore there is potential for a high collision risk. However, the full implications are currently not fully understood since mortality is currently recorded through accidental finds and there is a lack of comprehensive studies (Madders and Whitfield, 2006.)

Barn Owls have been confirmed at four locations to the east of the Site, in a corridor between Esgair Cwmowen and a neighbouring wind farm Mynydd Clogau. It is not known what impact the operational wind farm is currently having on the Barn Owl population and whether they avoid the existing wind farm by flying west from the roost and hunt over Y Glonc and Esgair Cwmowen. However, although there are three breeding pairs within 1 km of the Site it is

determined that there will be no negative effect. This is because the northern and eastern parts of the ECOCAS Site, which have the most suitable foraging habitat closest to these known breeding sites have no proposed wind turbines. There is a lack of detailed information on the impact of wind farms on Barn Owls, but as they are slow and agile flyers, hunting from perches or flying low to the ground it is most likely to be low.

11.3.6 Cumulative Impact

Within 5 km of the Site there is one operational wind farm; Mynydd Clogau which, has been operational since 2006 with 17 turbines. An application has been made to extend the wind farm (Mynydd Clogau 2) with a further 19 turbines. The closest turbines at ECOCAS and Mynydd Cloggau are approximately 750 m apart. Immediately adjacent to the ECOCAS boundary is an application for a 22 turbine wind farm; Tirgwynt. This application covers 420 hectares which is dissected by the upper part of the ECOCAS Site. Four turbines are located in the lower section of the Site, within 300 m of turbines to the north and south on ECOCAS. The closest turbine in the northern section is approximately 300 m from an ECOCAS turbine. Towards the northern border of the ECOCAS Site is the proposed Mynydd Waun Fawr Wind Farm, consisting of 16 turbines. The south border of this wind farm is approximately 1 km from the northern border of Tirgwynt. In total there may possibly be 91 turbines within a 5 km radius.

Within a 20 km radius of the ECOCAS Site there are a further three operational wind farms. The largest of these is Llandinam, approximately 15 km south, where there have been 103 operational turbines since 1992. No baseline surveys were carried out at this Site but fatality and behavioural studies have revealed that there are minimal impacts on birds. The Carno A (56 turbines operational since 1996) and Carno B (expansion to 68 turbines in 2008) Wind Farm is the closest wind farm at approximately 7 km south west. Additionally, 15 km north west of the ECOCAS Site there are 18 turbines at Cemmaes Wind Farm (operational since 2002). The total number of operational turbines within the 20 km circle is 206 with a further 74 proposed.

11.3.7 Assessment

At the time of this assessment eight proposed/operational wind farms within a 20 km radius of the ECOCAS Site have been identified. The older wind farms do not appear to have carried out any baseline surveys for birds prior to construction, although some monitoring is taking place at most of the sites. All of the sites have predicted negligible or non-significant negative impacts on birds. However, there has been no assessment of the wider impact caused by the cumulative effect of these wind farms. At present, there is a complete lack of understanding of cumulative impacts of wind farms on bird demography and populations.

The ECOCAS Wind Farm and two other proposed sites (Tirgwynt and Mynydd Clogau) will cover 925 hectares almost contiguously and combined there will be around 75 turbines of varying heights. A collision risk model for Red Kites was run at Mynydd Clogau and Tirgwynt and returned similar results at both sites with approximately one bird killed every 3 years at 98% avoidance or every 6 years at 99% avoidance. A similar figure can be assumed for ECOCAS (due to its location and similarity of size) therefore, it can be estimated that one bird will be killed each year at 98% avoidance or every two years at 99% avoidance, across the three wind farms. At 98% avoidance this is 0.013 birds per turbine per year. At this level of mortality the collision rate in the wider 20 km area can be estimated at 3.6 birds per year.

In 2008 the lowest estimation for breeding population of Red Kites in Wales was 750. At this population level the number of mortalities estimated would affect 0.24% of the population (<1% regionally important), which is a minor to negative significance on the local scale.

The collision risk for Golden Plovers has been calculated at Mynydd Clogau but has not been assessed at ECOCAS or Tirgwynt as the species does not utilise the site. For all other species the collision risk has not been considered as important.

Nightjars were not recorded at any other wind farm site, although specific surveys were not undertaken and they could be present but not have been recorded. A cumulative assessment could not be undertaken due to the lack of information from other sites.

The issue of displacement or disturbance to bird species appears to have not been addressed at other sites due to the abundance of similar habitat locally. However, given the number of wind

farms operational or proposed within 5 km of ECOCAS, there may be insufficient habitat of suitable quality to avoid an impact to some bird species.

11.3.8 Mitigation

The proposed locations of the turbines have been sited to avoid the areas of wet flushes, as have the on-site tracks and compounds where possible. At present the wetter areas on-site supporting mid to long ungrazed grass support high diversity of bird species than the drier areas with short heavily grazed swards. The Site should be managed to maintain existing areas of high species diversity and enhance the habitat in areas of poor species diversity. Stocking densities and grazing levels will be managed to provide a mid to long length sward preferred by smaller bird species and small mammals.

It is recommended that breeding bird surveys are conducted in the years following construction to monitor the impact of the Wind Farm. Recommended monitoring times are suggested for years 1, 2, 3, 5, 10 and 15 of the operational years of the Wind Farm. The Site offers a unique opportunity to monitor and assess the impact of wind farms on Barn Owls. It will be of particular importance to monitor whether the three adjacent nests continue to be used successfully.

In order to minimise disruption on the site, vegetation clearance and as much construction work as possible should be conducted outside of the breeding season. If vegetation cannot be cleared outside of the breeding season then an experienced ecologist should be present when the Site is cleared, prior to construction.

11.3.8.1 Cumulative Mitigation

As the greatest level of disturbance to bird species will occur during the construction period; construction of adjacent wind farms should be staggered to allow displaced birds to use undisturbed land. It is also proposed that the ECOCAS construction be staggered in terms of delivery to avoid disturbance to breeding birds on the Site, see Section 4.1.1.

Arrangements to share an access route to and from sites, and for electricity connections, would greatly reduce the cumulative impact of adjacent schemes. Attempts have been made to date by IPS, without success, to share common access routes where this was considered possible.

11.4 Conclusion

Following the assessment it is considered that there will be a minimal impact on the bird species and that the ECOCAS development provides an acceptable level of mitigation to protect those bird species breeding on the Site and flying across.

12 Hydrology

12.1 Introduction

The hydrology chapter outlines the impact of the proposed ECOCAS development on the hydrology throughout construction, operation and decommissioning of the project. Entec were commissioned on behalf of Independent Power Systems Ltd to carry out the assessment of the hydrology at the ECOCAS Site. The study provides an assessment of all the potential effects of the proposed Wind Farm on surface waters, groundwater, drainage and flood risk, in compliance with the Electricity Works (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2007 to ensure that no significant effects arise from the proposed development.

The study area for the assessment was set to determine the hydrology within and around the Site with a wider study area, covering up to 3 km downstream where necessary.

12.2 Methodology

The hydrology assessment involved a desk study collating and reviewing all the relevant hydrological data from the Environment Agency (EA), Countryside Council for Wales (CCW) and Powys County Council (PCC). The assessment also included consultation with the EA, CCW and PCC on specific site issues and a site walk over with the relevant statutory bodies. The site visit on 20th January 2009 was attended by Kayna Tregay, Nichola Tomlinson and Paul Williams from the EA, Ken Perry from CCW and Steve Packer from PCC. Areas proposed for water crossings were inspected and advice was given on best practice by the EA. The site visit also gave the statutory bodies the opportunity to gain a greater understanding and feel of the Site whilst concentrating on some site specific areas. An additional survey was carried out by Entec in February 2009 under the advice of the EA and CCW to determine the extent of blanket bog on Site using canes to measure the peat depth at site specific locations, particularly concentrating on the most sensitive areas on the Site.

12.3 Guidance

Guidance and good practice advice were followed throughout the study with additional environmental legislation on the life-cycle of the project and legislative drivers relating to the hydrology also being considered. The guidance followed has been set out in Table 12.1. Additional guidance and legislation can be found within the report (see Volume 4, Appendix 8).

Environment Agency Pollution Prevention Guidance Notes	PPG 1 General guide to the prevention of water pollution. PPG 2 Above ground oil storage tanks. PPG 5 Works that could potentially affect watercourses. PPG 6 Working at construction and demolition sites. PPG 21 Pollution incident response planning
Silt Pollution and How to Avoid it (EA Leaflet)	
Forests and Water Guidelines 2003	
CIRIA Report C532: Control of Water Pollution from Construction Sites	
CIRIA Report C502: Environmental Good Practice on Site	
TAN 15: Development and Flood Risk	
BS6031: 1981 Code of Practice for Earth Works	
Good Practice Guide for Handling Soils (MAFF 2000)	

Table 12.1 Summary of the guidance and legislation followed

12.4 Consultation

A preliminary scoping response was submitted for the ECOCAS Wind Farm development and responses were received from the EA and the CCW (Volume 4, Appendix 4, Pages 1.9-1.28). A summary of the responses can be found in Table 12.2.

Environment Agency (EA)	Impact on watercourse crossings need to be minimised with sitting of turbines being carefully considered. Where possible current tracks should be utilised. A Method Statement will need to be produced to detail the mitigation measures to be taken. Contingency plans should be included, for all phases of the development, to prevent pollution of watercourses with silt or other contaminants, and to ensure safe storage of fuels. Mitigation measures should include: • Interception facilities on roadways to ensure that suspended solids do not run off into watercourses • The provision of settlement lagoons to capture and treat sediment entrained run-off. These lagoons should be capable of containing the effluent from a 1 in 100 year event. • Effluent from concrete washing areas should be contained and treated separately in line with current waste management legislation. Appropriate guidance should be followed, including Environment Agency Pollution Prevention Guidance notes and other guidance. PPG 6 'Working at Construction and Demolition sites' and the leaflet 'Silt Pollution and how to Avoid it'. The EA do not feel that there is any flood risk to the development but there are potential downstream effects. An assessment is required of how any increases in surface water run-off will be controlled and attenuated so as to not adversely affect downstream properties and land. This should be done with reference to Section 8 of TAN 15. The development should not have an adverse effect on surface or groundwater quality. An assessment of this should be undertaken with particular regard to the private groundwater abstractions in the development area.
Countryside Council for Wales (CCW)	An assessment of any impacts of Llyn Mawr SSSI will need to be undertaken. To support this proposal CCW have been contacted for further clarification for any specific concerns that they may have concerning Llyn Mawr which is upstream of the Site. They have responded as follows: A detailed survey of the Site hydrology is required to indicate areas of likely habitat conservation value. An assessment on the impacts of Llyn Mwar should be undertaken. Further consultation resulted in the following comments from CCW: "I do not know if there are any aquifers in this area that might feed into Llyn Mawr SSSI. However I think you are right to suggest that our main concern would be in relation to surface run-off. I would also advise that depending on the habitats on Site, we would wish to see some evidence of consideration of impacts on habitats that are dependant on high water tables (such as peatlands, fens and marshy/wet grasslands). Whilst not part of the hydrology study I would reiterate that Llyn Mawr is also a Wildlife Trust Nature Reserve and is used by a range of waterfowl. I understand that it is sometimes used by whooper swans during the winter.". (Ken Perry, Senior Conservation Officer)

Table 12.2 Summary of consultation responses

12.5 Hydrological Assessment

12.5.1 Current Baseline

The desktop assessment has been based on data and information supplied by the EA, CCW and PCC.

The average rainfall statistics from one river catchment within 15 km of the Site are 1293 mm of rainfall between 1962 and 2000. Rainfall in the vicinity of the Site as suggested by the statistics is therefore moderately high. However, this value could potentially be higher as the proposed development will be at a higher altitude than that of the gauge measurements at 83m.

The Site of the ECOCAS Wind Farm is located on steep and undulating topography with a range of altitudes from 380 m in the north west of the Site to 485 m in the east. Land use on the Site comprises mainly of grazing livestock and agriculture with patches of coniferous trees surrounding the area.

A number of minor watercourses, including the Afon Rhiw, the Nant y Llyn Mawr and the Nant Cwmgerwyn have their sources in the Site boundary and feed into the Afon Carno and the River Severn. River flow data from the EA suggests that flow levels are low and do not exceed 0.24 m^3/s. The current surface water run-off is predominantly uncontrolled and free flowing. Due to the topography of the site surface run-off drains away in all directions into the minor watercourses in and around the vicinity of the Site. The nearest watercourse to the Site which has been sampled by the EA for water quality is the Afon Rhiw, 1.5 km north and downstream of the Site. The chemical and biological quality of the river in 2006 was classified as B (good) and the level of nutrients was 2 (low) for nitrates and 1 (very low) for phosphates. Water quality in the River Severn is similar to the Afon Rhiw with a classification of A (very good) for chemical quality and B (good) for biological quality reported in 2006.

To the south east of the Site there is a designated Site of Special Scientific Interest (SSSI), Llyn Mawr lake. It is not hydraulically connected to any of the watercourses on the Site and no surface water run-off from the Site is expected to affect the lake.

The underlying bedrock according to the British Geological Survey (BGS) sheet is that of Ludlow and Wenlock. The soils are classified as having low to intermediate leaching potential and could potentially transmit non or weakly absorbed pollutants but are very unlikely to transmit absorbed pollutants. The soils are primarily low in permeability according to the National Soils Resource Institute which is due to the acid loamy upland soils. Other soils within 3 km of the Site include 'slowly permeable seasonally wet acid loamy and clayey soils'. This indicates that there are low permeability soils within the Site and the surrounding area. The Site is therefore classified as a Minor Aquifer due to the low permeability of the underlying geology and soils.

The EA's Groundwater Source Protection Zones (SPZs) indicate that the Site lies outside of any SPZs.

The EA are aware of six incidents that have been reported within 3 km of the Site and one incident within 1 km of the Site. Those incidents relating to pollution are summarised in Table 12.3.

Incident	**Location**	**Date**
Spreading of septic tank waste	Off the A470 at Clatter	December 2008
Silty effluent from a wind farm development discharging to a tributary of the River Rhiw	River Rhiw	December 2005
Sewage fungus	Afon Carno at Maesypandy	October 2005
Diesel in stream from leaking tank	Stream at Clatter	February 2005
Decline in invertebrates in stream due to sheep dip	Carno	October 2002

Table 12.3 Incidents relating to pollution

12.5.2 Future Baseline

Hydrological systems are in a constant state of change and do not remain constant with time. There are two main influences on the hydrology at the ECOCAS Site that could potentially influence the baseline, which are the change in land use and climate change. The nature of land use and its elevation is unlikely to change during the life-time of the Wind Farm and therefore is likely to have a limited impact. Predicted future climate indicates that in Wales there will be a decrease in summer rainfall of up to 3% by the 2020s or 15% by the 2050s and an increase in winter rainfall of 10% and 15% respectively. Climate change is difficult to predict accurately and any significant changes in weather patterns will obviously have an impact on the state of the hydrological regime due to increases in run-off from the Site. These changes to the baseline have been considered during the assessment to provide a better understanding of the potential future impacts on the Site.

12.5.3 Constraints to the Development

Key receptors as determined by the desktop study are; the Minor Aquifer underlying the Site; the rivers, smaller tributaries and headwaters of the Nant y Lyn Mawr, the Nant Cwmgerwyn and the Afon Rhiw; the Afon Carno and the River Severn; the site users within and downstream of the Site due to flood risk; peaty/water-logged soils and the private water abstractions.

Following the site visit it was considered that the Llyn Mawr SSSI is not a receptor or a constraint to the development as the lake is not hydrologically connected to the Site and lies on higher ground than the nearest part of the ECOCAS Site.

The constraints to the ECOCAS development have been identified below:

- Watercourses on the Site and the underlying Minor Aquifer, with associated private supplies
- Sensitive water features such as peat and blanket bog
- Increases in surface run-off and as a result increases in flood risk

The constraints map in Volume 4, Appendix 8, Figure 2.3 highlights the areas that may be subject to environmental constraints. Potential effects arising from the development will be mitigated through preparation of an Environmental Management Plan (EMP) in adherence to good practice guidelines. The EMP will demonstrate that emergency action planning is in place and that site workers and users are aware of the potential risks to the water environment and their duty not to knowingly cause pollution to controlled waters, including both surface and ground water on and off-site. Those activities that need to be controlled during construction, operation and decommissioning of the project are set out below.

- Access track construction
- Watercourse crossings
- Wind turbine foundation placement
- Electrical cable laying
- Any off-site highways works
- Maintenance and refuelling of machinery and vehicles
- Concrete Batching (all supplies will be batched off-site)
- Borrow Pit excavation
- General site activities and working practices

12.5.4 Minor Aquifer and Water Courses

The proposed ECOCAS development seeks to avoid altering the hydrology, morphology, flood risk and water quality of the water bodies within and around the Site. Where possible development has been located sufficiently away from surface water bodies, by means of a 20 m buffer zone. The risk of ground water pollution is low as there will be no deep excavations and taking into account the impermeable nature of the soils and geology and adherence to standard good practice construction will also minimise the risk. During construction and decommissioning activities will be monitored closely to avoid the creation of uncontrolled or polluting discharges. Measures to prevent this include:

- Bunding of chemical and fuel stores to 110% of storage capacity
- Re-fuelling and maintenance of vehicles on areas of hard standing
- Provision of suitable drainage systems around the tracks that encourage infiltration rather than run-off
- The use of soil plugs in cable trenches to reduce run-off velocity and erosion potential
- The use of sumps and other sediment removal methods to remove sediment from run-off prior to discharge
- The design of a pollution incidence response plan in line with EA PPG 21 which details the correct response measures to any pollution incidence.

The additional hard standing due to the proposed tracks on-site and the foundations for the turbines will account for approximately 5 ha of hard standing which corresponds to a low percentage of the total site area. Some of the access tracks will require water crossings and these were examined on the site visit with the EA. It was considered that the site tracks were agreeable as they primarily followed existing tracks on the Site. It was agreed that there should be some alterations to the original layout to avoid double water crossings and 'T' Junctions. The EA indicated that they felt that the use of suitably sized culverts would be appropriate for the size and type of watercourses on Site. The map in Volume 4, Appendix 8, Figure 2.3 indicates the layout of the ECOCAS development and the proposed water crossings. The culverting of watercourses will require prior approval from the EA and the local authority under the Public Health Act 1936, the Land Drainage Act 1991 and the Water Resources Act 1991.

12.5.5 Surface Water Run-off

Surface run-off from the Site will be controlled through the use of appropriate sustainable drainage solutions (SuDS). This will limit the potential for increased run-off rates as a result of the additional hard standing. However it is important to note that the additional hard standing will not contribute greatly to the overall run-off as the ground is already impermeable in its

nature. The most appropriate SuDS techniques for this development have been identified as being wet ponds, dry detention, storm water wetlands and grassed swales. Further detail on the control of surface water run-off is discussed in the flood risk assessment.

12.5.6 Private Abstractions

There are 46 properties on private water supplies within 3 km of the Site. The nearest private water supplies within 500 m of the boundary are a spring serving Blaenycwm, a borehole serving Cefn Coch and a well near Llyn Mawr. The majority of these private supplied properties are class F single dwellings whilst there are 5 class E (less than 25 people served or less than 5 m^3 of water) The full list of private water supplies is given in Volume 4, Appendix 8, Figure 2.2.

These receptors are vulnerable to pollution from activities associated with the construction and operation process. Mitigation measures will be undertaken prior to construction and will inform any additional mitigation measures including, if necessary, a programme of private supply monitoring to ensure that the construction process has no adverse effects.

The impacts on the private water supplies will depend on the type and extent of any pollution, connectivity to the Site and hydrological connectivity to groundwater and surface water features. Mitigation should address the protection of private water supplies as sensitive potential receptors.

Mitigation and controls should be provided to site activities that have the potential to affect the areas of mire, generate surface run-off, or discharges rich in silt, sediment or other pollutants. Prior to the commencement of construction, private water supplies in the vicinity will be assessed and the construction method statements will incorporate additional measures to protect the supplies. A water quality monitoring programme may also be necessary and will be run throughout the construction phase of the development to confirm that there are no changes in water quality. This will protect the private water supplies in the site vicinity that may be affected if pollution due to site activities was to occur in local surface water and ground water.

12.5.7 Peat Habitat Assessment

The majority of the Site has been indicated as being covered by blanket bog in the Phase 1 Habitat Survey. See Volume 4, Appendix 5A. During the on-site visit in January 2009 Ken Perry from CCW and representatives from the EA indicated that the mapped extent may no longer be correct. Entec were therefore commissioned to undertake further peat depth sampling to inform the understanding of the habitat in the vicinity of the turbines and access tracks. The survey carried out in February 2009 indicated that the blanket bog indicated at turbine 12 and around the associated tracks did not appear to be blanket bog and that the current access tracks on-site represent areas of improved habitat within areas of blanket bog especially in the vicinity of turbine 9. Therefore it was suggested that wherever possible present access tracks should be utilised in preference to building new tracks across virgin areas of bog. Areas of deep peat (>1 m) were also found to be present on the Site in the vicinities of turbine 3,5,6,8 and 13 (see Volume 4, Appendix 8, Figure 2.1).

Areas of deep peat form habitats of significant conservation importance and the development has, where possible, avoided these sensitive areas. Following consultation with the EA and CCW on-site the general consensus was that the extent of good quality peat is generally less than that depicted in the original constraints map. Construction will need to be sensitive to the hydrological environment, therefore it may be preferable to use floating roads rather than excavated roads and natural drainage paths should be facilitated wherever possible to avoid the possible cutting off and drying-out of areas of blanket bog. Prior to construction a more detailed peat depth survey will be required to establish an accurate depth profile for the areas of peat across the Site. They survey should focus on the areas closest to the turbines and access tracks to determine the exact profile of peat in the vicinity.

12.6 Conclusion

The assessment has identified the potential receptors within and around the Site as well as activities that will need to be controlled to avoid potential negative effects on the water environment. The main receptors and risks relate to the surface watercourses, groundwater and the potential for polluting to occur that may alter the hydrology and water quality of watercourses. The assessment indicates that the ECOCAS development will have an acceptable impact on the hydrology as mitigation measures will be implemented through an EMP which will cover all site activities and potential effects on the water environment. Adherence to this EMP will be included in the Construction Method Statements.

12.7 Assessment of Flood Risk

12.7.1 Introduction

A Flood Consequence Assessment (FCA) was prepared by Entec following consultation with the EA and conforms to the requirements of TAN 15: Development and Flood Risk. A formal data request to the EA forms a significant part of the evidence base of this assessment. The TAN 15 and EA map of flood risk shows that the Site lies in Flood Zone A which is considered to be at little or no risk of fluvial or tidal/coastal flooding. Calculations have been undertaken to allow recommendations to be made for SuDS design in order to meet the EA's requirements for surface water management.

12.7.2 Planning Policy

According to TAN 15 the proposed development is classified as 'Less Vulnerable' and is therefore deemed to be appropriate for this Site, which is considered to be at little or no risk of fluvial or tidal/coastal flooding. The Site does not lie in the 1 in 1000 year flood zone and the EA have no record of historical fluvial flooding in the area.

Advice in TAN 15 also states that surface water management should be addressed for all new developments in any flood zone; the aim should be for new development not to create additional run-off compared to the undeveloped situation and to avoid increasing flood risk elsewhere.

12.7.3 Flood Risk

As already indicated in TAN 15 and by the EA mapping no fluvial or tidal flood risk is likely to occur on the Site. Ground water emergence is also an unlikely flood risk since the Site is located over a minor aquifer at high altitude. Surface water run-on is also unlikely to be of significance due to their being an absence of significant contributing areas at higher elevations adjacent to the Site, surface run-off is likely to be the only significant source of flood risk and this is discussed further.

Surface water run-off is likely to increase marginally if unmitigated due to the additional hard standing areas on the Site. However it should be noted that the additional hard standing is minimal in comparison to the total site area. Climate change may also result in increased rates of run-off due to increased rainfalls. The EA have requested that an assessment of the proposed impermeable area should indicate how surface water will be controlled and attenuated so as not to adversely affect downstream properties and land. Drainage calculations have been used to inform the surface water requirements of the Site and all calculations have been done using the WInDes Software Suite v.10.4 (see Volume 4, Appendix 8).

The IoH124 method has been used to calculate greenfield run-off rates as the methodology is suitable for calculating run-off rates for rural areas with minimal hard standing. This approach was agreed to by Peter Evans of the EA via email on the 2nd December 2008. Areas of the Site contained within a single drainage unit were identified and rates of run-off were calculated for each of these areas. The run-off rates were calculated assuming a 0% urban factor and a factor of 20% has been applied to peak run-off to allow for climate change over the next 50 years based on the guidance in TAN 15. Access tracks have been assumed to be 100% impermeable which is precautionary as some infiltration will occur in reality. Access tracks will be reduced in width after construction and the width of the road that is no longer required will be returned to greenfield. However, this will be undertaken as necessary in consultation with the EA and CCW as public access is also of prime importance. This will reduce the impact on run-off rates during the operation phase of the development and will be accounted for in the drainage design calculations. The results of the calculations are presented in Volume 4, Appendix 8, Table 3.1.

The results indicate that run-off rates from the 100 year rainfall event are increased by 4.3 l/s/ha on average across the Site. Run-off volumes have not been calculated as they will depend on the SuDS solution.

Run-off from the Site will be controlled through the use of SuDS and other appropriate drainage solutions. This will limit the increase in run-off rates as a result of the additional hard standing and will also facilitate the entrainment of any sediment from the turbine areas and access tracks. The most appropriate SuDS techniques for this Site will be wet ponds, dry detention, stormwater wetlands and grassed swales. Infiltration options are limited due to the

impermeable nature of the baseline geology and soils. Therefore the most appropriate examples of additional drainage solutions in mitigating increased run-off from roads and the entrainment of suspended solids are French drains and carrier drains.

Infiltration testing will need to be carried out prior to construction to determine the infiltration rates more accurately.

12.7.4 Conclusion

The Flood Consequence Assessment indicates that the main risk to the Site is from surface run-off which is likely to increase as a result of the additional impermeable hard standing and from increases in future rates of rainfall due to climate change. Mitigation and management of surface run-off will be achieved through the inclusion of sustainable drainage systems which will limit the discharge of water and sediment across and from the Site.

The assessment demonstrates that the proposed development at ECOCAS will provide an acceptable level of flood protection according to the requirements as set out in TAN 15.

13 Landscape and Visual Impact Assessment

13.1 Introduction

The main purpose of the Landscape and Visual Impact Assessment (LVIA) is to determine the potential effects that the proposed ECOCAS Wind Farm will have on the existing landscape and visual amenity. This will be carried out by describing the existing landscape and determining the ability of the landscape to absorb the proposed Wind Farm by assessing the landscape character and visual amenity.

The LVIA assessment has encompassed a radius of 30 km from the innermost circle that contains the Wind Farm, creating a total radius from the Site centre of 31.25 km. This has been done to ensure that the radius of assessment satisfactorily covers the 30 km assessment area. The assessment has incorporated desktop studies, field studies, modelling of predicted effects through photomontages and zones of theoretical visibility (ZTVs).

13.2 Methodology

13.2.1 Introduction

The LVIA provides an evaluation of the landscape and visual impacts and illustrates how the proposal will fit into the landscape character. The landscape character is made up of a combination of elements such as valleys, woods and trees. The character of the landscape is determined by the pattern of elements and the characteristics of the landscape such as tranquillity and wilderness which establishes the sense of place.

13.2.2 Study Area

Scottish Natural Heritage (SNH) guidance states that "Between 15 km and 30 km, wind farms are only likely to be seen in very clear visibility conditions...". To conform with SNH guidelines and following advice during consultation the study area for this assessment has been set at a

30 km radius from the circle containing the Wind Farm to ensure that the assessment conforms with the SNH guidelines.

Detailed landscape assessment with regard to LANDMAP has been restricted to a radius of 10 km from the Site centre creating a 'detailed study area'. The detailed study area intends to focus on those landscape aspects that are more likely to sustain a significant landscape effect as from 15 km onwards the Wind Farm is only likely to be seen during clear visibility. The visual assessment has been restricted to the 30 km ZTV from where views may be visible of the ECOCAS Wind Farm.

Cumulative assessment has been considered for all existing and proposed sites within a 30 km radius as 60 km was deemed by CCW as being 'excessive'. This parameter was selected to incorporate a holistic view of the combined impacts of all existing and proposed wind farms.

13.2.3 Guidance

This LVIA has been carried out according to the guidelines set out in 'Guidelines for Landscape and Visual Assessment' published by The Landscape Institute and the Institute of Environmental Management and Assessment (IEMA) in March 2002, which has become a widely recognised guideline for landscape assessment. Independent Power Systems Ltd (IPS) has supplemented their methodology with a number of recent guidelines which contain guidance specifically relating to wind farms which are set out in:

- 'Landscape Character Assessment Guidelines for England and Scotland' – Natural England and Scottish Natural Heritage (2002)
- 'Guidelines on the Environmental Impact of Wind Farms and Small Scale Hydro Electric Schemes' – Scottish Natural Heritage (2001)
- 'Visual Assessment of Wind Farms Best Practice' Scottish Natural Heritage (2002)
- 'Best Practice Guidelines for Wind Energy Development' – BWEA (1994)
- 'LANDMAP' Countryside Council for Wales
- Montgomeryshire Landscape Assessment (1992)

- Powys Landscape Character Assessment (2008)

13.2.4 Planning Policy

The LVIA has evaluated potential effects in the context of relevant planning policies for Wales.

The Welsh Assembly Ministerial Interim Planning Policy Statement (MIPPS) issued in July 2005 states that:

"The Assembly Government accepts that the introduction of new, often very large, structures into the open countryside needs careful consideration to minimise the impact on the environment and landscape. However, the need for wind turbines is established through a global environmental imperative and international treaty, and is a key part of meeting the Assembly Government's targets for renewable electricity production.".

Technical Advice Note 8 (TAN 8) published in July 2005 provides technical advice to supplement the policy set out in the MIPPS. TAN 8 recognises the issues related to wind farm development and provides guidance on how landscape and visual issues should be addressed by the developers and the Local Planning Authority when determining planning applications for wind farm developments. TAN 8 indicates that there are only a few unconstrained areas in Wales that are capable of accommodating large scale (>25 MW) wind farm developments and these areas comprise seven Strategic Search Areas (SSAs). The proposed Wind Farm at ECOCAS lies wholly within SSA B 'Carno North' as defined in TAN 8 and this assessment conforms with the guidance within TAN 8.

13.2.5 Consultation

To aid in the selection of viewpoints and to determine the extents required for ZTV analysis for the landscape and visual assessment consultation with Powys County Council (PCC) and the Countryside Council for Wales (CCW) was carried out (see

Volume 4, Appendix 4, Pages 10.1-10.6). A summary of the responses can be seen in Table 13.1.

Consultee	**Response**
Powys County Council (PCC)	Powys County Council made no comments on the viewpoints and asked for consultation to be carried out with CCW. Powys County Council provided details of operational and planned wind farms in the study area for the cumulative assessments.
Countryside Council for Wales (CCW)	Required landscape assessments to take into account LANDMAP data to determine the existing landscape in the study area. Proposed a visual analysis at a radius of 30 km and a cumulative assessment at a 60 km radius, the cumulative radius was reduced to 30 km after CCW determined that 60 km was excessive. CCW agreed with viewpoints 1,3,5,7,8,17 and 18 and had no view on viewpoints 10-13. Viewpoint 4 was moved to Bryn y Gadair and viewpoints 6,9,14 and 15 were all moved in accordance with advice from CCW. Additional viewpoints were requested at Caersws. Viewpoint 17, above Broneirion (to the west of Llandinam) was dropped after site visits determined that there was no view of the turbines even after micro-sighting of the viewpoint. This was deemed acceptable by CCW. In total 17 viewpoints including wireframes were agreed to.

Table 13.1 Summary of consultation response

13.2.6 Existing Landscape

The first stage of the assessment is to set out the existing character of the landscape. This will be done by describing the landforms, land cover, habitat, historical and cultural elements which combine to form the landscape.

A desktop study using LANDMAP will distinguish the sensitivity and capacity of the landscape in the study area. The quality of landscape requires a 'sense of place' to be considered through assessing factors such as how scenic, tranquil and remote a landscape is. This is then used to

establish the sensitivity of the landscape to changes and alterations. Site surveys are also carried out to help determine the classification of an existing landscape through photos and landscape assessments.

13.2.7 LANDMAP

LANDMAP is the computer based landscape assessment created by the CCW and the Wales Landscape Partnership Group. It is designed to assist in the decision making process over a range of disciplines with five aspect layers that contribute to the overall landscape character area. These aspect layers are detailed below.

Visual and Sensory: This aspect layer identifies those landscape qualities that are perceived through the senses. It deals with the individual physical attributes of landform and land cover, as well as their visual patterns of distribution and sensory characteristics, and the relationships between them in a particular area.

Landscape Habitats: This aspect layer looks at the distribution of vegetation and habitats and the basis for landscape ecology.

Cultural Landscape: This aspect layer considers the relationship that exists between people and places; how people have given meaning to places, how the landscape has shaped their actions and how their actions have shaped the landscape.

Geological Landscape: This aspect layer studies the geology, geomorphology and hydrology.

Historic Landscape: This aspect layer focuses on how archaeological and historical sites relate to each other and to the surrounding landscape.

The assessment of all of the layers allow Landscape Character Areas (LCAs) to be identified throughout Wales and this process has been embraced within the landscape assessment for the ECOCAS Wind Farm to determine the baseline conditions of the landscape as detailed in TAN 8.

13.2.8 Potential Landscape and Visual Issues

The potential landscape and visual issues are summarised below:

Landscape Issues

Landscape Elements :	Physical effects on the landscape elements, includes trees, grassland and field boundaries.
Landscape Patterns :	Physical effects on the patterns that are formed as a result of elements that already exist.
Landscape Character :	Effects on the landscape character defined by LANDMAP and effects on the historic landscape.

Visual Issues

Local :	Views from local communities and residential areas.
Nationally Designated Landscape :	Views from Snowdonia National Park and the Shropshire Hills - Areas of Outstanding Natural Beauty (AONB).
Plateaus and Summits :	Views from plateaus and walking summits.
Historic Parks and Gardens :	Most of these parks and gardens are well screened, however, assessments examine the potential visual effects.
Tourist Destinations :	Views from popular tourist destinations.
Major Transport/Tourist routes :	Views from key transport routes within and across the study area. Including footpaths, tourist routes and National Cycle Routes.
Cumulative Assessment :	Viewpoint assessment where cumulative views of existing and proposed wind farms may be seen.

13.2.9 Landscape Effects

The proposed ECOCAS Wind Farm will have both direct and indirect effects on the landscape. The direct effects physically alter the landscape whereas indirect effects affect the actual landscape character. The five main aspects of the landscape resource are the landscape elements, the landscape patterns, the landscape character and the designated landscapes and features. These are evaluated by considering the type of effect that may occur, the probability of the change occurring and the magnitude and sensitivity of change.

The effect of a wind farm on each landscape receptor is classified according to its ability to accommodate the effects of the construction, operation and decommissioning. This ability is expressed as positive, neutral or negative.

- **Positive** where the project complements or adds to the landscape, adding positive qualities to the landscape.
- **Neutral** where the project neither contributes or detracts from the landscape and is accommodated by the landscape context.
- **Negative** where the project introduces a new element that is not currently in the landscape and cannot be accommodated comfortably by the landscape context.

The ability of the landscape to accommodate the wind farm is assessed through professional judgement based on the magnitude of the effect occurring, the sensitivity of the receptors to change and the knowledge and overall understanding of the study area.

13.2.10 Magnitude of Change

The magnitude of change is the degree of change which will be experienced by the baseline landscape and is classified as high, medium, low or negligible. Within the magnitude of change the nature of the contrast, the scale of change and the duration or reversibility of the effect on

the landscape is also considered. The classification of the different levels of magnitude is shown in Table 13.2.

Definitions of Magnitude	**Level**
A change that may be large in scale and includes loss of key landscape characteristics or the addition of new elements that may lead to improvement or decline in overall landscape quality.	High
A more limited change with the loss of some key landscape characteristics or the addition of new landscape features that would lead to improvement or decline and indicates the potential for change in the landscape character.	Moderate
A small scale change affecting a small area of landscape character including the loss or gain of new features that are also small scale in the context of the landscape character.	Low
A change affecting smaller areas of landscape character including limited loss of landscape features or the additions which are characteristic or barely perceived.	Negligible

Table 13.2 Classification of magnitude of change

13.2.11 Sensitivity of Landscapes

The sensitivity of landscape receptors is closely dependent on the value of the landscape and its ability to accommodate the wind farm within it. This is classified as high, moderate or low and is derived from consideration of the landscape quality, the landscape value, developments already existing within the landscape, the scale of the landscape and the extent to which enclosure and variation in topography has on the sensitivity of the landscape.

The classification of the sensitivity of landscape character is set out in Table 13.3. Classifications are suggestive and circumstances may result in an alternative landscape sensitivity analysis being used in the assessment.

Landscape Sensitivity Categories	Level
Landscape with low capacity for change and is vulnerable to change. Includes high value landscapes where management objectives are to conserve the existing character.	High
Landscape with medium capacity for change and can therefore accommodate a reasonable amount of change. Includes landscapes protected at a local level or non-designated landscapes where there is evidence of local value.	Moderate
Landscape with high capacity for change and is able to tolerate changes. May include some low value or non-designated landscapes and is the focus of restoration and enhancement.	Low

Table 13.3 Landscape sensitivity categories

13.2.12 Visual Effects

Visual effects are the subsequent effect of the changes to the landscape and are wholly concerned with the development on views and visual amenity. The visual effects include visual obstruction, visual modification, visual amenity and cumulative effects.

The effect of a wind farm on each landscape receptor is classified according to its ability to accommodate the impacts during construction, operation and decommissioning. This ability is expressed as being positive, neutral or negative.

- **Positive** where the project complements or adds to the view, adding positive qualities to the landscape.
- **Neutral** where the project neither contributes or detracts from the view and is accommodated by the landscape context.
- **Negative** where the project introduces a new view that is not currently in the landscape view and cannot be accommodated comfortably by the landscape context.

The ability of the landscape to accommodate the wind farm is assessed through professional judgement based on the magnitude of the effect occurring, the sensitivity of the receptors to change and the knowledge and overall understanding of the study area.

13.2.13 Magnitude of Visual Change

The magnitude of change is the degree of change that will be experienced by the baseline landscape view and is classified as being high, moderate, low or negligible. Within the magnitude of change the nature of the contrast, the scale of change and the duration or reversibility of the effect on the landscape view is also considered. The classification of the different levels of magnitude is show in Table 13.4.

Definitions of Magnitude	**Level**
A major change, obstruction of a view, or a new element that is directly visible and likely to appear in the foreground or above a prominent section of the horizon.	High
A moderate or partial view of a new element within the view which may be readily noticed. Directly or obliquely visible including glimpsed or intermittent views.	Moderate
A low level of change affecting a small part of the view which may be obliquely viewed or partly screened.	Low
Small or intermittent change to the view which may be obliquely viewed and mostly screened.	Negligible

Table 13.4 Definitions of magnitude of change

13.2.14 Sensitivity of Visual Change

Sensitivity of each viewpoint is assessed as being high, moderate or low based upon the guidance from Guidelines for Landscape and Visual Assessment (Second Edition). It should be stressed that this is only a framework and there will be exceptions to the broad categories set out. The receptors are ranked in order of their sensitivity to visual effects in Table 13.5.

Receptors	Sensitivity
Long distance footpaths Summits and plateaus Residential communities within view of the proposed development Historic Parks and Gardens	High
Footpaths and other rights of way Recreational spaces and those undertaking recreational pursuits Roads	Moderate
Business and Industrial Areas	Low

Table 13.5 Sensitivity of receptors

13.2.15 Evaluation of Significance for Landscape and Visual Effects

The evaluation for landscape and visual impact is indicated in Table 13.6. The combinations of sensitivity and magnitude to change determine the significance of landscape impacts. Significance increases in line with the sensitivity of the Landscape Character Area (LCA) and the magnitude of change.

Magnitude of Change	**Sensitivity**		
	High	Moderate	Low
High	Substantial	High-Moderate	Moderate
Moderate	High-Moderate	Moderate	Slight
Low	Moderate	Slight	Slight-Neutral
Negligible	Slight	Slight-Neutral	Slight-Neutral

Key: Significant:

Not significant:

Table 13.6 Evaluation of landscape and visual impact

Substantial: Where the landscape character area is highly sensitive to any change to the landscape character and the magnitude of change is too great to accommodate any change.

High-Moderate: Where the landscape character area has high-moderate sensitivity to change and the magnitude of the change is assessed as being of a high-moderate level.

Moderate: Where the landscape character area has a high sensitivity to change but with a low magnitude of change or a moderate sensitivity and a moderate magnitude.

Slight: Where the landscape character area has a moderate sensitivity and a low magnitude of change or a high sensitivity to change but when the magnitude of change is likely to be negligible.

Slight-Neutral: Where the landscape character area has a low sensitivity to change and low or negligible sensitivity to magnitude of change or a negligible magnitude of change and moderate sensitivity to change.

13.2.16 Zone of Theoretical Visibility (ZTV)

ZTV analysis has been used to illustrate the zone of theoretical visibility for the ECOCAS Wind Farm and has also been used to determine the cumulative visibility of the existing wind farms along with those submitted for planning within a 31.25 km radius. The radius is set at 31.25 km in the direction of each cardinal compass point from the central point of the Wind Farm and the software calculates the predicted visibility. The colour bands used in the ZTV have been chosen in a variety of tones and shades having taken into consideration colour blindness and legibility as set out in 'Visual Representation of Wind Farms Good Practice Guidance'. The ZTVs have been checked for colour blind legibility using a clarification tool called Vischeck which allows images to be shown as they would appear for people with the three main types of colour blindness. Although there was some change to the colour scheme when the ZTVs were processed through Vischeck the legibility of the ZTVs was still of a sufficient quality for assessments. The software used to generate the ZTV does not take into account vegetation such as woodlands or hedgerows or any buildings or other structures such as electricity pylons and telecommunication masts. The ZTV was used in order to help with the identification of viewpoints from which it was considered suitable to prepare photomontages and evaluate the visual impact of the Wind Farm. The ZTV was also used to assess the cumulative impacts of the proposed Wind Farm along with the existing and proposed wind farms on the landscape and visual amenity.

13.2.17 Viewpoint Assessment

The purpose of the viewpoint assessment is to evaluate the level of impact that would be sustained by particular receptors. The viewpoints were selected to be representative of the area and to include a range of views from different visual receptors including those deemed most sensitive to change, i.e. designated landscapes, marked footpaths and beauty spots, picnic areas and other outdoor passive recreational locations. The views were also selected at

different altitudes and from different directions with differing foreground and background to give an accurate account of the visual aspect of the Wind Farm.

The CCW and PCC were contacted with regard to the viewpoints and were given the opportunity to comment on the viewpoints that were selected (see Volume 4, Appendix 4, Pages 10.1-10.6).

Assessments undertaken at each viewpoint was recorded on a site survey sheet. The weather and cloud patterns have a significant effect on the appearance of turbines and the weather that prevailed at the time of taking the photographs will have an impact on the results.

13.2.18 Photographs, Wireframes and Photomontages

The photomontages and wireframes that have been produced are meant to give an impression of the turbine in relation to the various viewpoints and to the surrounding area, rather than exactly how it will appear in all circumstances. A number of visits were made to the area surrounding the Site in order to photograph the various viewpoints. Every effort was made to take photographs only when the weather and light conditions were favourable, in order to give a photomontage that represented the situation during high visibility – in other words maximum visibility of the turbines, had they been in position. On a number of occasions the light and weather conditions were such that a view of the turbines would have been impossible, from certain viewpoints and these were re-photographed later in the year. Because of our intention to show the turbine during times of high visibility, the turbines will obviously be less visible than shown in the photomontages during poor light or in adverse weather conditions. A major factor on visual impact is the distance from each viewpoint to the nearest proposed turbine. The distances from each individual viewpoint to the nearest turbine are shown with each corresponding photomontage.

In total 17 viewpoints were selected within a 31.25 km radius of the study area and represent a sample of the views within the landscape. Consultation to determine viewpoints was carried out with PCC and CCW and all the viewpoint locations were agreed to after some micro-siting.

Photographs were taken with a Canon EOS 300D SLR digital camera, with a 50 mm lens equivalent. The camera was used on a 1.5 m high tripod and for each viewpoint seven

separate photographs were taken. The photographs were then stitched together using computer software to form a panoramic view that follows the SNH guidelines on the production of photomontages.

The wireframes have been produced to include the existing turbines together with the ECOCAS Wind Farm. Each wireframe covers a field of view angle of 110 degrees and has been created using software that incorporates the turbine layout and surrounding topography generated from the digital terrain data provided by the Ordnance Survey.

Photomontages were created using software that overlays the wireframe onto the photograph. Once these are lined up, the turbines were rendered onto the image and the wireframe was removed. In some cases minor alterations may have been made to the settings to ensure that the photomontage is such as to provide the most accurate representation.

13.2.19 Cumulative Assessment

The assessment for cumulative landscape and visual impacts includes all existing operational wind farms and those that have been submitted to planning, where there is sufficient information, at the time of the assessment (March 2009). The assessments for cumulative impacts include ZTVs of the proposed Wind Farm and existing wind farms and the proposed Wind Farm and proposed wind farms. Due to the high proportion of wind farms within the study area it was deemed appropriate to split the ZTV into existing and proposed so as to give a better representation of the potential impacts.

The cumulative assessment follows the guidance published by SNH in 2005 and two types of cumulative visual effect are considered.

Fixed Viewpoint Inter-Visibility – viewpoints of overlapping ZTVs where visual receptors would have simultaneous views of more than one wind farm.

Sequential Visibility – viewpoints where receptors may have progressive views of two or more wind farms.

The following criteria, set out in Table 13.7, has been used to assess the magnitude of the cumulative effects with the photomontages and wireframes for visual assessment.

Definitions of Magnitude	**Level**
More than one wind farm is visible. The presence of the proposed Wind Farm increases substantially the scale and dominance of wind turbines in the landscape	High
More than one wind farm is visible. The presence of the proposed Wind Farm results in a moderate increase in the scale and dominance of wind turbines in the landscape	Moderate
More than one wind farm is visible. The presence of the proposed Wind Farm has a marginal effect on the scale and dominance of wind turbines in the landscape	Low
The presence of the proposed Wind Farm has no effect on the scale and dominance of wind turbines in the landscape	Negligible

Table 13.7 Magnitude of cumulative change

13.3 Baseline Description

13.3.1 Introduction

The baseline study records the existing landscape within the defined study area and is presented whilst drawing upon LANDMAP, the Landscape Character Assessment in Wales, relevant landscape planning designations and policies in the determination of the sensitivity of landscape receptors.

The study area is in the old county of Montgomeryshire, which lies in the northern part of the principal area of Powys. The county is surrounded by Denbighshire to the north, Shropshire to the east and south east, Radnorshire to the south, Cardiganshire to the south west and Merionethshire to the west and north west.

There are a mixture of landscape covers in Montgomeryshire which form the lowland farmlands to the upland plateaus. There is also a high proportion of coniferous forestry plantation dotted throughout the upland areas and parcels of deciduous mixed broadleaf are scattered through the lowlands. The topography of Montgomeryshire comprises of upland plateaux, hill and

scarps and lowland valley regions. The upland areas, above 300 m, are prevalent in the western half of Montgomeryshire and run from north to south between Gwynedd and Ceredigion. These areas are typified by upland marginal grazing and moorland with some areas of forestry plantation. Ridges and plateaus typify the area and are characterised by the open moorland which gives way to the majority of the wind farm development in Montgomeryshire and coniferous forestry plantations. The broad uplands also form the watershed between the two main water catchment areas and are dominated by rolling hills and upland summits such as the Cambrian Mountains of Ceredigion to the north west which rises to 550 m and the border peaks of Radnorshire and Shropshire. The hill and scarp areas in Montgomeryshire, between 150-300 m, characterise the majority of the middle of the study area and is typified by rolling, undulating farmland. There are a high proportion of deciduous mixed woodland and small-scale field systems in this area due to the livestock farming, which has meant that field boundaries and patterns remain small but with strongly defined hedgerows, that follow the topography of the landscape. In the lowland areas, below 150 m, much of the eastern part of Montgomeryshire is associated with the River Severn. This area contains the majority of settlements including the key transportation corridors which run along the valley floor. Montgomeryshire is dominated by the south west to north east valley of the River Severn where the key urban areas are situated, such as Newtown and Welshpool.

The main communication corridors that run through the valleys are the A470, A483, A458 and A487. These trunk roads link the main settlements of Dolgellau, Machynlleth, Newtown and Welshpool. There are a number of 'B' roads on the higher ground but they reduce in frequency towards the plateaus. The B4518 and the B4393 are some of the popular scenic routes that pass through the area. The rail network that links Newtown to Machynlleth also passes through the river valleys linking Mid-Wales to the south east. There are also three national trails that partially run through and surround the detailed study area. They are the Severn Way, the Kerryridge Way and Glyndwr's Way.

Radio and television masts are significant features in the area with more features such as wind farms being prominent on the plateaus. There are a number of operational wind farms that exist within the current landscape such as Carno Wind Farm on the Trannon plateau and

Mynydd Clogau Wind Farm on the Mynydd Clogau ridge. The landscape has already absorbed wind farms into its current character and will be able to accommodate others within it.

13.4 Landscape Assessment

13.4.1 Landscape Character Areas

There are 13 Landscape Character Areas (LCAs) which lie within and adjacent to the 10 km detailed study area. See Volume 5, Figure 13. These LCAs have been defined according to LANDMAP assessments and the Powys Landscape Character Study (2008). LANDMAP was used to determine which of the five aspects were deemed to be of the highest value in each of the defined landscape character areas. Thematic maps for each aspect layer within LANDMAP were created and the highest aspects (Outstanding-High) in each landscape character area are discussed further. These maps are shown in Volume 5, Figures 14-18.

LCA M5 - Dyfnant Forest/Llanbrynmair

The boundary of LCA M5 lies some 6 km to the north west of the ECOCAS Wind Farm Site and includes the upland area of Pen Coed at 360 m and the eastern fringe of the Llanbrynmair Moors. This landscape is predominantly made up of coniferous plantation with mixed broadleaf in the isolated lower lying areas. There are limited views in and out of the area due to the dense forestry creating an oppressive and enclosed character. The dense coniferous forests are surrounded by some open upland rough grazing including areas of heath and blanket bog in the north which are intersected by blocks of coniferous forest. To the south of the area there is a more widespread mix of open upland and blocks of forest. In this landscape the highest LANDMAP values are given to the geological, landscape habitat and cultural aspects. The landscape of the area is formed by the bedrock geology and the extensive Quaternary drift. This has formed the characteristic surface features of the area that are now predominant. The landscape habitat is a mosaic of unimproved marshy grassland and blanket bogs which is interspersed with large blocks of coniferous forest in the northern area. There are a wide range of Biodiversity Action Plans (BAPs) and other significant species which have been recorded in the landscape making its assessment high. In terms of the cultural aspect, this runs through

most of Montgomeryshire as high, due to the rich rural landscape over a wide topographical range that provides the framework for the whole study area. Historically the landscape has evidence of Neolithic and Bronze Age burial and ritual monuments making it important in terms of its historical significance. The area also contains a number of important sites that are listed as Scheduled Ancient Monuments (SAMs) that add to its significance.

LCA M7 - Pont Llogel

LCA M7 is 10 km north of the ECOCAS Site, with only a small proportion of the character area located within the 10 km radius of assessment. The landscape in the central and southern areas of the character area is typical of rolling farmland with strong field patterns that follow the topography. Small and irregular field parcels spread out over the rolling ridges whilst much of the wooded areas follow small scale valleys and watercourses through the area. On the higher ground trees can be seen grouped together with areas of marshy damp grazing land. In the north upland grazing with varied field patterns is prominent with small scale well defined fields in the lower lying areas and more weakly defined larger fields in the higher reaches. This landscape area is assessed as high in its visual and sensory aspect and in the cultural aspect. The traditional farming landscape of this area with its traditional land management techniques such as hedge laying and coppiced woodland is currently under economic pressure to modernise farming practices. The landscape is typical of the rolling traditional farmland of Montgomeryshire with strongly defined field patterns that follow the underlying topography, and hilltop grouped trees and marshy or semi improved damp grazing land. These characteristics and elements combine to create a high assessment for this aspect layer. In terms of the cultural aspect this runs through most of Montgomeryshire as high due to the rich rural landscape over a wide topographical range that provides the framework for the whole study area. Although the area has a high assessment in the visual and sensory and cultural aspect layers the overall sensitivity is classed as being moderate due to the distance of the character area from the proposed wind farm location.

LCA M10 - Guilsfield

LCA M10 is located 10 km east of the Site with only a small proportion of the landscape character area being included in the 10 km radius of assessment. The majority of this area is comprised of rolling hillsides and pasture land with rounded hill tops. Broadleaved woodland parcels are interspersed with well defined small fields. Much of the wooded areas follow small scale valleys and watercourses through the area. On the higher ground trees can be seen grouped together with areas of marshy damp grazing land. The landscape is that of traditional farming and has had limited intrusion by modern development. This LCA is valued highly in terms of its cultural and historic aspect as a number of country houses, listed buildings, registered historic landscapes, parks and gardens are associated with this landscape. Although the area has a high assessment in the cultural aspect layer the overall sensitivity is classed as being moderate due to the distance of the character area from the proposed wind farm location.

LCA M12 - Banwy Valley

LCA M12 is 9 km north of the Site with only a small strip of its area present in this zone of assessment. This valley holds a narrow river corridor where small to medium settlements cluster. Around the bottom of the valley floor lies the major transport corridor of the A458. There are a number of well defined small to medium sized field patterns running along the bottom of the valley and it is surrounded by the steep sided valley. The landscape is valued highly geologically and in terms of the landscape habitat. There is a major river system with well developed features that are of regional significance to the area. The area is characterised mainly by fields with mature dense hedges on the flat valley bottom along the river Banwy. The area also contains nationally important sites including llechwedd-Newydd and Pen-Y-Coed pastures and SSSIs which support a range of nationally important and local Biodiversity Action Plan (BAP) species. Although the area has a high assessment in the geological and landscape habitat aspect layers the overall sensitivity is classed as being moderate due to the distance of the character area from the proposed wind farm location.

LCA M13 - Tregynon/Llanerfyl

LCA M13 lies less than 2 km to the east of the Site, the predominant landscape character is defined by rolling farmland with traditional farming management. To the north the character is that of low rolling hills with gentle sloping sides and round tops. Small scale irregular fields are defined by hedgerow boundaries and some hedgerow trees. Broadleaved woodland is common in the low-lying areas and follows the watercourses running across the landscape. In the central and southern parts of the area the landscape is dominated by rolling hillsides and pasture with gentle sloping sides and rolling tops. The LANDMAP assessments have classified all of the aspects as high for this landscape. The visual and sensory aspect is classified as high due to the extensive area of rolling hillsides and pasture land with gently sloping sides and rounded tops. Views across are from rolling ridges and due to the size and the long distance views are limited to far distant ridgelines of upland areas. The sense of place is settled, safe and intimate and the area has high aesthetic qualities with limited intrusion by modern development. Geologically the area has a regional structural south west to north east orientation and includes a low scarp in the Tirymynach area. The aspect includes key sites of regional importance such as the Talerddig Bridge and Cwm Llwyd. The landscape habitat is classified as an area of fields with mature dense hedges on the flat valley bottom along the river Banwy. The area contains the nationally important sites of llechwedd-Newydd and Pen-Y-Coed pastures as well as SSSIs and important biodiversity networks that support a range of nationally important and local Biodiversity Action Plan (BAP) species. In terms of the cultural aspect this runs through most of Montgomeryshire as high due to the rich rural landscape over a wide topographical range that provides the framework for the whole study area.

LCA M14 - Esgair Cwmowen

The ECOCAS Wind Farm is located in the middle of LCA M14, which is comprised primarily of upland grazing with a patchwork of vegetation. The area is primarily that of rough grazing heather and bracken with irregular field patterns that run with the topography. These areas are broken up by intermittent blocks of coniferous and mixed woodland parcels. The dominant feature in the landscape is its exposure and windiness. In the areas towards the edge of the landscape there are more sheltered areas with small irregular fields. The LANDMAP assessments have classified all aspects as high in this landscape character area. The visual and

sensory aspect is classified as high due to the overall dominance of the landscape. Geologically the important upland massif with its unique steeped topography, unusual periglacial features (north east of Y Foel) and at least two Regionally Important Geological and Geomorphological Sites (RIGS) sites (Tan Y Foel Quarry RIGS and Ty'n-y-Graig RIGS) mean that this area has also been given a high assessment. In terms of the landscape habitat the area is comprised of small enclosed fields and steep hill sides covered in bracken and scrub. The wet gullies offer an important habitat for a range of semi natural communities such as oligotrophic lakes including the Llyn Mawr SSSI. The cultural aspect is visually rich with a wide topographical range and small natural post glacial lakes. Neolithic and bronze age hilltop burial and ritual monuments are dispersed through the area with prehistoric, medieval hilltop house sites also being prominent. This area also contains some Scheduled Ancient Monuments (SAMs) which add to its overall nature.

LCA M15 - Dyfi Valley Catchment

This LCA is situated 8 km to the west of ECOCAS on the edge of the 10 km assessment zone. The flat open lowland farmland of this landscape runs alongside the River Dovey. There are a number of small to medium regular fields that are predominantly for livestock farming. The rolling farmland rises in both the north and south to areas of moorland. The area is surrounded by an extensive network of valleys connecting tributaries leading to the River Dyfi. This LCA has been assessed by LANDMAP as being high in terms of its Visual and Sensory aspect layer. Traditional farmed elements, foreground picturesque hills and the mountain scape of Snowdonia National Park and the River Dovey add to this.

LCA M17 - Dyfi & Twymyn Hillsides

The undulating hillside landscape of the Dyfi & Twymyn Hillsides located 10 km to the west of the Wind Farm Site forms part of the transitional scarp slopes falling to the north and south. There is a range of vegetation across the area with scattered broadleaf trees, rough grazing bracken and heather scrub being typical features in the west. This landscape has been assessed as high for its cultural aspect due to the varied, visually rich rural landscape of a wide topographical range that provides the framework for the study area as a whole.

LCA M22 - Trannon

The majority of this landscape is typified by isolated upland moorland with wide skies and long dramatic views. There are exposed rock outcrops and screes in higher areas whilst in the central area of this landscape is an existing wind farm. The majority of the land cover is exposed heather and unimproved grassland with gorse and bracken growth at the lower edges of the area. The low vegetation cover of heather and bilberry with stream courses running through them include the sources of the River Severn and the River Wye. The Trannon character area has high assessments in terms of its geological, habitat and cultural aspect. The geological aspect is classified as high due to the well developed lobate landforms in the Esgair Draen Llyn area which has the potential for a Regionally Important Geological and Geomorphological Sites (RIGS) status. The habitat aspect is of high value due to Waun Cwm Calach SSSI which has acidic and base rich rock formations that support a rich flora. The cultural aspect of the area is assessed as high due to the especially visible examples of efforts to generate sustainable energy in the form of wind turbines which affects the adjacent and distant landscapes.

LCA M23 - Carno Valley

This landscape spreads over the upland plateau area that forms the upper reaches and valley sides. The A470 corridor lies at the centre of the area with the main railway line from Newtown to the Welsh coast in the west also lying in the valley. The northern area is predominantly traditional livestock farming with strongly defined field patterns and managed hedgerows and boundaries. Some areas of well wooded and broadleaf trees are also typical features. The Carno Valley area is assessed by LANDMAP as being high in terms of its cultural aspect due to the varied, visually rich rural landscape of a wide topographical range that provides the framework for the Study Area as a whole.

LCA M26 - Caersws Valleys

This landscape area is defined by a broad flat basin shape. The small traditional development of Caersws lies in the bottom of the basin as does the A470. The extensive area of lowland agricultural land is enclosed by a higher ring of ground that forms the edges of the basin. Views from the area are restricted by the surrounding rim of low hills and ridges. LANDMAP

assessments have determined the geological and cultural aspects of this area as being of high value due to the major river systems with well developed features such as meanders and the registered landscape of special historic interest of Clywedog Valley that contains remnants of the once thriving lead mining industry. There is also evidence of roman roads in this area and a dominance of contemporary cultural essence in the presence of the Clywedog Reservoir whose waterscape is dramatic.

LCA 28 – Llawr-y-glyn Hillsides

The upland hillsides and irregular small to medium field patterns are the predominant landscape character in this area. The landscape is that of well maintained marginal farming with a high proportion of hedgerow trees and grazed fields. The highest aspects in this area are geological and cultural. The geological aspect is one of lobate landforms and the area has the potential for a Regionally Important Geological and Geomorphological Sites (RIGS) status. The cultural aspect is determined as high due to the varied, visually rich rural landscape of a wide topographical range that provides the framework for the Study Area as a whole.

LCA 31 – Llandinam to Llandyssil Hillsides

This landscape area is defined by the patchwork of small fields which are typical of mixed arable farming and in the northern and central areas by rolling upland grazing. The highest aspects in this area are geological and cultural. Geologically there is a regionally important site, Montgomery Castle (Regionally Important Geological and Geomorphological Site, RIGS), and the escarpment is deemed to be a prominent landscape feature. In terms of the cultural aspect the eastern part of the area contains remnants of fortifications from pre-history to the medieval period. The Vale of Montgomery Registered Landscape of Outstanding Historic Interest is also included within this aspect area towards the south and south west of Montgomery making it high in terms of the cultural aspect.

13.4.1.1 Summary of Landscape Quality, Sensitivity and Capacity

Below is the summary of the landscape characteristics as defined in Section 13.4.1.

Landscape Character Area	**Landscape Characteristics**	**Landscape Classification**	**Quality (determined by LANDMAP)**	**Sensitivity**	**Capacity for change**
LCA-M5 Dyfnant Forest/ Llanbrynmair	Coniferous plantation with mixed broadleaf in the isolated lower lying areas. Limited views in and out of the area due to the dense forestry creating an oppressive and enclosed character.	Wooded upland plateau	Low - Moderate	Low - Moderate	Moderate - High
LCA-M7 Pont Llogel	The landscape in the central and southern areas is typical of rolling farmland with strong field patterns that follow the topography. Small and irregular field parcels spread out over the rolling ridges whilst much of the wooded areas follow small scale valleys and watercourses through the area.	Hillside and scarp slopes grazing	Moderate	Moderate	Moderate
LCA-M10 Guilsfield	The majority of this area is comprised of rolling hillsides and pasture land with rounded hill tops. Broadleaved woodland parcels are interspersed with well defined small fields. The landscape is that of traditional farming and has had limited intrusion by modern development.	Hillside and scarp slopes mosaic	Moderate	Moderate	Moderate
LCA-M12 Banwy Valley	This valley holds a narrow river corridor where small to medium settlements cluster. Around the bottom of the valley floor lies the major transport corridor of the A458. There are a number of well defined small to medium sized field patterns running along the bottom of the valley and is surrounded by the steep sided valley.	Flat open lowland	Moderate	Moderate	Moderate

Landscape Character Area	Landscape Characteristics	Landscape Classification	Quality (determined by LANDMAP)	Sensitivity	Capacity for change
LCA-M13 Tregynon/Llanerfyl	The predominant landscape character is defined by rolling farmland with traditional farming management. To the north the character is that of low rolling hills with gentle sloping sides and round tops. Small scale irregular fields are defined by hedgerow boundaries and some hedgerow trees.	Hillside and scarp slopes mosaic	Moderate - High	High - Moderate	Moderate - Low
LCA-M14 Esgair Cwmowen	The landscape in this area is comprised of upland grazing with a patchwork of vegetation. The area is primarily that of rough grazing heather and bracken with irregular field patterns that run with the topography. These areas are broken up by intermittent blocks of coniferous and mixed woodland parcels. The dominant feature in the landscape is its exposure and windiness. In the areas towards the edge of the landscape there are more sheltered areas with small irregular fields.	Upland grazing	High	High - Moderate	Moderate - Low
LCA-M15 Dyfi Valley Catchment	The flat open lowland farmland of this landscape runs alongside the River Dovey. There are a number of small to medium regular fields that are predominantly for livestock farming.	Mosaic lowland valleys	High	High - Moderate	Moderate - Low

Landscape Character Area	Landscape Characteristics	Landscape Classification	Quality (determined by LANDMAP)	Sensitivity	Capacity for change
LCA-M17 Dyfi & Twymyn Hillsides	The undulating hillside forms part of the transitional scarp slopes falling to the north and south. There is a range of vegetation across the area with scattered broadleaf trees, rough grazing bracken and heather scrub being typical features in the west.	Hillside and scarp slopes grazing	Moderate	Moderate	Moderate
LCA-M22 Trannon	The majority of this landscape is typified by isolated upland moorland with wide skies and long dramatic views. There are exposed rock outcrops and screes in higher areas whilst in the central area of this landscape is an existing wind farm. The majority of the land cover is exposed heather and unimproved grassland with gorse and bracken growth at the lower edges of the area.	Upland moorland	Moderate	Moderate	Moderate
LCA-23 Carno Valley	This landscape spreads over the upland plateau area that forms the upper reaches and valley sides. The A470 corridor lies at the centre of the area with the main railway line from Newtown to the Welsh coast in the west also lying in the valley. The northern area is predominantly traditional livestock farming with strongly defined field patterns and managed hedgerows and boundaries. Some areas of well wooded and broadleaf trees are also typical features.	Hillside and lower plateau grazing/mosaic	Moderate	Moderate	Moderate

Landscape Character Area	Landscape Characteristics	Landscape Classification	Quality (determined by LANDMAP)	Sensitivity	Capacity for change
LCA-M26 Caersws Valleys	This landscape area is defined by a broad flat basin shape. The small traditional development of Caersws lies in the bottom of the basin as does the A470. The extensive area of lowland agricultural land is enclosed by a higher ring of ground that forms the edges of the basin. Views from the area are restricted by the surrounding rim of low hills and ridges.	Flat open lowland	Moderate	Moderate	Moderate
LCA-M28 Llawr-y-glyn Hillsides	The upland hillsides and irregular small to medium field patterns are the predominant landscape character in this area. The landscape is that of well maintained marginal farming with a high proportion of hedgerow trees and grazed fields.	Mosaic upland plateau	Moderate	Moderate	Moderate
LCA-M31 Llandinam to Llandyssil Hillsides	This landscape area is defined by the patchwork of small fields which are typical of mixed arable farming and in the northern and central areas by rolling upland grazing.	Hillside and scarp slopes grazing	Moderate – Low	Moderate - Low	Moderate

13.4.2 ECOCAS Wind Farm Site

The detailed study area for the landscape assessment covers an area of approximately 396 km^2. The ECOCAS Wind Farm lies in the centre of the landscape character area Esgair Cwmowen Uplands as defined by LANDMAP. The area surrounding Esgair Cwmowen is assessed as being essentially rural in nature with the predominant industry being agricultural. The topography and elevation in the area is high and therefore the majority of agriculture is managed livestock which is typified by small to medium scale field patterns enclosed by strongly vegetated hedgerows. Typically agricultural sheep farming has led to the patchworks of grazed land and rough heather and bracken. Irregular field patterns run along the rolling and undulating topography and there are intermittent small blocks of coniferous and mixed woodland parcels. In the areas towards the edge of the landscape there are more sheltered intimate areas with small irregular fields. The dominant feature in the landscape is its exposure and windiness.

The ECOCAS Wind Farm lies to the south behind the Esgair Cwmowen ridge. As the Site is located behind the ridge there will be some screening of the turbines for views from the north. The Site is also surrounded by a number of woodland parcels and to the east of the Site there are two commercial forestry plantations Bryn yr Ysbyty and Cryniarth. These plantations are made up of coniferous trees and therefore provide a screen for views of the Wind Farm from the west all year round. The landscape drops away sharply to the west which also provides screening of views due to the steep sided hills. To the south of the Site lies Garreg Hir and two lakes, Lake Llyn Mawr, which is a Site of Special Scientific Interest (SSSI) and the Llyn Du Lake which form a distinctive pattern in the south of a more rolling and undulating landscape into the valley bottom. The northern part of the Site is primarily open upland grazing with intermittent streams whilst to the east of the Site are views of the Mynydd Clogau Wind Farm.

The present character of Site area is open rough grazed plateau moorland with wind turbines and commercial plantations already accommodating some of the area. The relative vastness of the scale of landscape can accommodate the development of wind farms as the large scale landscape and the presence of existing wind farms do not dominate the underlying character, but rather are accommodated within the landscape. There is certainly a capacity for this landscape to accommodate a sensitively located wind farm such as the ECOCAS Wind Farm.

13.4.2.1 Significance of the Wind Farm on the landscape character areas

Below is a summary of the significance of the ECOCAS Wind Farm in each of the character areas.

Character Type	**Character Area**	**Landscape Sensitivity**	**Magnitude of Impact**	**Significance of Impact**
Upland plateau	LCA-M5 Dyfnant Forest/Llanbrynmair	Low - Moderate	Low - Negligible	Slight - Neutral
	LCA-M28 Llawr-y-glyn Hillsides	Moderate	Moderate - Low	Moderate
Uplands	LCA-M14 Esgair Cwmowen	High - Moderate	High - Moderate	High - Moderate
	LCA-M22 Trannon	Moderate	Moderate - Low	Moderate
Hillside and scarp slopes	LCA-M7 Pont Llogel	Moderate	Low - Negligible	Slight - Neutral
	LCA-M10 Guilsfield	Moderate	Low - Negligible	Slight - Neutral
	LCA-M13 Tregynon/Llanerfyl	High - Moderate	High - Moderate	High - Moderate
	LCA-M17 Dyfi & Twymyn Hillsides	Moderate	Moderate - Low	Moderate
	LCA-M31 Llandinam to Llandyssil Hillsides	Moderate	Moderate – Low	Moderate - Low
Lowland and valley bottoms	LCA-M12 Banwy Valley	Moderate	Low - Negligible	Slight - Neutral
	LCA-M15 Dyfi Valley Catchment	High - Moderate	Low - Negligible	Slight
	LCA-23 Carno Valley	Moderate	Moderate	Moderate
	LCA-M26 Caersws Valleys	Moderate	Moderate	Moderate

13.4.3 Designated Areas

13.4.3.1 Snowdonia National Park

The Snowdonia National Park Boundary extends across the north west sector of the 31.25 km radius study area. Much of this southern part of the National Park is under commercial forestry production and therefore views from the National Park towards the Site are likely to be screened by this. Viewpoint 8 has been taken from within the Snowdonia National Park and the assessment of the viewpoint can be seen in the analysis. As the National Park is some distance from the development it is deemed not to be a significant impact.

13.4.3.2 Special Landscape Areas

Although the Special Landscape Areas are not statutory designations they have been included as part of the assessment as they indicate areas of landscape that have been deemed important by the local planning authorities. A map detailing the areas can be seen in Volume 5, Figure 19.

Within the Montgomeryshire District there are five Special Landscape Areas (SLAs) identified in the Powys Structure Plan, the Isolated Border Hills, Brewyn Mountains, Western Uplands, Wye Valley and the Upper Severn Valley. The boundaries of the SLAs as identified in the Powys Structure Plan were confirmed following the completion of the Montgomeryshire Landscape Assessment which was undertaken in 1991 for the whole of Montgomeryshire. This work was undertaken as part of the preparatory work for the Montgomeryshire Local Plan (1992). The ECOCAS Wind Farm lies on the very eastern fringe of the Western Uplands SLA and therefore has little impact on the SLA. Although the Western Uplands is designated as a protected landscape it has already accommodated a number of wind turbines and therefore the landscape of the Western Uplands has changed with this. The landscape change in the Western Uplands is assessed as being moderate as it has already encompassed a number of wind turbines.

There are no Areas of Outstanding Natural Beauty (AONB) within or adjacent to the Site. However, the Shropshire Hills AONB lies within the 31.25 km radius and viewpoint 13 is indicative of the view that this area may experience. Due to the distance of the proposed Wind

Farm to the AONB it is deemed not to be significant as the impact on views from of the AONB will be minimal, due to the distance from the development.

13.5 Assessment

The highest magnitude of change will occur in LCAs 13 and 14 as they are the closest areas to the Wind Farm and will therefore experience greater change. All the other LCAs will experience a moderate magnitude of change although this change will be easily encompassed in the current landscape. TAN 8 accepts that a significant change in landscape character will occur from wind farm development and, although the magnitude of change for some areas will be high, only parts of the LCAs will be affected due to the screening affect of coniferous woodlands and the topography of the landscape. Therefore the magnitude of change is deemed as being acceptable due to the encompassing nature of the landscape character areas.

13.6 Zone of Theoretical Visibility

The zones of theoretical visibility (ZTV) diagrams have been prepared for both hub height and tip height with an area of coverage of a 31.25 km radius. The ZTV's are prepared based on a digital terrain model which does not take into account the screening effects of surface features such as woodland, hedgerows and buildings. The ZTV's also cannot take into account weather or light conditions which can significantly reduce the visibility of the Wind Farm. The ZTV diagrams should, therefore be considered as a worst case scenario of visibility giving an indication of the visibility rather than absolute visibility.

13.6.1 Assessment

The ZTVs for the ECOCAS Wind Farm (hub height and tip height) can be found in Volume 5, Figures 20 & 21. Within the 10 km radius, where the turbines are likely to be most visible, 41% of the area is predicted as having a view of part or all of the turbine hubs and 49% of the area is predicted as having a view of part or all of the turbine tips. However, only 14% of the area within the 10 km radius is predicted as having a view of sixteen to seventeen

turbine hubs whilst the tips of the sixteen to seventeen band of turbines are assessed as covering 39% of the area. The viewpoint assessments within a 10 km radius of the ECOCAS Wind Farm have primarily been assessed as having a low to negligible magnitude of change. One of the main reasons for this is the topography and vegetation that screens the turbines from these distances.

Within the 10 km to 20 km radius, in 24% of the total area the turbine hubs are predicted as being visible and in 26% of the total area the turbine tips are deemed to be visible. Due to the distance from the Wind Farm most of the seventeen turbine hubs are deemed to be visible. In reality, at this distance the apparent height of the turbine hubs will be 4 mm and 2 mm at 10 km and 20 km, respectively, when measured on a photographic image at a distance of 0.5 m from the viewer. Following the same rule as before the apparent height to the turbine tips will be 6 mm and 3 mm at 10 km and 20 km respectively.

Within the last radius band, up to 30 km, only 2% of the total area is likely to have a view of the turbine hubs and 2.5% of the area is likely to have a view of the turbine tips. In reality, at this distance, views towards the Site are extremely limited. From viewpoint 8 at Aran Fawddwy, which is 25.8 km from the ECOCAS Wind Farm there is a negligible magnitude of change as the turbines are barely recognisable on the far horizon, even in very clear visibility.

13.7 Viewpoint Analysis

The study area for the ECOCAS Wind Farm visual assessments covers an area of approximately 3069 km^2. The ZTV significantly exaggerates the likely visibility of the Wind Farm, therefore a more detailed viewpoint analysis was undertaken to accurately predict visual effects. Using the ZTV diagrams as a guide, a total of 18 viewpoints were selected and agreed to by CCW and PCC. Viewpoints chosen have been selected to illustrate the presence of the Wind Farm in the landscape rather than to show the screening effect of landform and landscape features. In many cases, finding an uninterrupted view of the Site from locations within the surrounding landscape has been difficult. Therefore, although views shown are representative, they are not necessarily typical. After Site visits to determine the suitability of the viewpoint locations it was agreed that the original viewpoint 17, on the Severn Way above Broneirion and to the west of

Llandinam should be dropped as no views were capable even after micro-siting of the viewpoint on higher ground, thereby reducing the finally agreed viewpoints to a total of 17, as stated at Section 13.2.18 . This was confirmed by Ken Perry of CCW as being an acceptable change to the original viewpoint locations. It was also confirmed that photomontages of viewpoints 8 and 13 would not be necessary due to the distance from the proposed Wind Farm. All correspondence can be found in Volume 4, Appendix 4, Pages 10.1-10.6. Wireframes for these viewpoints and baseline views have been included to give a representation of the predicted view. All of the viewpoints have been selected at high-moderate sensitivity receptors so as to be representative of the receptors most likely to experience a change to the visual amenity. Table 13.8 sets out the locations of the viewpoints chosen whilst in Volume 5, Figure 22 a map of the viewpoint locations can be seen.

Viewpoint no.	Viewpoint Location	OS Grid Reference	
		Eastings	Northings
1	Garreg Hir	299892	297794
2	A470 - North Clatter	298727	295661
3	Glyndwr's Way – Newchapel	298503	283093
4	Gellilefrith - Severn Way	296207	286426
5	Bryn y Gadiar	295706	294292
6	A470 - Talerddig	293376	299673
7	North Lanbrynmair	288454	304935
8	Aran Fawddwy - Snowdonia National Park	286261	322370
9	Pen Coed	298339	308300
10	B4395 - Penyfford Glyndwr's Way	301626	312996
11	Rhos	303436	300875
12	B4389 - Belan-deg	310035	302996
13	Offas Dyke - Kingswood	324730	303263
14	A489 - East Newtown	313698	290996
15	Kerry Hill	314031	286074
16	B4355 - Dolfor	310734	287856
17	Caersws	302224	291029

Table 13.8 Viewpoint locations

For each viewpoint an evaluation was carried out to determine the visual impacts of the proposed Wind Farm. A summary of the viewpoint assessments is detailed in Table 13.9.

Viewpoint 1: Garreg Hir

This viewpoint has been chosen to provide a representative view to that experienced by walkers on the summit of Garreg Hir. This is a remote area and is just south of the proposed Wind Farm. It is only visited by very few walkers as compared with, say, other more accessible areas within Wales.

Existing View: The existing view is illustrated in Volume 6, Figure 1 (Baseline) which shows the long exposed landscape looking northwards towards Esgair Cwmowen. The landscape is primarily comprised of rough grazing heather and bracken with irregular field patterns that run with the topography. Part of the existing Mynydd Clogau Wind Farm can be seen in the right-hand side of the wireframe but due to the atmospheric conditions they become less visible in the photograph.

Predicted View: The predicted view is illustrated in Volume 6, Figure 1 (Photomontage).

Magnitude of Change: The ECOCAS Wind Farm lies approximately 1 km north from the viewpoint and all of the proposed turbines can be clearly seen within the view. Although the magnitude of change is high it is evident that the turbines have been located so as to cause minimum disruption to the landscape and therefore are easily embraced in the landscape due to its encompassing nature. It should be noted that viewpoints have been taken to show the Wind Farm at its most visible and that the good weather conditions at the time of the photograph are not typical of the weather normally experienced in the area. During the on-site visit on the 20th January 2009 the Garreg Hir ridge was pointed out to representatives from the EA, PCC and CCW. None of the representatives commented on the location of Garreg Hir in relation to the proposed Wind Farm layout.

Viewpoint 2: A470 - North Clatter

This viewpoint is representative of the view experienced by people travelling along the A470.

Existing View: The existing view is of rolling hills with patched field boundaries and tree vegetation defining the boundaries. It is illustrated in Volume 6, Figure 2 (Baseline).

Predicted View: The predicted view is shown in Volume 6, Figure 2 (Photomontage).

Magnitude of Change: The magnitude of change has been assessed as being low at this viewpoint as the change only affects a small part of the view. Only 5 out of the 17 turbines are visible from this viewpoint and 4 of the 5 turbines are only visible from the hub to the tip whilst one has only the tip visible. The turbines that are visible from this viewpoint are located in a dip between two hills. It should be noted that the majority of people experiencing this viewpoint will possibly see it as they are travelling along in vehicles and therefore will only get a passing glimpse of the Wind Farm as they travel along. The view will be quickly screened by the topography of the hills as you move past the viewpoint and should not cause a distraction to drivers.

Viewpoint 3: Glyndwr's Way – Newchapel

This viewpoint is representative of the view experienced by walkers on Glyndwr's Way near to Newchapel.

Existing View: The existing view is shown in Volume 6, Figure 3 (Baseline), looking north towards the proposed ECOCAS Wind Farm. The view is of rolling hills with largely defined field patterns and parcels of woodland. To the right of the photograph the valley floor of the river Severn can be seen. The existing wind farms of Carno and Mynydd Clogau are also visible although they are barely noticeable due to the distance of the viewpoint.

Predicted View: The predicted view is shown in Volume 6, Figure 3 (Photomontage).

Magnitude of Change: The magnitude of change experienced at this viewpoint is assessed as being negligible as there is only going to be a small change to the existing view which is mostly screened by the current topography. Although all 17 turbines are visible in the photomontage the distance of the receptor to the turbines (15.4 km) means that the turbines are barely visible in the distance and do not break into the horizon excessively.

Viewpoint 4: Gellilefrith - Severn Way

This viewpoint has been chosen to be representative of the view experienced by walkers on the Severn Way and drivers on the A4569.

Existing View: The existing view is shown in Volume 6, Figure 4 (Baseline), looking north towards the proposed ECOCAS Wind Farm. The view is of a gentle hill on the left and rolling

pastures on the right with scattered farms and isolated houses. Some woodland is present although this is mostly located in parcels on top of the hills. The foreground is dominated by large open fields primarily used for sheep grazing.

Predicted View: The predicted view can be seen in Volume 6, Figure 4 (Photomontage).

Magnitude of Change: The magnitude of change will be negligible due to the distance of the viewpoint from the Wind Farm (12.5 km). Although all 17 turbines are deemed as being visible, only the blade tips and hubs are showing, and most do not penetrate the horizon. The rolling hillside and vastness of the landscape at this viewpoint encompasses the turbines so that they are barely noticeable in the photomontage.

Viewpoint 5: Bryn y Gadiar

This viewpoint is representative of the view experienced by walkers at Bryn y Gadiar looking towards Carno.

Existing View: The existing view as shown in Volume 6, Figure 5 (Baseline), is of a smooth horizon to the left of the picture and gently undulating hills to the right. The landscape is made up of well defined field boundaries on the hillsides that run with the topography of the landscape and there are parcels of forestry tree cover on top of the hill sides and on the slopes. The tips of the blades of the Mynydd Clogau Wind Farm can be seen in the very distance although due to the distance of the viewpoint these are barely noticeable.

Predicted View: The predicted view can be seen in Volume 6, Figure 5 (Photomontage).

Magnitude of Change: The magnitude of change has been assessed as low for this viewpoint as the Wind Farm will only affect a small part of the view which will be partly screened by the topography and woodland parcels. The Wind Farm is located behind a ridge with parcels of woodland cover screening parts of the development. Out of the 17 wind turbines 16 turbine tips are visible and 15 of these also have their hubs visible. As the Wind Farm has been located behind a ridge the expansive landscape encompasses it so that it is barely visible at this viewpoint.

Viewpoint 6: A470 – Talerddig

This viewpoint represents the view experienced by drivers on the A470 travelling south east to Carno.

Existing View: The existing view is shown in Volume 6, Figure 6 (Baseline), and looks eastwards through hills on either side of a valley towards undulating hills in the distance. The landscape is divided by hedgerow field boundaries that run along the hill slopes with parcels of woodland covering some of the hill tops and slopes.

Predicted View: The predicted view can be seen in Volume 6, Figure 6 (Photomontage).

Magnitude of Change: The magnitude of change has been assessed as being low as only a small part of the view will be affected and the view will be partly screened by the vegetation cover and topography. The ECOCAS Wind Farm is located behind a ridge with scattered woodland partly screening the wind turbines. Of the 17 turbines 15 tips are visible; however, due to the screening nature of the topography and the vegetation the turbines are easily encompassed and blend in with the existing view.

Viewpoint 7: North Lanbrynmair

This viewpoint is representative of the view experienced by walkers on Glyndwr's Way north of Landbrynmair.

Existing View: The existing view is shown in Volume 6, Figure 7 (Baseline), looking towards the south east and is of gently rolling hills with defined field patterns and parcels of woodland. In the valley on the right side of the existing view the A470 can be seen snaking along the valley bottom. The Carno Wind Farm is very visible in this viewpoint and is located on top of the smooth hill on the right side of the existing view. The turbines of the Carno Wind Farm dominate the right side of the view and the eye is drawn to these structures. The Llandinam Wind Farm is also visible in the far distance of this view but is barely noticeable due to the long distance.

Predicted View: The predicted view can be seen in Volume 6, Figure 7 (Photomontage).

Magnitude of Change: The magnitude of change at this viewpoint has been assessed as being negligible as the change to the existing view is slight. In addition, the ECOCAS Wind

Farm is 11.7 km from this viewpoint and to a greater extent is screened by the topography. Although all 17 turbine tips of the ECOCAS Wind Farm are visible they do not break into the horizon excessively. The Carno Wind Farm is the most prominent feature within this viewpoint and the ECOCAS Wind Farm together with the Llandinam Wind Farm would only be noticeable on days of good visibility due to the distance of the viewpoint from these wind farms.

Viewpoint 8: Aran Fawddwy - Snowdonia National Park

This viewpoint is representative of the view experienced by walkers reaching the Aran Fawddwy peak which is the highest Welsh mountain south of Snowdon.

Existing View: The existing view towards the south east is characterised by undulating upland peaks and plateaus, and can be seen in Volume 6, Figure 8 (Baseline). The Mynydd Clogau, Llandinam, Carno, Bryn Titli, Cemmaes and Cefn Croes Wind Farms are visible from this viewpoint although the turbines can barely be seen due to the distance from the viewpoint (25.8 km). It should be noted that the weather conditions prevailing at the time of this photo are not typical of the weather normally experienced in this region. The days of excellent visibility from this viewpoint are minimal and it took several visits to take this photograph in conditions when visibility was sufficient to even capture an acceptable image.

Predicted View: During consultation with Ken Perry (CCW) it was agreed that only a wireframe of this viewpoint would be needed. This was due to the significant distance of the viewpoint from the Wind Farm.

Magnitude of Change: This viewpoint has been assessed as having a negligible magnitude of change due to the small change to the view that would occur which is screened by the topography and the distance of the viewpoint. This viewpoint is the furthest away from the ECOCAS Wind Farm at 25.8 km. The long distance means that the Wind Farm becomes embraced into the landscape and is no longer visible at this distance.

Viewpoint 9: Pen Coed

This viewpoint is representative of the view experienced by walkers on Glyndwr's Way near Pen Coed.

Existing View: The existing view can be seen in Volume 6, Figure 9 (Baseline), looking southwards towards the ECOCAS Wind Farm and shows a smooth horizon in the distance with rolling hills in the mid foreground. The landscape is rural in nature with the primary land use being sheep grazing. The field parcels are defined with hedgerows and tree lines following the topography of the hillside. There are a number of parcels of woodland on the hill slopes and on the tops of the hills. To the right of the existing view there is a large area of coniferous forest that runs along the horizon and into the distance. Beyond this coniferous forest is the Carno Wind Farm which is barely noticeable due to the screening affect of the forest.

Predicted View: The predicted view can be seen in Volume 6, Figure 9 (Photomontage).

Magnitude of Change: The magnitude of change at this viewpoint has been assessed as being low. Although all 17 turbine tips are visible within this viewpoint the encompassing nature and vastness of the landscape reduces the impact of the ECOCAS Wind Farm at this viewpoint. The topography of the hills also shields the Wind Farm from view as you walk along the footpath and there are only a few places where it can be clearly viewed. It should be noted that the prevailing weather conditions at the time that the photographs for this photomontage were taken were not typical of the normal weather experienced in this area and the Wind Farm would, therefore only be visible in very good conditions.

Viewpoint 10: B4395 - Penyfford Glyndwr's Way

This viewpoint is representative of the view experienced by walkers on Glyndwr's Way and also by vehicles on the B4395.

Existing View: The existing view can be seen in Volume 6, Figure 10 (Baseline), looking southwards and is of rolling and undulating hills with well defined field boundaries of hedgerows. There are parcels of woodland on the slopes in the background and small patches of coniferous woodland in the mid-ground. The Carno Wind Farm is also just visible but due to the long distance is barely noticeable behind the hills on the horizon.

Predicted View: The predicted view can be seen in Volume 6, Figure 10 (Photomontage).

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being low due to the small change to the current view as the majority of the turbines are screened by the topography. From this viewpoint, 14 of the turbine tips are visible, although due to the significant distance between the ECOCAS Wind Farm and the viewpoint (13.4 km) they are unlikely to be noticeable.

Viewpoint 11: Rhos

This viewpoint is representative of the view experienced by walkers and vehicles travelling to the caravan site at Rhos.

Existing View: The existing view shown in Volume 6, Figure 11 (Baseline), looks south west towards the ECOCAS Wind Farm on the road leading into Rhos. There are two hill slopes that draw down to the valley bottom where Rhos is located, with a gently rolling hill on the horizon. The landscape is primarily made up of large well defined fields with hedgerow boundaries whilst there are also parcels of woodland in the horizon and scattered around the foreground. There are some large barns at the end of the road leading into Rhos and some residential properties with pylons leading down along the road. To the right of the residential properties a caravan site can be viewed which runs further down the valley bottom.

Predicted View: The predicted view can be seen in Volume 6, Figure 11 (Photomontage).

Magnitude of Change: The magnitude of change at this viewpoint has been assessed as being high as there is substantial change to the view with the turbines being prominent on the horizon. A number of the turbines lie behind the ridge with only 5 of the turbines actually standing on or in front of the ridge. Although the magnitude of change is high the ECOCAS Wind Farm has been designed in such a way as to avoid placing turbines in the eastern part of the site in order to avoid creating too significant an impact on Rhos.

Viewpoint 12: B4389 - Belan-deg

This viewpoint is representative of the view experienced by vehicles travelling along the B4389 near Belan-deg.

Existing View: The existing view as shown in Volume 6, Figure 12 (Baseline), is of rolling hills with a patchwork of field boundaries and trees defining the boundaries. The Mynydd Clogau Wind Farm can be seen at the centre of the photograph, while the turbines of the Carno Wind Farm, which is visible in the wireframe, is hidden by low-lying clouds in Figure 12. The Llandinam and Bryn Titli Wind Farms are also visible from this viewpoint but are barely noticeable on the horizon due to the significant distance from the viewpoint.

Predicted View: The predicted view can be seen in Volume 6, Figure 12 (Photomontage).

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being low due to the limited amount of change to the view. As the existing Wind Farms of Mynydd Clogau and Carno lie on either side of the proposed ECOCAS Wind Farm they embrace the ECOCAS Wind Farm to form a single cluster rather than being spread across the whole of the horizon. Although all of the turbine hubs and tips are visible from this viewpoint the distance of the viewpoint from the Wind Farm (9.9 km) and the undulating hills in the background screen it from view.

Viewpoint 13: Offas Dyke – Kingswood

This viewpoint is representative of the view experienced by walkers on the Offas Dyke footpath.

Existing View: The existing view shown in Volume 6, Figure 13 (Baseline), is of long uninterrupted views out to the horizon with well defined field boundaries and clusters of woodland in the foreground. There are also clusters of woodland on the gently undulating hills on the horizon that create a patchwork effect. The village of Kingswood can be seen in the mid foreground on the left of the photograph.

Predicted View: During consultation with Ken Perry (CCW) it was agreed that only a wireframe from this viewpoint would be needed. This was due to the significant distance of the viewpoint from the Wind Farm.

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being negligible primarily due to the distance of the Wind Farm from the view point (24.2 km). The turbines are barely visible at this distance as they are screened by normal atmospheric conditions at the horizon. Even during periods of extremely good visibility the turbines would be barely noticeable from this viewpoint.

Viewpoint 14: A489 - East Newtown

This viewpoint is representative of the view experienced by vehicles on the A489 travelling east towards Newton.

Existing View: The existing view as shown in Volume 6, Figure 14 (Baseline), is of a grazed hill slope with large fields defined by hedgerows in the foreground. The horizon is primarily smooth with gently rolling hills in the mid-foreground. Parcels of woodland and settlements in the mid-foreground are scattered around the well defined field boundaries. From this viewpoint both the Carno and Mynydd Clogau Wind Farms are visible, although due to the atmospheric conditions at the horizon they are barely noticeable in this photograph. Some overhead lines can be seen from the viewpoint and after micro-siting of the viewpoint it was deemed unfeasible to take a photograph that did not capture these within it. This viewpoint was selected as the overhead lines caused the least amount of disturbance or distraction from the viewpoint.

Predicted View: The predicted view can be seen in Volume 6, Figure 14 (Photomontage).

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being low due to the small amount of change that will occur to the existing view. Due to the long distance from the viewpoint to the Wind Farm (14.8 km) the turbines are barely noticeable on the horizon as atmospheric conditions always have a screening effect. The ECOCAS turbines are located next to the existing Mynydd Clogau Wind Farm and therefore appear in this viewpoint to be an extension of this existing development rather than a separate entity. It should be noted that the good weather conditions prevailing at the time of this photograph are not typical of the weather normally experienced in this area.

Viewpoint 15: Kerry Hill

This viewpoint is representative of the view experienced by walkers on the Kerry Ridgeway near Kerry Hill.

Existing View: The existing view as shown in Volume 6, Figure 15 (Baseline), is of a smooth horizon with gently undulating hills in the mid-foreground. The Wind Farms of Carno, Cemmaes and Mynydd Clogau can also just be made out on the far horizon. There are patches of woodland parcels on the slopes and tops of the hills creating a patchwork effect. The fields are well defined with hedgerows dividing up the slopes with some settlements nestled within areas of woodland. The large open fields in the foreground of the photograph are primarily used for sheep grazing.

Predicted View: The predicted view can be seen in Volume 6, Figure 15 (Photomontage).

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being negligible as, although all 17 hubs of the turbines are visible, the long exposed views across the ridge make the turbines seem insignificant in comparison. As the viewpoint is 18 km from the ECOCAS Wind Farm they are barely noticeable due to the atmospheric conditions at this distance which screens the turbines from view.

Viewpoint 16: B4355 - Dolfor

This viewpoint is representative of the view experienced by vehicles on the B4355 travelling north towards Newtown.

Existing View: The existing view as shown in Volume 6, Figure 16 (Baseline), is of a smooth horizon with gently undulating hills in the mid-foreground. The Wind Farms of Carno, Cemmaes and Mynydd Clogau can also just be made out on the far horizon. There are patches of woodland parcels on the slopes and tops of the hills creating and the field patterns are well defined with hedgerows dividing up the slopes. The large open fields, in the foreground of the photograph, are primarily used for sheep grazing. To the right of the photograph the settlement of Newtown is visible and part of the Genau-Hafod farm is also visible on the left of the photograph.

Predicted View: The predicted view can be seen in Volume 6, Figure 16 (Photomontage).

Magnitude of Change: The magnitude of change for this viewpoint has been assessed as being negligible due to the distance of the viewpoint from the Wind Farm (14.4 km). Although all 17 of the turbine hubs are visible in this viewpoint they appear as small structures on the horizon that are barely visible. Due to the location of the ECOCAS Wind Farm in relation to the Mynydd Clogau Wind Farm the ECOCAS turbines also appear to be a cohesive extension to the existing development.

Viewpoint 17: Caersws

This viewpoint is representative of the view experienced by walkers on the Severn Way near Caersws.

Existing View: The existing view as shown in Volume 6, Figure 17 (Baseline), is of rugged hills in the horizon patterned with fields and parcels of woodland. There are also residential properties nestled in the woodland areas on the hill slopes. The foreground is primarily large open fields defined by hedgerows and is used for sheep grazing. In the distance, the valley where the A470 runs, is visible. To the left of the photograph a farm house is visible behind some trees.

Predicted View: The predicted view can be seen in Volume 6, Figure 17 (Photomontage).

Magnitude of Change: The magnitude of change has been assessed as being negligible for this viewpoint as only 3 of the turbine hubs are visible out of the 7 turbine tips that are visible. Due to the distance of the viewpoint from the ECOCAS turbines (7.6 km) and the rugged topography of the horizon the turbines are barely noticeable from this viewpoint.

Viewpoint	Viewpoint location	Distance from nearest turbine (km)	Sensitivity of receptors	Magnitude of change	Significance
1	Garreg Hir	0.8	High	High	Substantial
2	A470 - North Clatter	2.9	Moderate	Low	Slight
3	Glyndwr's Way – Newchapel	15.4	High	Negligible	Slight
4	Gellilefrith - Severn Way	12.5	High	Negligible	Slight
5	Bryn y Gadiar	5.5	Moderate	Low	Slight
6	A470 - Talerddig	5.5	Moderate	Low	Slight
7	North Lanbrynmair	11.7	Moderate		Slight-Neutral
8	Aran Fawddwy - Snowdonia National Park	25.8	High	Negligible	Slight
9	Pen Coed	8.4	Moderate	Low	Slight
10	B4395 - Penyfford Glyndwr's Way	13.4	Moderate	Low	Slight
11	Rhos	3.0	High	High	Substantial
12	B4389 - Belan-deg	9.9	Moderate	Low	Slight
13	Offas Dyke - Kingswood	24.2	High	Negligible	Slight
14	A489 - East Newtown	14.8	Moderate	low	Slight
15	Kerry Hill	18.0	High	Negligible	Slight
16	B4355 - Dolfor	14.4	Moderate	Negligible	Slight-Neutral
17	Caersws	7.6	High	Negligible	Slight

Table 13.9 Summary of the potential visual effects

13.8 Assessment

Only two of the viewpoints have been assessed as having a substantial significance, these are Viewpoint 1 at Garreg Hir and Viewpoint 11 at Rhos. All the other viewpoints have a slight to slight-neutral significance and are therefore assessed as not having an unacceptable level of change to the visual amenity. It should be noted that the photographs taken at Garreg Hir and

Rhos were taken on days when the visibility was untypically good, which has the effect of maximising the visual impact of the turbines at these viewpoints. It is clear from planning policies such as TAN 8 that the overriding concern has to be for the development of renewables to reach the targets as set by WAG. This must be the overriding consideration despite the visual changes that the Wind Farm will have on a small number of the viewpoints.

13.8.1 Footpaths and Cycle Routes

There are several long distance trails within the 30 km study area which are indicated in Volume 5, Figure 23. Within the 10 km study radius, closest to the ECOCAS site, there are only two long distance footpaths, Glyndwr's Way and the Severn Way, and one cycle route, Sustrans 8, that pass within the area. The other trails within the 30 km radius include the Ann Griffiths Walk, Kerry Ridgeway, Montgomery Canal Walk, Pererindod Melangell, Offa's Dyke Path and Sustrans 81. Viewpoints have been selected to encompass a number of these trails to determine whether there would be a significant impact on the views experienced along the trails. From the viewpoint assessments it was determined that due to the distances of the trails from the proposed ECOCAS development that they would not experience a significant effect on their visual amenity.

13.9 Cumulative Impact

13.9.1 Existing Wind Farms

An assessment of the cumulative change has been carried out on the existing wind farms that are already built, along with the proposed ECOCAS turbine. This has been done by an assessment of the wireframes and viewpoints (see Table 13.10) along with the ZTVs compiled for hub and tip heights (see Volume 5, Figures 24-27). For the existing wind farms, together with the ECOCAS Wind Farm, there are no viewpoints where there would be a high magnitude of cumulative change (see Table 13.10). Despite there being two viewpoints where there will be a substantial change from the ECOCAS Wind Farm on the landscape and visual amenity there will only be a negligible to low cumulative change as at these viewpoints only the

proposed ECOCAS Wind Farm would be visible. Viewpoint 8, where all the existing turbines are visible, has a low magnitude of cumulative change due to the distance of the viewpoint to the turbines which are barely visible on the horizon.

Viewpoint no.	**Existing Wind Farms**						**Magnitude of Cumulative Change**
	Cemmaes	**Carno A+B**	**P&L Llandinam**	**Bryn Titli**	**Cefn Croes**	**Mynydd Clogau**	
1	✓					✓	Low
2							Negligible
3		✓				✓	Low
4							Negligible
5						✓	Low
6							Negligible
7		✓	✓				Low
8	✓	✓	✓	✓	✓	✓	Low
9		✓					Low
10		✓					Low
11							Negligible
12		✓	✓	✓		✓	Low
13			✓		✓		Low
14		✓				✓	Low
15	✓	✓	✓			✓	Low
16	✓	✓				✓	Low
17							Negligible

Table 13.10 Magnitude of cumulative change for existing wind farms

Two separate ZTVs have been calculated for the hub height and tip height of the ECOCAS Wind Farm with the existing wind farms. In the ZTV of the ECOCAS Wind Farm and the existing wind farms at hub height (see Volume 5, Figure 24) the yellow band of colour indicates where the ECOCAS Wind Farm and other existing wind farms may be visible. The blue band indicates where one or more of the existing wind farms are visible whilst the orange band represents the areas where only the ECOCAS Wind Farm would be visible and therefore would not add to the cumulative impact. The orange band which is concentrated primarily within the 20 km radius band covers 5.9% of the ZTV and only 2.7% of the total area within the 30 km radius band. The ZTV of the existing wind farms together with the ECOCAS Wind Farm at tip height can be seen in Volume 5, Figure 25. The orange band which represents where the ECOCAS turbine tips are visible covers 4.6% of the total ZTV and only 2.3% of the total area within the 30 km radius. It is clear that the ECOCAS Wind Farm will not significantly add to the cumulative situation as only a very small percentage of the ZTV indicates where only the ECOCAS Wind Farm would be visible. It should also be noted that at distances of 10 km or more that the wind farm would only be visible during times of very good visibility. The ZTV indicates the worst case scenario and does not take into account the screening effect of for example, woodland areas or the effects of atmospheric conditions.

The location of the ECOCAS Wind Farm has been designed to avoid any negative cumulative impacts with the existing wind farms and the assessment confirms this.

13.9.2 Proposed and Submitted Wind Farms

At the time of writing the following wind farms were in the planning system (see Table 13.11). They have been assessed primarily by the ZTV analysis as creating wireframes for all of the proposed and submitted turbines with the existing wind farms would be overly complex and would not provide a clearer impression of the cumulative effects than that given by the ZTV.

Viewpoint no.	Proposed & Submitted Wind Farms										
	Carnedd Wen	Llanbadarn Fynydd	Llanbrynmair	Llandinam	Mynydd Waun Fawr	Mynydd Clogau II	Cemmaes	Waun Garno	Garreg Lwyd	Tirgwynt	Fferm Wynt Llaithuddu
1	✓		✓		✓	✓	✓			✓	
2										✓	
3	✓		✓	✓		✓		✓		✓	
4						✓		✓		✓	
5	✓		✓		✓	✓		✓		✓	
6										✓	
7	✓	✓	✓	✓	✓	✓			✓	✓	
8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9			✓		✓					✓	
10	✓		✓		✓					✓	
11						✓				✓	
12	✓			✓	✓	✓				✓	
13				✓	✓	✓		✓		✓	
14	✓				✓	✓		✓		✓	
15	✓		✓	✓	✓	✓		✓		✓	
16	✓				✓	✓		✓		✓	
17	✓		✓			✓		✓		✓	

Table 13.11 Cumulative assessment of proposed and submitted wind farms

The Tirgwynt Wind Farm is visible from all of the viewpoints as this development is proposed on the northern part of the Esgair Cwmowen ridge and sweeps up to the north. It is clear from the visual analysis that there are areas of fixed viewpoint inter-visibility as at some viewpoints all of the wind farms are likely to be visible. However, these viewpoints are at long distances and therefore the turbines would only be seen during times of very good visibility.

The potential for sequential visibility is low due to the topography of the region as the hills hide the views of the Wind Farm as you move away from the receptors. The main transportation routes across the landscape are confined to the valley floors where views are restricted by the topography and therefore these routes are unlikely to experience large amounts of sequential visibility. Where there is potential for sequential visibility is at large distances away from the wind farms and at these distances the turbines are generally unnoticeable on the horizon.

The cumulative impact of the ECOCAS Wind Farm is also assessed in the ZTVs. The ZTVs for the planned and proposed turbines together with the ECOCAS development can be seen in Volume 5, Figures 26 & 27. The blue colour bands indicate where one or more of the existing wind farms are visible whilst the yellow band indicates where the proposed wind farms and part of the proposed ECOCAS Wind Farm would be visible. The orange band, which is concentrated in four main areas within the 20 km radius, indicates those locations where only the ECOCAS Wind Farm would be visible. Within the total area of the ZTV the ECOCAS Wind Farm accounts for an added visibility of 0.16% for hub heights and 0.18% for tip height of the turbines. It is clear that the ECOCAS Wind Farm would not add a significant amount of visible areas, should all the proposed wind farms be approved.

13.10 Predicted Landscape and Visual Effects

13.10.1 Construction Effects

The main effects during the construction phase will be restricted to within the main site boundary. During this period, short-term negative landscape and visual impacts are likely to occur, through the removal of ground cover and vegetation although this will be minimal, as the site layout has been set out to be as compact as possible. All activities on-site during

construction will be carefully monitored to ensure that no unacceptable impacts occur. The overall impact during construction on the landscape and visual amenity is medium although there will be a high local impact during the main construction works due to the cranes and lorries on-site that will be visible from some receptors. It is emphasised that the construction effects are for short periods, particularly the visual impact of cranes during the lifting of wind turbine components which is expected to take some four months to complete in two phases (see Section 4.1.1).

13.10.2 Operational Effects

The predicted effects of the proposed ECOCAS Wind Farm on the landscape character and visual amenity have been assessed using ZTVs, visual assessments and landscape assessments in the field. The greatest effects of the ECOCAS Wind Farm on the landscape character will be contained to the areas adjacent to the site and the effects will diminish as you move away from the site as the topography and landscape elements will reduce the effects of the ECOCAS Wind Farm on the landscape character. The receptors closest to the site will experience a greater magnitude of change as the turbines will be more prominent. However, the Wind Farm has been shown not to be visible throughout large areas of the study area as the Wind Farm is screened by areas of woodland and the undulating topography. The effects of the ECOCAS Wind Farm on the visual amenity will occur due to the visibility of the turbines themselves and this has been assessed through the ZTV analysis.

13.10.3 Decommissioning Effects

The impacts on the landscape and views of the site and surrounding area during the decommissioning phase will be similar to the construction phase. However, it is likely that the magnitude of the change will be slightly reduced due to the shorter duration of works and the restoration of the land back to its previous state. Once the decommissioning activities have been completed the landscape and views will return to a state similar to the conditions that currently exist on the proposed site.

13.11 Conclusion

The landscape and visual assessment details the ECOCAS Wind Farm's impact on the visual amenity and landscape of the surrounding area. Although there will be some impacts on the landscape and visual amenity the overriding consideration must be to strive to achieve the targets set by WAG in order to reduce the effects of climate change. In balancing the landscape of the ECOCAS Wind Farm against the need to identify suitable locations for renewable energy development, as set out in TAN 8, the ECOCAS Wind Farm is an acceptable development in terms of its effect on landscape character. It is clear from the assessments that the layout and design of the ECOCAS Wind Farm has been considered carefully so as to minimise any impact on the surrounding landscape. The site has been designed to be compact in order to avoid it appearing as a sprawling mass of turbines. In addition, the majority of turbines have been positioned so that they do not sit high on the ridge line of Esgair Cwmowen where they would be more visible but at the same time accessing the wind resource to maximum effect.

The cumulative effects of the ECOCAS Wind Farm along with the built and proposed wind farms are deemed to be insignificant as the addition of the ECOCAS Wind Farm will not have an unacceptable level of impact on the visual amenity.

14 Archaeology and Cultural Heritage

14.1 Introduction

This section of the Environmental Statement (ES) reports on the assessment of the possible effects that the proposed ECOCAS Wind Farm Development may have on the cultural heritage of the Site and the surrounding area. A comprehensive Report ('Base Report') is included at Volume 4, Appendix 9 together with two Addenda to the Base Report dealing with 'Visual Impact on Wider Historic Landscape', Addendum A, shown at Volume 4, Appendix 9A and 'Assessment of Significance of Impact of Development on Historic Landscapes (ASIDOHL2)', Addendum B, shown at Volume 4, Appendix 9B. The Report and Addenda were commissioned from Cambrian Archaeological Projects Limited (CAP) by Independent Power Systems Ltd, on behalf of the project sponsors.

14.2 Scope of Assessments and Reports

A substantial part of the Base Report is included below, as to do otherwise would require paraphrasing of its content and this may result in confusion between the intention of the original Base Report and any substantially truncated version. However, where repetition appears evident or clarification has been regarded as necessary, this has been taken into account. Therefore, the following text has endeavoured to include the key points and, where necessary, makes reference to the text, diagrams, photographs and analyses which are contained in full in the Base Report and the Addenda. It is emphasised that all 'Table', 'Figure' and 'Plate' references, together with their respective numberings, refer to the Base Report or Addenda unless it is indicated as referring to a specific Table or Figure within this text, which will always bear the prefix 14, which is this ES Chapter.

It is appropriate, in relation to this section of the ES, to relate the timescale of the ECOCAS wind turbine proposals to those associated with the cultural heritage addressed here. The planned development has a proposed life of 25 years, after which the Planning Authority can require the decommissioning, removal of all equipment and reinstatement of the Site to its previous state. As identified in the Report and Addenda, the Bronze Age is well represented on the Sponsors' land, which has been actively farmed for centuries, whereas the proposed

development can be regarded as a temporary interval when compared with the usage of the land over thousands of years.

The Sponsors have, over decades of occupation of their land, acted responsibly in regard to the protection of Welsh Cultural Heritage. This is discussed further in the ES, particularly Mr Watkins' actions in placing on permanent loan artefacts discovered on his land for exhibition at the Powysland Museum in Welshpool. Some of these artefacts are shown in the photograph below.

Also, promises have been made to Clwyd Powys Archaeological Trust that the Sponsors will seek to protect their land from exploitation or damage to archaeological remains. It is against this background that the Sponsors will seek to collaborate regarding any possible disturbance of archaeological features and to facilitate a 'watching brief' on archaeological matters during the construction phase of the project. Further, they accept the courses of action that may be necessary to meet any requirements identified.

The Archaeological Specification is shown at Appendix 1 to the Base Report which incorporates the method statement and scope as agreed in consultation with CPAT, CCW and Cadw, the details of which are included in Section 14.3.

The assessments undertaken by CAP, in order to produce the Base Report and Addenda, consisted of four elements:

1. a desk based assessment;
2. a comprehensive field walkover survey;
3. a Historic Landscape and Visual Assessment (HLVA); and
4. ASIDOHL2 assessment.

The Base Report covers the desk based assessment and field walkover section of the study (items 1 and 2 above). Addendum A covers the HLVA study (item 3 above) and Addendum B the ASODOHL2 assessment (item 4 above).

The desk based assessment appraised the documentary, photographic and cartographic evidence pertaining to the site and its immediate environs. The field walkover assessed all sites recorded by the HER located within, and 500 m beyond, the assessment boundary. The Historic Landscape Visual Assessment focused on the likely impact of the development proposal on the setting of scheduled ancient monuments and listed buildings within a 10 km radius of the Site. The ASIDOHL2 assessment (The Assessment of the Significance of Impacts of Development on Historic Landscapes) was carried out to a radius of 15 km from the edge of the development area boundary.

14.3 Consultation

During the preparation of the scope of work and the preparation of assessment methodologies, the following people and organisations were consulted; Mr Mark Walters of Clwyd Powys Archaeological Trust, Richard Kelly of Countryside Council for Wales (CCW) and Judith Alfrey of Cadw. Also, the interface between the proposed elements of the project development and the cultural heritage of the Site and its surroundings, were discussed with all who had technical input to the project, for example, design of the site access routes by Entec, turbine locations and infrastructure developed using Garrad Hassan Windfarmer computer software, with identification of exclusion zones, in order to minimise impingement on the cultural heritage of the Site.

In addition, consultation included a site 'walk-over' on the 20th January 2009 which was attended by Kayna Tregay, Nichola Tomlinson and Paul Williams from the EA, Ken Perry from CCW, Steve Packer from PCC, accompanied by IPS staff, and the landowners/sponsors

Messrs Watkins and Jones. The site visit also gave the statutory bodies the opportunity to gain a greater understanding and feel of the Site whilst concentrating on some site specific areas, for example a view of ancient cairns and their relationship to the proposed access routes, wind turbine locations and infrastructure layout.

14.4 Base Report

14.4.1 Geology and Topography

The topography of the proposed development area is largely hilly undulating uplands with steep slopes in places, mainly in the southern and western parts of the development area. Owing to the upland nature of the development area no areas of woodland are present. Immediately outside the development boundary but within the 10 km search boundary areas of managed forestry are located to the north west and the south west. The assessment area is located on a hilly range to the east of, and overlooking, the Clwyd Valley. The Afon Carno flows to the south west of the development area whilst the smaller Nant Llyn Mawr flows to the east. The upland nature of the development area means that settlement in the area is restricted to small nucleated farmsteads whilst in the lowland areas to the south and west settlement in the form of larger villages (Clatter, Carno and Talerddig) is in evidence.

The area of the proposed development is located on the boundary between two distinct types of underlying solid geology. The western half of the development area is composed of a sedimentary Llandovery formation of slate/mudstone/siltstone of Silurian age. The eastern half of the development area is composed of a mixture of sedimentary Ludlow and Wenlock formations of slate/mudstone/siltstone also of Silurian age (British Geological Survey, 1979).

The underlying solid geology is overlain in the development area by two distinct soil deposits. The western half of the development area is predominantly composed of Manod – a well drained fine loamy or fine silty soil over rock. Shallow soils are evident in places with bare rock occasionally exposed. The eastern half of the development area is predominantly overlain by Cegin – a slowly permeable seasonally waterlogged fine silty clay and clayey soils. Some fine silty and fine loamy soils with slowly permeable subsoils and slight seasonal

waterlogging on slopes are evident. Well drained fine loamy soils over rock in places (Soil Survey of England & Wales, 1983).

14.4.2 Archaeological and Historical Background

Below is a brief description of the archaeological and historical background to the area of the proposed development. The full assessment of the archaeological and historical background is contained within the desk based assessment section below. The following is an extract from Samuel Lewis' 1833 Topographic Dictionary of Wales concerning the parish of Carno:

CARNO, a parish in the lower division of the hundred of LLANIDLOES, county of MONTGOMERY, NORTH WALES, 11 miles (W. N. W.) from Newtown, contains 1010 inhabitants. In 948, a battle was fought here for the sovereignty of North Wales, between Ievav and Iago, the sons of Edwal Voel, and those of Hywel Dda, late king of all Wales, which terminated in favour of the former. And in 1077, or, according to some, in 1082, an eminence called Mynydd Carn, from a large carnedd upon it, commemorative of some distinguished warrior of a still more remote period, was the scene of one of the most sanguinary battles ever fought in the principality, between Grufydd ab Cynan, rightful sovereign of North Wales, aided by Rhys ab Tewdwr, Prince of South Wales, and Trahaern ab Caradoc, who then usurped the throne, in which the latter was defeated and slain, after a sharp and obstinate conflict, with the flower of his army, and Grufydd succeeded to the throne, which he filled for fifty-seven years, and died in 1137: his biography is preserved in the Welsh Archaeology, from which he appears to have been distinguished by strong and decisive powers of mind. The scene of this battle is by some fixed at Carno in Brecknockshire, but the event may possibly be confounded with an engagement that took place there, in 728, between Rhodri Molwynog, and Ethelbald King of Mercia.

'The village is situated on the road from Newtown to Machynlleth: there is a turbary in the parish, where peat is obtained for the consumption of the adjoining district. The hills command fine views of the vale of Carno and the surrounding eminences. The living is a perpetual curacy, endowed with £800 royal bounty, and £200 parliamentary grant, and in the peculiar jurisdiction and patronage of the Bishop of Bangor. The church, dedicated to St. John the Baptist, is an unadorned stone edifice, rebuilt in 1807: it formerly belonged to the knights of St. John of Jerusalem, who are said to have had a house near it. There are

places of worship for Baptists, Independents, and Calvinistic and Wesleyan Methodists. The poor are maintained by an average annual expenditure amounting to £725.11.

DERWLWYN, a township in the parish of CARNO, lower division of the hundred of LLANIDLOES, county of MONTGOMERY, NORTH WALES, 12 miles (W. N. W.) from Newtown. The population is returned with the parish, but in 1821 it was included in the return for the township of Trawscoed. The names of these townships denote that they formerly abounded with wood, though little of that article is observable at present, they being for the most part rugged and mountainous.

LLYSIN, a township in the parish of CARNO, lower division of the hundred of LLANIDLOES, county of MONTGOMERY, NORTH WALES, 10 miles (N. W. by W.) from Newtown. The population is returned with the parish. The waste lands of this place, as well as many others in the contiguous parishes, were enclosed and allotted under an act of parliament, obtained in 1816, commonly called 'The Arustley Enclosure Act.'

14.5 Archaeological Desk Based Assessment

The main scope and objectives of the archaeological desk based assessment were to reveal by desk based study, the nature, significance and, where possible, the chronology of the archaeology within the area of the proposed development. The purpose of the desk based assessment, in accordance with standards and guidance as laid down by the Institute for Archaeologists, is to gain information about the known or potential archaeological resource within the given area (including presence or absence, character and extent, date, integrity, state of preservation and relative quality of the potential archaeological resource), in order to make an assessment of its merit in context, leading to one or more of the following:

- The formulation of a strategy to ensure the recording, preservation or management of the resource.
- The formulation of a strategy for further investigation, whether or not intrusive, where the character and value of the resource is not sufficiently defined to permit a mitigation strategy or other response to be devised.
- The formulation of a proposal for further archaeological investigation within a programme of research.

14.5.1 Field Survey

With regards to the field survey the main objective in accordance with the standards and guidance laid down by the Institute for Archaeologists is to gain information about the archaeological resource within a given area or site (including presence or absence, character, extent, date, integrity, state of preservation and quality), in order to make an assessment of its merit in the appropriate context, leading to one or more of the following:

- The formulation of a strategy to ensure the recording, preservation or management of the resource.
- The formulation of a strategy to mitigate a threat to the archaeological resource.
- The formulation of a proposal for further archaeological investigation within a programme of research.

The field study aimed to examine on the ground the land designated for the proposed Wind Farm, and 500 m beyond its boundary, and isolate and record any archaeology and historic landscape features that survive within it.

14.5.2 Methodology

For the purposes of the archaeological desk based study the following repositories were visited/consulted:

- Regional Historic Environment Record, Welshpool
- Portable Antiquities Scheme (Powys)
- National Library, Aberystwyth
- RCAHMW, Aberystwyth

At these repositories the following sources were consulted:

- All Ordnance Survey Maps
- Tithe Enclosure Award and Parish Maps
- Estate Maps
- Historical documents pertaining to the site

- Archaeological books and journals
- Unpublished reports
- Aerial photographs

At the Clwyd Powys Historic Environment Record a search of all sites recorded in the HER as being located either within or up to 500 m from the edge of the proposed development area was undertaken. This was then supplemented with a similar search of data held by the Archaeology Data Service.

For purposes of the field study once all cartographic and archaeological records had been consulted and all relevant material identified, the proposed development area was subject to a comprehensive field walkover. A finds sampling strategy was in place during the field study should any surface scatters of pottery shards or other potential finds warrant it. Any finds or new archaeological sites made whilst conducting the walkover had their locations recorded on a hand held GPS system.

For a summary of the impact assessment, two Tables have been prepared; Appendix 1 lists all known sites of cultural heritage interest within the development site boundary and 500 m beyond. Alongside each entry is a summary of the direct physical effect components outlined below; Appendix 2 lists all known sites of cultural heritage interest within the development Site boundary and 500 m beyond. Alongside each entry is a summary of the indirect impact on setting caused by the development. The methodology for completing the two assessment processes is described below.

14.5.3 Assessment of Direct, Physical Effects

The system employed to evaluate the cultural value and direct effects of the proposed development on the archaeological resource is based on the site significance value scale as set out in the Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, part 2 HA 208/07) (Ref. 10-5).

The value of all the known and potential assets that may be affected by the Development should be ranked, whether they are archaeological remains, historic buildings or historic landscapes. The value of each asset has been ranked according to the following scale:

Very High - World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives;

High - Scheduled Monuments (including proposed sites). Undesignated assets of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives;

Medium - Designated or undesignated assets that contribute to regional research objectives;

Low - Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives;

Negligible - Assets with very little or no surviving archaeological interest; or

Unknown - The importance of the resource has not been ascertained.

The following list provides an indication as to the predicted effect the development will have on individual archaeological features. Potential impacts, direct and indirect, have been assessed in terms of their longevity, reversibility and nature (beneficial /neutral /adverse):

- **Permanent impacts** are those that persist beyond the predicted operational lifetime of the development. All direct impacts are considered to be permanent;
- **Temporary impacts** arise as a result of the presence of elements of the development but which would be removed by the dismantlement of those elements. Temporary impacts can be short-term (e.g. construction phase impacts); or long-term (arising from the long-term presence of the development affecting the setting of a receptor);
- **Reversible impacts** are those that are removed by the decommissioning / dismantling of the development;
- **Beneficial impacts** are those that contribute to the value of a receptor through enhancement of desirable characteristics or the introduction of new, positive attributes. In terms of cultural heritage, beneficial impacts include those that add to an appreciation of the receptor and/or its setting;

- **Neutral impacts** occur where the development can be accommodated comfortably by the receptor while neither contributing to nor detracting from the value of the receptor; and
- **Adverse impacts** are those that detract from the value of a receptor through a reduction in, or disruption of, valuable characterising components or patterns, or the introduction of new inappropriate characteristics. In terms of cultural heritage, adverse impacts include those that detract from an appreciation of the receptor and/or its setting, or compromise views to or from the receptor.

The magnitude of the effect needs to be viewed in conjunction with the value of the monument, in order to appreciate the overall significance of any effect on a given archaeological feature. The magnitude of the effect (degree of change) can also be negative or positive, and should be ranked without regard to the value of the asset. The total destruction of a Low Value asset will have the same magnitude of impact on the asset as the total destruction of a High Value asset; the value of the asset is factored in when the significance of the effect is assessed.

The magnitude of impact was ranked according to the following scale:

Major: Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting;

Moderate: Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset;

Minor: Changes to key archaeological materials, such that the asset is slightly altered. Slight changes to setting;

Negligible: Very minor changes to archaeological materials, or setting; or

No Change: No change

Assessing the significance of the effects of the scheme brings together the value of the resource and the magnitude of the impact for each cultural heritage asset, using the matrix

illustrated in the Table 14.1 below. The adverse or beneficial significance of effect has been expressed according to the following scale: Major; Moderate; Minor; or Negligible. For the purpose of satisfying the EIA regulations, those effects that are rated as 'moderate', 'moderate/minor' or 'major' or 'major/moderate' based on Table 10-1, are considered to be 'significant'.

		Magnitude of Effect				
		No Change	Negligible	Minor	Moderate	Major
Value	Very High	Negligible	Minor	Moderate /Major	Major	Major
	High	Negligible	Minor	Moderate /Minor	Moderate /Major	Major
	Medium	Negligible	Negligible /Minor	Minor	Moderate	Moderate /Major
	Low	Negligible	Negligible /Minor	Negligible /Minor	Minor	Moderate /Minor
	Negligible	Negligible	Negligible	Negligible /Minor	Negligible /Minor	Minor

Table 14.1 Matrix of Significance Criteria

14.5.4 Assessment of Indirect Effects on the Setting of Cultural Heritage Features – Policies and Guidance

There are no established definitive criteria or methodologies for assessing the setting of listed buildings or scheduled monuments, a concept that was introduced by the Planning (Listed Buildings and Conservation Areas) Act 1990. The requirement to assess the potential effects of a development on the setting of designated heritage features, such as scheduled monuments, conservation areas and listed buildings, is outlined in the Department of the Environment's Planning Policy Guidance 15, 1994, Planning and the Historic Environment (2:16 – 2:17).

The following assessment has been undertaken using the guidance provided by English Heritage's document Wind Energy and the Historic Environment (page 8: setting and visual amenity), Historic Scotland's Scoping of Wind Farm Proposals Assessment of Impact on the

Setting of Historic Environment Resources: General Considerations and published articles (Black 2006; Collcutt 1999; Lambrick & Hind 2005; Masser 2006).

The guidance to settings for listed buildings given in PPG15 (2.16) refers to this concept as *"…an essential part of the building's character, especially if a garden or grounds have been laid out to compliment its design or function*." The aim in assessing the setting is to prevent listed buildings becoming isolated from their surroundings. The guidance further clarifies the concept by the statement (2.17) *"… the setting of a building may be limited to obviously ancillary land, but may often include land some distance from it."* . The character of a listed building is described as deriving partly from *"the harmony produced by a particular grouping of buildings"* and that *"setting can only be defined through a historical assessment of a building's surroundings"*. With specific regard to developments of high structures PPG15 (2:17) notes that this *"might affect the setting of a listed building from some distance away, or alter views of a historic skyline".*

No specific distance is mentioned, because the local topography, vegetation and built environment will have a direct influence on the potential effects of a development on the setting of the site. It is clear from the guidance, however, that the principal aim of the assessment is to preserve the integrity of the site as a historic and/or architectural asset within surroundings that historically enhance it. A country house and its parkland, therefore, has a wider landscape setting than a farmhouse which is focused on the enclave formed by the ancillary buildings (barns, farmyard etc). It is also clear from this guidance that an effective assessment can only be made with the benefit of a site visit to understand the site in its setting.

English Heritage's guidance on Wind Energy and the Historic Environment acknowledges that *"change within the setting of historic sites may often be acceptable"* and lists six factors to assess to help in determining whether *"in certain instances development will be considered inappropriate"*. These six factors are:

- visual dominance;
- scale;
- inter-visibility;
- vistas & sight-lines;
- movement (sound & light effects); and

- unaltered settings.

Historic Scotland's guidance adds further factors including;

- importance of topographic location;
- relevance of present and past land use;
- group setting and relationship to other historic features;
- views to and from the site and how this affects the perception or experience of the site and its setting for recreational or educational benefit; and
- its local diversity and distinctiveness.

Landscapes and land use often change over time, and thus an assessment of the setting of a designated site within the wider landscape requires a balance to be achieved between the concept of its original historic setting and its development as part of the modern day landscape.

The assessment methodology is split into two parts: firstly the listing/schedule description for each cultural asset was studied to understand the particular attributes that have led to its designation as a protected feature; secondly the sites were visited and assessed within their settings to establish their relationship to the proposed Wind Farm.

The study has considered the physical attributes of each site and its setting in terms of topography, its original economic function and natural resources, historic resonance with land-use, connections and communications with neighbouring features of the historic landscape and inter-visibility between them, as well as cultural associations and issues of public perception. The assessment has also examined what peripheral effect turbine structures and rotating blades would have on the historic views from each site, and on public appreciation of them as features of special historic and architectural interest.

In order to strike a balance with the DMRB's Magnitude of Effects ranking, the same terms, *Major, Moderate, Minor and Negligible* have been used to assess the degree or magnitude of change to all sites within the study area and all high value sites within the historic landscape in the wider setting. Inevitably the magnitude of the in-direct effect is predominantly

governed by the distance of an element or elements of the proposed development from the cultural asset being assessed.

14.5.5 The Desk-Based Assessment – HER Search Data

A search of the HER returned a total of 95 entries. All sites and buildings of archaeological/historical significance, as well as their locations, recorded within the proposed development area and up to 500 m from the boundary are shown on Figure 3 and the physical impact Table (Appendix 2).

14.5.5.1 Palaeolithic

No recorded Palaeolithic finds or activity could be found for this area.

14.5.5.2 Mesolithic

No recorded Mesolithic finds or activity could be found for this area.

14.5.5.3 Neolithic

No recorded Neolithic finds or activity could be found for this area.

14.5.5.4 Bronze Age

The HER records a total of 35 entries for Bronze Age sites within, and 500m beyond, the boundaries of the development area. Details of these HER records are shown in Appendix 4.

14.5.5.5 Iron Age

No recorded Iron Age finds or activity could be found for this area.

14.5.5.6 Romano-British period

No recorded Romano-British period finds or activity could be found for this area.

14.5.5.7 Post Roman/Early Medieval period

No recorded Post Roman/Early Medieval period finds or activity could be found for this area.

14.5.5.8 Medieval

The HER records a total of eight entries for Medieval sites within, and 500 m beyond, the boundaries of the development area. Details of these HER records are shown in Appendix 4.

14.5.5.9 Post Medieval

The HER records a total of 46 entries for Post Medieval sites within, and 500 m beyond, the boundaries of the development area. Details of these HER records are shown in Appendix 4.

14.5.5.10 Modern

No recorded Modern finds or activity could be found for this area.

14.5.5.11 Undated/Uncertain

The HER records a total of five entries for Undated/Uncertain sites within, and 500 m beyond, the boundaries of the development area. Details of these HER records are shown in Appendix 4.

14.5.6 Map Regression

As the area of proposed development is spread over a reasonably large locale the map regression section will discuss three distinct parts separately. The first part is the north western quadrant of the development area with Carneddau located at its centre. The second is the smaller area located to the south of the first area and north of Garreg Hir. The third and largest area is that to the east of areas one and two which encompasses Y Glonc and half of Esgair Cwmowen.

The 1809-36 2 Inch OS Surveyors Drawings (Figure 5) shows the development area although not in as much detail as later OS maps. The farmstead at Carneddau and a surrounding semi concentric field system is shown in small detail. The farmstead at Y Glonc

as well as a nearby sheep 'pound' is also marked. No further detail is discernible at such a small scale.

The development area falls within three parishes. The parish tithe maps of Carno, Llanwenog and Manafon all date to c.1840 and were all consulted. As the majority of the development area is uninhabited upland the tithe maps do not show a great deal of detail as regards field boundaries etc. Owing to both the poor state of preservation of the maps and poor copy quality they are not reproduced within the report.

The Manafon Tithe shows the eastern half of the development area. The farmstead of Y Glonc is shown as a single structure surrounded by a small irregular field system. Boundary stones marking the edge of the parish are also shown as being present. No other details of significance are discernible within the development area.

The Llanwenog Tithe map shows the smallest section of the development area located to the north of Garreg Hir. A structure is shown in this area, most likely a small farmstead. No other features apart from paths/trackways are evident.

The Carno Tithe map covers the north western quadrant of the development area. This area is again relatively sparse of features aside from field boundaries forming a semi concentric system around the central Carneddau farmstead. The farmstead at Carneddau is shown although the number of structures is difficult to interpret. No further features were identifiable.

The 1891 1st Edition 6 Inch OS Map (Figure 6) shows the development area in very clear detail. The north western quadrant with Carneddau farmstead at its centre is shown as are the field boundaries mentioned earlier. The farmstead is, by this point, seemingly made up of two to three structures. A well is also marked as being reasonably close to the farmstead. An apparent boundary or standing stone is marked to the north as is a triangulation point.

The smallest section of the development area, north of Garreg Hir, is also shown in very clear detail. The majority of the area is shown as being either blank fields or featureless upland although a farmstead named Lledgwm is marked at almost the extreme southern tip.

The eastern section of the development area is also shown in very clear detail and appears as a large expanse of open upland with very few features. The farmstead of Y Glonc,

apparently a single structure, is marked as is a nearby sheepfold. No other features are shown within this whole area.

The 1903 2nd Edition 6 Inch OS Map (Figure 7) shows largely the same detail as that seen on the first edition with very few changes within the proposed area of development. The details contained within the map are shown in slightly better clarity although remain largely the same as shown in 1897. The only significant changes noted were as follows:

One of the buildings at Carneddau is by this point shown as being unroofed.

One of the buildings at Lledgwm is by this point shown as being unroofed.

The sheepfold near Y Glonc Farmstead is marked only as an un-named enclosure on this map perhaps suggesting disuse.

The 1948 Provisional Edition OS map (Figure 8) shows only the southern and north western sections of the development area. Coverage of the eastern half of the development area for the 1948 OS could not be located at any of the repositories visited. Shown in the southern section is the farmstead of Lledgwm now labelled as being in ruins. The farmstead at Carneddau is still shown as are its surrounding features. The farm does not appear ruinous although one of the two structures is shown as being unroofed.

The 2008 Ordnance Survey map (Figure 1) shows the landscape of the assessment area as it appears today. It appears largely unchanged from that seen on the 1st edition 1897 OS map as much of the area is still shown as being open upland. The farmsteads at Carneddau and Y Glonc are still marked whilst Lledgwm has now disappeared completely. The main difference between this newer map and those discussed previously is that antiquities are shown. Several areas marked Cairn are now visible, a stone row is marked to the south of the development area whilst a stone circle is marked to the north.

14.5.7 Aerial Photographs

The area is reasonably well covered by aerial photography and various photographs were consulted during the course of the desk top assessment. The majority of the aerial photographs consulted were not of any particular use as given the open upland nature of most of the assessment area locating landmarks to tie in locations was not always possible. A list of the aerial photographs consulted is contained within the bibliography section of the report.

14.5.8 Portable Antiquities Scheme

The Portable Antiquities Scheme database was consulted in order that any recent finds from the assessment area be included in this study. The database search returned no finds from the assessment area.

14.5.9 The Field Walkover

As the area of proposed development is spread over a reasonably large locale the field walkover section will discuss three distinct parts separately. The first part is the north western quadrant of the development area with Carneddau located at its centre. The second is the smaller area located to the south of the first area and north of Garreg Hir. The third and largest area is that to the west of areas one and two which encompasses Y Glonc and half of Esgair Cwmowen. Figure 9 in the Report shows the locations of all the features recorded during the walkover.

The whole of the survey area, including all proposed turbine and track locations, was walked as well as up to 500 m beyond its boundary. It should be noted that all 'Plate' reference numbers shown relate to the Base Report.

Area 1. Contained within Area 1 are the proposed locations of turbines 1-8. The walkover of Area 1 found no obvious extant archaeological remains at the proposed locations of turbines 1 to 8. HER data spots within this area contain a mix of prehistoric and post medieval features. The prehistoric features are predominantly made up of cairns such as PRNs 6312 and 6313. The post medieval features are made up of a mixture of peat stands, peat mounds, structures such as farmsteads and field boundaries. Carneddau farmstead (PRN 6317) (Plate 1) is located at the centre of Area 1. The name Carneddau is suggestive of cairns being in the area and this can be seen in the large number of mounds (natural knolls, clearance cairns and burial mounds) in the surrounding area (Plates 2 & 3). The semi concentric arrangement of field boundaries around Carneddau is also clearly visible on the ground (Plate 4). Carneddau Cairn I (PRN 6313) (Plate 5) and Carneddau Cairn II (PRN 6312) (Plate 6) have both been excavated in the past and shown to be prehistoric. A further feature, possibly a cairn (Plate 7), was noted on the walkover some 60 m to the north east of PRN 6312. The feature appears as a large round mound with a flat top. It measures approximately 20 m in diameter and appears to be composed of turf covering a

collection of smaller stones. The feature also appears to have a linear relationship with PRNs 6312 and 6313 as shown on plate 8. Approximately 40 m further to the north east of the 'cairn' feature a single piece of struck flint was recovered. The only other new find made during the walkover of Area 1 was a relatively modern quarry. Whilst the quarry is of little archaeological interest the possible cairn may be affected by the development proposals.

Area 2. Contained within Area 2 are the proposed locations of turbines 9-10. The walkover of Area 2 found no obvious extant archaeological remains at the proposed locations of turbines 9 and 10. HER data spots within this area include various prehistoric elements such as round houses, cairns and a stone row (plates 9 - 12). None of these features seem likely to be directly physically impacted upon by the development process. The walkover has also produced a further three sites previously unrecorded by the HER. The first is a possible structure located at SN 9081 8327. This may be the stone remains of a ford over a small stream. The second feature is the earthwork remains of two tracks located at SN 9390 8384. The two tracks both appear to start at this location with one running uphill away from the current road and one running downhill away from the current road. Both of these tracks appear to be marked on the 1st Edition OS map but have since gone out of use. The third feature is a reasonably large quarry site located at SN 9866 8261. A further feature located just to the north west of area 2 was a small hillside terrace at SN 8728 8822. This small terrace did not appear large enough to represent a house platform but did appear anthropogenic nonetheless. This appears reasonably modern but is no longer in use. All of the newly located features are of little value and so will not be overly affected by the development proposals.

Area 3. Contained within Area 3 are the proposed locations of turbines 11-17. The walkover of area 3 encompasses Y Glonc, Esgair Cwmowen and Mynydd Dwyriw. At the proposed locations of turbines 11–17 no visibly extant archaeological remains were present. Whilst no turbine locations appear to physically impact on archaeological remains the proposed access tracks to turbines 11 and 14 may impact on the following PRNs: 19092 – Llanllugan stone circle, 4798 – Glonc Kerb Cairn, 4886 – Plas Newydd Hut. The walkover successfully located PRN 4886 and found it to be located so as to possibly be impacted upon during track construction. PRN 19092 and PRN 4798 are both described as a circular setting of ten stones and, given the close nature of their respective grid references, are likely to in fact be the same feature. Although an excavation of 4798 took place in 1983 no trace of

this feature could be located on the ground. PRN 91, the Y Capel stone circle (Plate 13), is also located within Area 3. The walkover also located a further six features previously unrecorded by the HER. At the far north of the area covered in the walkover several clearance cairns were evident. As these were outside of the 500 m buffer zone a single generic GPS spot was recorded to represent the centre of a scattered group of features. This is SO 0255 0875. A sheepfold (Plate 14) on the north bank of a small stream to the north west of Camlas farmstead was also recorded at SO 0295 0434. This is seemingly marked on the 1st Edition OS map but has now had its northern wall robbed away so as to create a passing point on a further stream to the north. A quarry was recorded at SO 0051 9852 just to the south east of PRN 6528 – an apparent Bronze Age stone setting. This site could not be located on the ground with the only possible feature in the area seemingly being some material from the quarry possibly interpreted as prehistoric. On the flat top ridge of Esgair Cwmowen a previously unrecorded bank (Plate 15) was noted at SO 0140 9644. This was a low bank of earth and stone construction which seemingly ran for only approximately 7-8 m in a straight line before terminating at both ends. A further quarry (Plate 16) was located adjacent to PRN 6534 on the top of Esgair Cwmowen. PRN 6534 is labelled as a shelter but should be termed as a sheepfold. A quarry adjacent to the shelter is likely to represent where the rocks used in its construction originated. A further modern quarry was noted adjacent to the trackway 110 m west of turbine 14 at SO 0016 8665. No further features were located by the walkover in area 3. All of the newly located features are of little value and so will not be overly affected by the development proposals.

14.5.10 Discussion and Interpretation

14.5.10.1 Reliability of Field Investigation & Desk Top Assessment

The investigation was largely unhampered aside from bad weather reducing visibility during the walkover. This was not a serious obstacle however.

14.5.10.2 Overall Interpretation

The area of proposed development and 500 m beyond appears to contain a relatively large amount of archaeological features. These features belong predominantly to two periods; the Bronze Age and the Post Medieval period.

The majority of the Bronze Age features appear associated with ritual and funerary activity (i.e. burial mounds, cairns, stone circles, etc). That such a relatively dense concentration of Bronze Age features are found in such close association with each other would suggest a Bronze Age landscape of relative importance. Whilst only one Bronze Age site, the Carneddau Ring Bank I, is likely to receive a minor impact resulting in a moderate/slight change, this is purely in terms of physical impact. Indirect impacts such as change/damage to setting will be discussed in the ASIDOHL2 assessment and the HLVA assessment.

The majority of Post Medieval features within and 500 m beyond the development boundary seem associated with exploitation of natural resources on the uplands as well as agriculture (Farmsteads, field boundaries and clearance cairns etc). Whilst these features do comprise a Post Medieval upland landscape, and are equally as prevalent as Bronze Age features, a lower value must be assigned to them given their relative frequency elsewhere in the country. Two Post Medieval features are sited reasonably close to proposed turbine locations. Owing to their low value the impact magnitude is judged only to be slight.

It should also be stressed that although the HER contains information on known sites there is a strong potential for previously unrecorded sites being exposed as a result of any potential development.

14.5.10.3 Significance

The known archaeology on the Esgair Cwmowen uplands is very significant in terms of Bronze Age features. Each of these features is likely to act as an integral part of a larger landscape. Any slight change to one feature, either through physical impact or indirect impact (setting etc), must therefore be considered in cumulative terms. This will be dealt with in both the ASIDOHL2 assessment and the HLVA assessment.

14.5.10.4 Predicted Physical Impacts

All predicated physical impacts in terms of magnitude on each recorded site are shown on the physical impact Table in Appendix 2. The following sites could all potentially be physically affected by the development of turbines.

PRN 6506, the Carneddau Ring Bank I, is located approximately 45 m from the centre of turbine 2. Given the short distance between development and feature and dependent upon

the nature of the construction method to be employed, i.e. nature, size, location, depth of groundworks for both turbine and crane pad/hardstanding, the feature may be physically impacted upon by groundworks. At this stage a moderate/slight magnitude of impact is predicted. This will be a permanent impact.

PRN 6524, the Carneddau Peat Stand I, is located reasonably close to the proposed location of turbine 3 at only 35 m distant. Again, dependent upon construction methods as outlined above, the feature may be physically impacted upon during groundworks. Owing to the negligible value of the feature however only a neutral/slight impact is predicted. This will be a permanent impact.

PRN 6508, the Carneddau structure I, is located approximately 56 m from the centre of turbine 1. Again, dependent upon construction methods as outlined above, the feature may be physically impacted upon during groundworks. The feature is assigned only a low value and the impact, at almost 60 m, is deemed to be negligible. The result is a predicted neutral/slight magnitude of impact which will be permanent.

The following sites could all be potentially physically affected by the development of turbine access tracks.

PRN 6312, the Carneddau Cairn II, is located immediately adjacent to a proposed access track close to turbine 1. This is a relatively high value site which could be damaged by development. If the site itself is avoided by the track this may still leave it prone to increased erosion owing to the presence of the track nearby. The feature is assigned a high value and the impact is deemed to be major. The result is a predicted large magnitude of impact which will be permanent.

PRN 6313, the Carneddau Cairn I, is located immediately adjacent to a proposed access track close to turbine 1. This is a relatively high value site which could be damaged by development. If the site itself is avoided by the track this may still leave it prone to increased erosion owing to the presence of the track nearby. The feature is assigned a high value and the impact is deemed to be major. The result is a predicted large magnitude of impact which will be permanent.

The possible cairn feature located by the walkover adjacent to PRN 6312 would also be at the same risk as PRNs 6312 and 6313. Whilst it has not been ascertained whether or not

this is an actual prehistoric feature it will still be at risk of being damaged by track installation and also from increased erosion once the track has been installed.

PRN 4798, the Glonc Kerb Cairn, is located immediately adjacent to a proposed access track close to turbine 11. This is a relatively high value site which could be damaged by development. If the site itself is avoided by the track this may still leave it prone to increased erosion owing to the presence of the track nearby. The feature is assigned a high value and the impact is deemed to be major. The result is a predicted large magnitude of impact which will be permanent.

PRN 4886, the Plas Newydd hut, is located immediately adjacent to a proposed access track close to turbine 11. This is a relatively low value site which could be damaged by development. If the site itself is avoided by the track this may still leave it prone to increased erosion owing to the presence of the track nearby. The feature is assigned a low value and the impact is deemed to be moderate. The result is a predicted moderate magnitude of impact which will be permanent.

PRN 6573, the Carneddau ring bank II, is located immediately adjacent to a proposed access track close to turbine 3. This is a relatively low value site which could be damaged by development. Despite its low value the fact that it belongs to a post medieval system of concentric field boundaries rather than a coaxial system means it is of local importance. The feature is assigned a low value and the impact is deemed to be moderate. The result is a predicted moderate magnitude of impact which will be permanent.

PRN 6501, the Carneddau Mound, is located immediately adjacent to a proposed access track close to turbine 6. This is a relatively low value site which could be damaged by development. If the site itself is avoided by the track this may still leave it prone to increased erosion owing to the presence of the track nearby. The feature is assigned a low value and the impact is deemed to be moderate yet permanent. The result is a predicted slight magnitude of impact.

14.5.10.5 Predicted Visual Impacts

Appendix 4 shows a Table detailing predicted visual impacts in terms of magnitude. This is assessed on the relative importance of a feature against how many turbines will become

visible. Figure 10 shows a ZTV map with the development and archaeology data points overlaid.

Given that the landscape of the development area and its hinterland appears to contain large amounts of Bronze Age religious, ritual and funerary monuments as well as potential settlement the issue of 'setting' is most important.

Cairns as burial monuments were given prominent positions within the landscape and arranged to have lines of inter-visibility with contemporary monuments. The large amount of burial monuments and other features associated with ritual (Y Capel and possibly Llanllugan stone circles, various standing stones) would appear to indicate that the monuments acknowledge one another and as such have a very high group value.

The visual impact of the development will impact on the setting of these monuments by occluding lines of sight between various elements. Views between monuments which will be visually impacted upon are between Mg 277 (Craig y Llyn Mawr Cairn) and Mg 278B (Nant Cwm Gerwyn Cairn I) and between Carneddau Cairn I and Mg 179 Y Capel Stone circle. The view between Mg 277 and Mg 278B is likely to be partially interrupted by the location of turbine 10 whereas the view between Carneddau Cairn I and Mg 179 is likely to be occluded by turbine 2. Both of these visual impacts are deemed reversible upon the decommissioning of the development.

The table in Appendix 3 shows that of the 95 recorded HER data points within, and 500 m beyond, the development boundary all will be able to see at least 1 to 3 turbines with the majority being able to see 14 to 17 turbines.

Of the 95 sites, 8 are scheduled ancient monuments (SAMs). All of the SAM sites are expected to be able to see between 11 and 17 turbines which equates to a large magnitude of impact.

14.5.11 Conclusions and Proposals

Although the Desk Based Assessment has located a reasonable amount of archaeological features relatively few of these are close to the proposed turbine locations. Therefore, where the proposed turbine locations are close to archaeological features, as is the case with turbines 1, 2 and 3, if movement of turbines should prove unfeasible then further archaeological recording work prior to construction should be investigated.

If the movement of turbines should not be possible then further investigation of these three specific locations, either through geophysical survey or evaluation trenching, is recommended to ensure the least damage to the archaeological resource. A watching brief on access track construction in the following areas is also recommended so as to protect the archaeological resource:

Close to PRNs 4798, 19092, 6313 and 4886.

PRN 6573, the Carneddau ring bank II, is located immediately adjacent to a proposed access track close to turbine 3. As the proposed access track appears to follow the current track then a watching brief during development of the track may be sufficient to record this feature.

PRN 6501, the Carneddau Mound, is located immediately adjacent to a proposed access track close to turbine 6. As the proposed access track appears to follow the current track then a watching brief during development of the track may be sufficient to record this feature.

14.6 Addendum A to Base Report

Addendum A to the Base Report is in itself a very substantial document which seeks to determine the possible indirect impacts that the proposed ECOCAS Wind Farm development may have on the setting of sites of cultural heritage interest within the wider landscape. Again, as for the Base Report, the main elements of Addendum A have been reproduced below in order to capture the essence of the Addendum but without repeating all of the detail contained within it, which can be readily accessed from within the ES Volumes as required by each reader. Attention is particularly drawn to the Figures and Plates, shown at Appendix 1 to the Addendum which conveys the scale of the landscape in which the wind turbines are planned to be sited, as can also be seen in the Photomontages Volume of the ES. As previously stated in respect of the Base Report, it is emphasised that all 'Table', 'Figure' and 'Plate' references below, together with their respective numberings, refer to the Addenda documents.

14.6.1 Visual Impact on Wider Historic Landscape

The presence of development features may have indirect impacts on the setting of sites of cultural heritage interest in the wider landscape. Wind turbines and, to a lesser extent, anemometer masts have the potential to cause indirect visual impacts over a wide area. In particular, there is potential for the development to be present in views of and from SAMs, Listed Buildings and other cultural heritage sites and areas in the vicinity of the development. Forestry felling may also have an indirect effect on sites in the wider landscape, arising from the removal of tree cover and the opening out of currently restricted views. These need not be adverse in nature and can often be beneficial.

The assessment of magnitude of impacts has been based on analysis of the ZTV (Appendix 1, Figure 1), taking into account the proposed positions of the wind turbines, the distance of the assessed site from the development and the number of turbines visible. The ZTV model is, however, a coarse predictive tool, based on bare-earth surface topography and maximum turbine height and takes no account of obstructions to visibility caused by existing forestry and other vegetation or by buildings and or other man-made features. In practice it is likely that the development would be screened from view from many of the

sites by the presence of intervening features in the landscape. All maps pertinent to the study are contained within Appendix 1 as Figures 1 to 7.

A list of all SAM's and Listed Buildings, Parks and Gardens and Battlefield sites within a 10 km radius of the edge of the development boundary is contained in Appendix 1. Not all of the SAMs, Listed Buildings, Parks and Gardens and Battlefield sites will have any turbines visible from their locations. Sites with no turbine visibility are included as a separate gazetteer within Appendix 2.

With regards to SAMs and Listed Building sites up to the 10 km radius from the edge of the development boundary, the desk based assessment collected 219 archaeological data points from the regional HER database. Of this total, 72 sites are SAM sites and 147 sites are Grade II Listed Buildings. There are two Parks and Gardens sites, that of Plas Dinam and Broneiron Lodge near Llanidloes. All of these sites have been overlain onto the Zone of Theoretical Visibility map in order to assess the severity of the indirect visual impact of the proposed Wind Farm (see Figure 1). The ZTV map has shown that of the 72 SAM sites a total of 23 will have no turbines visible and will therefore not be adversely affected by the development. The ZTV map has similarly shown that of the 147 Listed Buildings 108 will have no turbine visibility and will therefore remain unaffected. Tables 1 & 2 list the potential number of turbines visible from each SAM site and Listed Building II (LB) within a 10 km radius of the application site boundary theoretically affected according to the ZTV map.

14.6.2 Conclusions

The development proposal has been laid out to cause the minimum disturbance possible and will cause no physical damage to these monuments (see Desk Based Assessment) but the construction of the wind turbines will impact on the original setting of these monuments within the landscape.

Having assessed the likely visual impact on all SAM sites and Listed Buildings within a 10 km radius from the edge of the development area it can be demonstrated that:

Of the 147 Listed Building sites within the 10 km radius 15% (21) will have visibility of between 1-3 turbines, 4% (6) will have visibility of between 4-6 turbines, 3% (4) will have visibility of between 7-10 turbines, 1% (2) will have visibility of between 11-13 turbines and

4% (6) will have visibility of between 14-17 turbines. The remaining 108 (73%) Listed Buildings will have no visibility of any turbines. As the majority of Listed Buildings which have visibility of Turbines will only be able to see between 1 and 3 then the impact on the setting of Listed Buildings as a whole is regarded as being medium.

Of the 72 SAM sites within the 10 km radius 11% (8) will have visibility of between 1-3 turbines, 3% (2) will have visibility of between 4-6 turbines, 4% (3) will have visibility of between 7-10 turbines, 13% (9) will have visibility of between 11-13 turbines and 38% (27) will have visibility of between 14-17 turbines. The remaining 23 (32%) SAM sites will have no visibility of any turbines. The majority of SAM sites within a 10 km radius from the edge of the development area are upland sites such as Cairns. Although 32% of SAMs have no turbine visibility the majority, 38%, have visibility of the maximum amount of turbines possible. In this particular case the impact on the setting of SAMs within a 10 km radius from the edge of the development area is regarded to be considerable.

Of the 219 high value sites within a 10 km radius of the edge of the development area a total of 131 (108 LBs and 23 SAMs), 60%, will have no turbine visibility and will therefore not be affected by the development. The overall impact on the settings of SAMs and Listed Buildings within a 10 km radius from the edge of the development area is therefore deemed to be considerable.

It should, however be noted that the life of the ECOCAS Wind Farm will only be 25 years after which the Wind Farm will be decommissioned. Therefore the historic landscape will not be changed in the long term as the Site will return to a state similar to that of before construction. Although there will clearly be an impact, the overriding concern is to provide clean renewable energy for the future and this should be of primary importance to reach Government targets.

14.7 Addendum B to Base Report

Addendum B to the Base Report is, as for Addendum A, a very substantial document. It seeks to assess the significance of impact of the proposed ECOCAS Wind Farm development on wider historic landscapes (ASIDOHL v2), particularly those relating to the Caersws Basin, the Clywedog Valley and the TAN 8 area Y Glonc.

Again, as for the Base Report and Addendum A, the main elements of Addendum B have been reproduced below in order to embrace the contents of the Addendum but without repeating all of the detail contained within it. However, the full text and attachments can be readily accessed from the within the ES Volumes as required by each reader. As previously stated in respect of the Base Report and Addendum A, it is emphasised that all 'Table', 'Figure' and 'Plate', etc., references below, together with their respective numberings, refer to the Addenda documents.

14.7.1 Introduction

This assessment supplements the previously undertaken Desk Based Assessment, Field Walkover Survey and Historic Landscape Assessment and presents an Assessment of Significance of Impact of Development on Historic Landscape (ASODOHL2). As well as any direct impacts of the proposal on known and potential archaeological sites within the survey area, the construction and operation of the new Wind Farm (hereafter referred to as 'the Development') also has the potential to indirectly impact upon the wider historic landscape. The Regional Historical Landscapes (RHLs) of the Caersws Basin (HL 56) and the Clywedog Valley (HL 57) as well as the TAN 8 area Y Glonc (Powys SSA 20) have been identified to be at risk of potential in-direct impacts as a result of the Development.

The Caersws Basin RHL (HL 56) lies approximately 3,500 m (3.5 km) south of the development area and includes the town of Caersws. The Clywedog Valley RHL (HL57) lies approximately 11 km to the south west and includes the town of Llanidloes. The TAN 8 area of Y Glonc, whilst not technically a historic character area, has the development situated within its boundaries and thus will be subject to the same ASIDOHL2 process.

Because of the close proximity to both of these registered historic landscape areas, as well as the TAN 8 area, (i.e. within 15 km), the CCW and the regional Archaeological Trust -

Clwyd Powys Archaeological Trust (CPAT) have requested that an Assessment of Significance of Impact of Development on Historic Landscapes (ASIDOHL) be undertaken to assess the impact of the Development on both the Historical Landscape and the TAN 8 area. A 15 km ASIDOHL2 survey area was agreed through consultation with both CCW and CPAT. Correspondence detailing this agreement is presented in Appendix 2.

14.7.2 Overview of ASIDOHL

Recent guidance methodology for assessing the significance of impacts of development on a historic landscape (ASIDOHL2) has been published by the Welsh Assembly Government (WAG) in conjunction with the heritage service of the Welsh Assembly Government (Cadw), and CCW. The study of the impacts of development on the historic landscapes presented for the Development was undertaken according to this methodology.

To set the ASIDOHL2 in context, in addition to the details of the proposed development contained in the ES, is a summary of the topography and archaeology of the application site. For a more detailed description of the archaeological/historical background to the assessment area see the preceding Desk Based Assessment and Historic Landscape Assessment.

This assessment also summarises the ASIDOHL2 process with excerpts taken from the 1998 – 2007 ASIDOHL guidelines, details of which appear within the Technical Annex of the 'Guide to Good Practice on Using the Register of Landscapes of Historic Interest in Wales, in the Planning and Development Process –ASIDOHL2' (2nd Edition 2007). These guidelines were first disseminated in 2000, updated in February 2003, and again revised in 2007.

All figures and maps showing the application site area in relation to RHLs and relevant Historic Character Areas (HCAs) are presented in Appendix 3 (see Figure 1).

The Appendices to this ASIDOHL2 assessment contain the following:

- Appendix 1 – Correspondence detailing agreement between CPAT and CCW that a 15 km ASIDOHL2 radius be applied to the study.
- Appendix 2 – All relevant maps pertaining to the development area and HCAs.
- Appendix 3 – Gazetteer of all known archaeological data points recorded by the HER and contained within the relevant HCAs.

- Appendix 4 – Summary descriptions of each HCA included within the ASIDOHL2 assessment.

14.7.3 Summary of Topography and Archaeology in the Survey Area

The development area lies within the Montgomeryshire district of PCC and the parishes of Carno, Llanwnog and Manafon.

The development area covers approximately 3.25 square kilometres (km^2) of undulating upland plateau. The western edge of the development area is bordered by areas of forestry on relatively steep slopes, whilst the eastern edge has more gentle slopes gradually rising to 419 m above sea level at the top of Esgair Cwmowen. In the eastern half of the assessment area two streams drain off Y Glonc to the south of Esgair Cwmowen into the Nant y Llyn Mawr. A stream drains the northern half of the assessment area passing close to Carneddau and eventually becoming the River Rhiw outside the assessment area. The assessment area encompasses only one summit (Y Glonc at 461 m above sea level) whilst also coming close to the summit of Esgair Cwmowen (419 m above sea level).

The landscape of the assessment area is predominantly unenclosed or partially enclosed rough upland grazing. Smaller enclosed fields are visible within the western half of the assessment area at the base of Esgair Cwmowen.

The archaeological landscape dates predominantly to two distinct periods; the Bronze Age and the Post Medieval period. Whilst other periods are represented in the archaeological record the Bronze Age and the Post Medieval period do make up the majority of the total number of sites. As well as a number of Bronze Age cairns other prehistoric sites include several other features such as stone circles and a stone row. No known Neolithic, Iron Age, Roman or Early Medieval sites are located within the assessment area. Medieval sites within the survey area are scarce although a few are postulated. Post Medieval sites within the assessment area are made up of farmsteads, peat stands, smaller structures, field systems, clearance cairns and track ways.

14.7.4 Historic Landscapes and HCAs

The Welsh landscape is steeped in history and displays the influence of man from later prehistoric times through to the industrial era. Some landscapes are of special historic significance, and in recent years this fact has been recognised by the identification of 58 areas as being key Historic Landscapes. These are described within the Register of Landscapes of Outstanding Historic Interest in Wales (Cadw, CCW & ICOMOS UK 1998) and the Register of Landscapes of Special Historic Interest in Wales (Cadw, CCW & ICOMOS UK 2001). In combination, and for ease of reference, these documents are known collectively as 'the Register'.

In parallel with the creation of the Register, Cadw and the Welsh Archaeological Trusts are undertaking a follow-up programme of Historic Landscape Characterisation in Wales. The programme gathers together more detailed information about each area on the Register, and it is designed to cater for a variety of needs, but primarily to provide information for landscape conservation and management. Information is gathered in such a way as to be compatible and interchangeable with the historic landscape aspect in CCW's LANDMAP programme, so that the results of a characterisation study can be directly fed into a LANDMAP exercise and vice versa.

The characterisation process divides each landscape area on the Register into a number of smaller, more discrete, geographical areas of broadly consistent historic character, designated as HCAs. These areas are defined according to their key historic elements or characteristics, for example, an area might be physically characterised by a particular form of historic settlement or land use pattern, or it might have distinctive historic buildings, archaeological sites or traditional field boundaries, or, it may contain important ancient habitats, and so on.

Alternatively, a landscape area might not have any strongly definitive physical characteristics, but instead it might have significant historic documentary evidence relating to it, or have important historic associations, and so on. All of these elements or characteristics can occur either singly or in combination. In some cases, an area might be characterised by a range of elements that are not necessarily similar, but together demonstrate a particular land use theme or process; for example, defence, industry, communications, land enclosure, landscape planning or ornamentation, and so on. One theme may be dominant or several might have been at work at the same, or at different

times. Grouping elements and characteristics together under land use themes greatly increases our capacity to understand the historical development of the landscape. HCAs take diverse forms, ranging from Bronze Age funerary zones to recent industrial landscapes, from unenclosed upland to densely populated settlements.

Historic Landscape Characterisation sets out to establish the historic depth of past human activity within the modern landscape by identifying its principal historic components, tangible evidence of activities and habits of past land users and occupiers which often reflect their beliefs, attitudes, traditions and values. At present there is no standard accepted methodology for establishing the historical characterisation of landscapes, but recent work in Wales has suggested a practical approach based on subdivision of the overall historic landscape into sub-units of broadly homogenous character. This process can be summarised as:

One (or more) components	>	Dominant pattern
One (or more) dominant patterns	>	Coherent character
Coherent character (with definable limits)	>	Character area (HCA)
Several HCAs	>	Local landscape

HCA's form the basic unit assessed within an ASIDOHL2. As discussed later in this Appendix, the contribution of each HCA to the wider Historic Landscape (and thus its value in ASIDOHL2 terms) is variable: some are key elements, whilst others are only of incidental importance. Each HCA directly or indirectly affected by the Development is assessed individually within the ASIDOHL2.

14.7.5 Historic Landscapes and the Planning Process

The Register seeks to promote policies to preserve the character of historic landscapes, although it imposes no additional planning controls and recognises that continuing development is a necessary part of a living landscape. Nevertheless, historic landscapes remain a factor in the planning process:

"When Environmental Assessment is necessary, the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 require, amongst other things, the

significant effects of the development on the landscape and cultural heritage to be assessed.... Factors that need to be borne in mind include the effect of the development on the overall historic integrity and coherence of the area on the Register, whether by outright removal, severance, fragmentation, or dislocation of historic elements. The cumulative effects of secondary or piecemeal changes over time should also be taken into account." (Cadw, CCW & ICOMOS UK 1998).

Similarly, the Planning Policy Wales 2002 guidance given to planning authorities states that:

"Information on the landscapes on the second part of the Register should also be taken into account by local planning authorities in preparing UDPs, and in considering the implications of developments which are of such a scale that they would have more than local impact on an area on the Register." (Planning Policy Wales March 2002, Para. 6.5.23).

14.7.6 ASIDOHL2 Methodology

14.7.6.1 Summary of ASIDOHL2 Stages

ASIDOHL2 is structured into five stages, summarised in Table 1.

ASIDOHL2 Stages 2-4 involve an objective grading and scoring process, by which values are assigned for the direct and indirect impacts, and for the relative importance of the HCAs (and their individual components) within a local and national context. Leading from this, a similar grading process is followed in Stage 5, producing a single value for the overall significance of the impact of a development. It is noteworthy that the ASIDOHL2 methodology as it presently stands cannot lead to the expression of positive benefits of a development, the range of impacts being graded from Negligible to Very Severe.

Stage	Summary of Stages
1	Compilation of an introduction of essential, contextual information.
2	Description and quantification of the direct, physical impacts on the HCA(s) affected.
3	Description and quantification of the indirect, physical and visual impacts on the HCA(s) affected.
4	Evaluation of the relative importance of the parts of the HCA(s) (or part(s) thereof) directly or indirectly affected by development in relation to: a) the whole of the HCA(s) concerned; and b) the whole of the Historic Landscape area on the Register; followed by c) an evaluation of the relative importance of the HCA(s) concerned in the national context, and a determination of the average overall value of all HCA(s) (or parts thereof) affected.
5	Assessment of the overall significance of impact of development, and the effects that altering the HCA(s) concerned has on the whole of the historic landscape on the Register.

Table 14.1 The ASIDOHL Process

The full ASIDOHL2 methodology can be found in the Technical Annex of the 'Guide to Good Practice on Using the Register of Landscapes of Historic Interest in Wales, in the Planning and Development Process –ASIDOHL2' (2nd Edition 2007).

Stage 1: Contextual information

The first stage of the assessment comprises the gathering of essential contextual information that forms the introduction, in addition to information such as the planning history.

Stage 2: Direct effects

Direct physical impacts are quantified and expressed in three ways, namely:

a) in absolute terms, expressed as a percentage of the area of land that is directly affected;

b) in relative terms, expressed as a percentage of key elements that are directly affected; and

c) in landscape terms, expressed by statements concerning the extrinsic value of elements that are directly affected.

The intrinsic importance or status of each element or characteristic affected should also be briefly described, recorded together with a statement of intrinsic importance or status using the categories adopted by the Welsh Archaeological Trusts (as set out in the Department of Transport/Welsh Office/Scottish Office Design Manual for Roads and Bridges Paragraph 3.4 Vol. 11 Section 3 Part 2), as follows:

- Category A: National importance
- Category B: Regional importance
- Category C: Local importance
- Category D: Features
- Category U: Features needing further investigation.

Table 14.2 below presents the criterion for expressing the magnitude of the direct impacts of a development in landscape terms. This aspect is considered in two stages. First, the value of each affected element to the HCA is assessed. Second, the effect of the loss (or partial loss) of that element or characteristic to the HCA is considered.

Percentage	**Direct Impact**	**Magnitude**
75-100%	permanently lost or removed	Very Severe
50-74%	permanently lost or removed	Severe
30-49%	permanently lost or removed	Considerable
15-29%	permanently lost or removed	Moderate
5-14%	permanently lost or removed	Slight
0-4%	permanently lost or removed	Very Slight

Table 14.2 Criteria for assessing the overall magnitude of direct physical impacts of a proposed development on an historic landscape in absolute and relative terms

The key to the ASIDOHL process is its scoring system, by which the overall magnitude on a HCA can be expressed (Table 14.3 below). The scores for each affected element (i.e Status

[Category] + Magnitude + Landscape Value + Landscape Effect) are added up to produce a combined total. This figure is then divided by the number of elements identified in order to obtain an average figure. This average score is then added to the score for the magnitude of absolute impact. On a 28 point scale, which is the maximum possible, this figure provides a measure of the overall magnitude of direct, physical impacts on the HCA. Scores are then graded according to the scale shown in Table 14.4 below.

Impacts and element sensitivity	Score
Direst Physical Impacts - Absolute	
Very Severe	6
Severe	5
Considerable	4
Moderate	3
Direct Physical Impacts – Relative	
Very Severe	6
Severe	5
Considerable	4
Moderate	3
Site Category	
A	4
B	3
C	2
Direct, Physical Impacts – Landscape Value	
Very High	6
High	5
Considerable	4
Medium	3
Low	2
Very Low	1
Landscape Value Effect	
Lost	6
Substantially Reduced	5
Considerably Reduced	4
Moderately Reduced	3
Slightly Reduced	2
Unaffected	1

Table 14.3 Direct, physical impacts: grades and scores.

Score	Grading
24 - 28	Very Severe
19 - 23	Severe
14 - 18	Considerable
9 - 13	Moderate
4 - 8	Slight
0 - 3	Very Slight

Table 14.4 Overall magnitude of direct and/or in-direct physical impacts

14.7.7 Conclusions

As can be seen from the above, the detailed scoring methodology is contained in the Tables to the Addendum and it is not considered that it will serve to repeat the detail here, but rather to declare the results that arise from employing that methodology regarding the proposed ECOCAS Wind Farm development. The detailed conclusions for each of the RHLs and Y Glonc are given below.

Caersws Basin

The Caersws Basin has a varied history with its focus mainly on the Roman town of Caersws at its centre. Surrounding the town are prehistoric and Iron Age elements that imply a long history of continuity in the area up to the arrival of the Romans. Medieval activity in the area is fairly scarce, however, it is present albeit at a small scale in the form of agricultural and religious elements. The post medieval period is better represented by high status elements such as Llandinam Hall, Maesmawr Hall, Broneirion House and Plas Dinam. On the basis of the assessment, the significance of the impact on this registered Historic Landscape as a whole is considered to be Moderate.

Clywedog Valley

The Clywedog Valley also has a varied history with a major focus on post-medieval industrial metal mines. However the landscape also holds very significant prehistoric, Iron Age and Roman elements that demonstrate a long history of continuity in the area focused on the exploitation of metal ores. Medieval activity is also fairly well represented in the form of Iron-workings as well as late medieval farmsteads and surviving medieval listed elements

within the town of Llanidloes itself. As well as post-medieval sites focusing on metal mines, the historic landscape, especially elements close to Llanidloes town, also has a strong focus on the textile industry prevalent in the area in the 19th century, which helped cause the rapid growth of the town at that time.

As already mentioned, the proposed Esgair Cwmowen Wind Farm will be over 11 km away from this registered historic landscape, from where very little of the development will be clearly visible. West of Llanidloes however, moving into the main central areas of the historic landscape, the topography rises which allows a more clear view of the proposed development. However on these higher summits, where most of the major sites lie, the development will be over 11 km distant (up to 17 km in places). On this visual basis alone the significance of the impact on the registered Historic Landscape as a whole is considered to be slight, however this is supported by the staged ASIDOHL assessment as the significance of the impact on the registered Historic Landscape as a whole is also considered to be Slight.

Y Glonc

While Y Glonc is not an RHL but is in fact a designated area within TAN 8 (SSA Powys 20), it was agreed between Clwyd Powys Archaeological Trust and Cambrian Archaeological Projects (CAP) that for the purposes of assessment it should be treated as if it were a RHL. This is because the development may have both a direct and indirect physical and visual impact on the historical sites within the ECOCAS Wind Farm Site. The proposed ECOCAS Wind Farm lies within the north western half of the Y Glonc TAN 8 SSA.

The assessment undertaken by CAP indicates that direct physical impacts will take the form of envisaged potential damage to archaeological features occurring, during construction. However, CAP's view is that indirect physical impacts are more likely to occur post construction and these are envisaged to entail potential erosion of features due to improved access and increased weight of traffic. Also, visual impacts on the landscape are envisaged by CAP owing to the Wind Farm development. It is estimated by them that the development will be highly visible within the TAN 8 SSA area of Y Glonc with up to 17 turbines being visible from between 70 and 80% of the area. For Y Glonc the overall significance has been judged by CAP to be "severe".

Although the result of the assessment above gives an overall classification of "severe", it takes no recognition of two major issues. Firstly, it has not been recognised that the development is of a temporary nature and will only be in existence for 25 years relative to the thousands of years that the historic sites have existed. Therefore, the CAP suggestion that the inter-visibility is a permanent feature between the historic sites and the wind turbines takes no recognition of this temporary intrusion. Secondly, the developer has undertaken to carry out the works under strict controls regarding the positions of the turbines and track infrastructure and as a result no erosion of the historic sites will occur. It is anticipated that continuous monitoring will be undertaken by an archaeologist on the Site to ensure that no actions are undertaken that can cause damage to the historic sites. Also, it should be recognised that the design of the access tracks and infrastructure, including crossing points and drainage has involved consultation with the EA, CCW and PCC.

It is not anticipated that any damage will occur to any of the historic sites and conditions can be applied to any approval in order to be certain that no such damage will occur.

15 Noise

15.1 Introduction

An evaluation of the noise impact produced by the ECOCAS Wind Farm has been conducted by White Young Green (WYG) which considers various sensitive receptors surrounding the proposed Wind Farm location. Noise standards and guidelines have been applied to the noise level produced during the three main phases of the project: construction, operation and decommissioning.

The different duration of these three phases, with the installation and decommissioning estimated to last between 9 and 12 months and the operating phase 25 years, makes the noise produced during the installation and decommissioning phases of temporary nature, while the noise produced during the operating phase can be considered of a relatively permanent nature.

The reference standards for noise assessment which apply to wind farm projects are chosen in accordance to the source and nature of noise associated to each of the three phases. Therefore in the construction and decommissioning phases of the ECOCAS Wind Farm the guidelines in the British Standard 5228: Part 1: 1984 Noise Control on Construction and Open Sites will be used, while in the operating phase the guidelines in the PPS 22 and its companion guide ETSU-R-97: The Assessment & Rating of Noise from Wind Farms will be used.

15.2 Installation and Decommissioning phases

The noise produced during the installation, caused by operations such as excavation works, vehicle movement, road building, etc., is regulated by British Standard 5228: Part 1: 1984 Noise Control on Construction and Open Sites. Besides complying to those standards, the contractors appointed for the construction of the Wind Farm will be requested to adhere to the following standards of good practice:

- sound insulation measures will be used for all the machinery and equipment generating a major impact on the overall Site noise, and their use will be limited to the minimum amount of time in relation to the specific operation;

- working hours will be agreed with Powys County Council (PCC) and will not exceed the day-time working hours prescribed in the ETSU-R-97, that is from 7am to 7pm from Monday to Friday, and Saturday from 7am to 2pm (as already discussed in Section 4.1.2); any restrictions to this schedule from PCC Environmental Health Department will be promptly implemented. The only exception to this schedule, subject to agreement with PCC, will be allowed during the mounting of the nacelle and blades on the turbine tower, where priority will be given to weather conditions independently of the time of the day, as health and safety policies are given the highest priority during all the phases of the ECOCAS project; and
- the installation of the 17 turbines will be split into two phases, where at each phase the development of the Site will be limited to the area hosting eight or nine turbines. This approach will limit the overall noise produced by plants and machinery working simultaneously all over the Site, and will allow 'learning' from the initial phase as to how the noise levels may be further mitigated in the second phase.

The noise produced during the decommissioning of the turbines is estimated to be similar to that produced during the construction phase, with the likely difference being the shorter timeframe of this phase. During the decommissioning phase all the noise reduction measures implemented in the construction phase will be adopted.

Besides the noise produced at the Site, during the installation and decommissioning phases additional HGVs and LGVs traffic from contractors will increase the noise levels on the roads used to deliver the working equipment or transport the staff to the Site. According to the Noise and Vibration Section of the Design Manual for Roads and Bridges published by the Highways Agency, such noise source is assumed to be significant only when traffic flow increases more than 25% on each road trunk for which traffic flow data is available. As shown in Chapter 5, the movement of vehicles associated with the ECOCAS Wind Farm is below such a threshold and therefore the impact of such noise on the environment can be considered as not significant.

15.3 Operational phase

In this phase the only two sources of noise to be considered are the mechanical and aerodynamic noises produced by the wind turbines.

Mechanical noise is typically due to the movement of parts in the gearbox, the shafts and the generator, whose working frequencies might resonate in the tower or the blades. According to studies published by the Danish Wind Energy Association, the adoption of simulation programs and proven engineering practices has greatly improved the design of modern wind turbines, with one of the results being the reduction of mechanical noise to such a level that it can only be perceived in the immediate surroundings of the turbine, thus reducing its impact on distant sensitive receptors to a not significant level.

Aerodynamic noise is due to the interactions of the air flow over different parts of the blades. The noise is strongly dependent on the blades rotational speed, with the largest noise produced at the highest speeds. To minimise this effect, wind turbine manufacturers have introduced a series of working modes which, acting on the pitch of the blades and their rotational speed, are characterised by specific noise emissions. In this respect, the analysis performed for the ECOCAS Wind Farm assumes the turbine to adopt the noisiest working mode in order to simulate a worst case scenario.

15.4 Methodology

The method used in the assessment of the noise levels produced by the ECOCAS Wind Farm during its operation is the result of a comprehensive consultation process with the Environmental Health Officers of PCC, Paul Bufton and Nia Hughes. During the consultation a number of approaches have been discussed in detail and during an on-site meeting with Paul Bufton, Nigel Mann (WYG) and Terry Hill of IPS, it was agreed that it is the responsibility of the wind farm developer to ensure that each wind turbine stays within the noise levels determined in accordance to ETSU-R-97, as described below. Concerning the noise levels specified in ETSU-R-97, different minimum limits are fixed for daytime and night-time periods based on the LA90,10 min standard, the sound pressure exceeded for 90% of the time over a 10 minutes period, adjusted for the human ear sensitivity to the various sound frequencies. The daytime limits apply to the 'quiet periods of the day' comprising:

- All evenings from 18:00 to 23:00
- Saturday afternoons from 13:00 to 18:00
- All day Sunday 07:00-23:00

Night-time periods are defined as 23:00 to 07:00, independently of the day of the week.

For quiet daytime periods the recommended limit is set by two conditions, a variable one and an absolute one, and the higher applies. The variable condition states that the noise level introduced by the Wind Farm should not exceed 5dB(A) above the prevailing background noise, while the absolute condition sets the maximum noise level as a value in the range 35-40db(A); the choice is specific to the property under investigation and depends on a number of factors such as the number of dwellings in the neighbourhood of the Wind Farm, the effect of noise limits on the number of kWh generated or the duration and level of exposure.

Similar conditions apply to night-time periods, with the difference that the maximum noise level is now set to 43dB(A) instead of a value in the range 35-40dB(A). This level is based on the assumption of a 35dB(A) sleep disturbance limit (as reported in Planning Policy Guidance Note PPG 24), adjusted for the attenuation through an open window. As for the quiet daytime periods, the higher between this level and the 5dB(A) level above prevailing background noise is taken as the recommended limit for the Wind Farm noise.

In the case where the occupier of the property has a financial interest in the Wind Farm development, both daytime and night-time fixed maximum levels can be increased to 45dB(A), or an increase of the 5dB(A) limit above background noise can be considered.

According to ETSU-R-97 – Section 6, in some particular cases the standard method just described can be replaced with a simplified one. The simplified method sets a threshold of 35dB(A) as a maximum noise level, and the Wind Farm noise at each of the receptors has to remain within this value up to a wind speed of 10 m/s at 10 m height, with the receptors assumed to be downwind with respect to the Wind Farm itself.

Because of the optimal design (see Section 2.4) of the ECOCAS Wind Farm with respect to the possible noise issues, the simplified assessment method can be applied to the analysis of the ECOCAS Wind Farm. Therefore a desktop study has been used to test the 35dB(A)

threshold at each of the dwellings potentially affected by ECOCAS Wind Farm noise. Using the CadnaA modelling software with topographical data covering the site and its surroundings on a 5 km by 5 km grid, the model assumes a geometric divergence of sound from each of the turbines and a worst case scenario for sound propagation.

The worst case scenario implies that the propagation of the various noise frequencies between the ECOCAS Wind Farm and each of the receptors occurs with the minimal level of absorption introduced by air, ground, buildings and other attenuation factors. In more detail, the atmospheric conditions are assumed to correspond to those of minimal absorption according to ISO 9613 Part 2, while the ground absorption, the screening effect of buildings or barriers and other miscellaneous attenuation factors are assumed to be zero.

From the technical specifications of the Vestas V90 turbine, the turbine model chosen for the ECOCAS planning application, the maximum noise level is produced in the so-called '0' mode. In this working mode the noise level at 10 m height for a wind speed of 10 m/s is 106.7dB. This level consists of the sum of all the audible frequencies at the source position, but air absorption (the only attenuation factor dependent on external conditions considered in the worst case scenario) is different for low and high frequencies, and because of the different propagation coefficients the noise level must be analysed on a frequency-band basis moving away from the Wind Farm. The noise level at each receptor is then computed by taking into account the attenuation at different frequencies as a function of distance from the Wind Farm and adding up the contributions of the various frequencies.

With this approach, only the audible frequencies are included in the analysis, ignoring ultra- and infra-sounds. The exclusion of ultrasounds, that is sound waves with frequencies above 20 kHz, is justified by the property of air to increase absorption with increasing frequency, with the result to have a strong reduction in the energy of these sounds within a small distance from the Wind Farm. Concerning infra-sounds, that is sound waves with typical frequencies below 20 Hz, the main source of noise in this frequency range is the sweeping of the blades past the tower. A characteristic of these sounds is to decrease with increasing distance between tower and rotation plane of the blades, with modern turbines having a design which reduces the infrasonic noise to a very low level. This is confirmed by the BWEA report 'Low Frequency Noise and Wind Turbines', stating that the generation of infra-sounds from modern wind farms is considered to be not significant.

The analysis confirms that the key element responsible for the reduction of the noise level below the 35dB threshold at each of the receptors is the large distance from the Wind Farm. This is evident by looking at the map of the predicted turbine noise in Volume 4, Appendix 10, where the closest receptor to the ECOCAS Wind Farm is located at 730 m from the nearest turbine, corresponding to about eight rotor diameters and more than two rotor diameters outside its exclusion area (see Section 3.2).

15.5 Results

In one case (Lleutstuchaf), see Table 15.1, the resulting value of 34.4dB is very close to the 35dB threshold, it must be noted that the assumptions are for a worst case scenario. In a more realistic situation the attenuation factors due to ground absorption and vegetation screening are likely to be greater than zero, thus increasing the overall sound attenuation and in turn increasing the margin from the 35dB threshold.

As partly shown in Table 15.1 (the full table, as well as the full noise report, can be found in Volume 4, Appendix 10), all the other sensitive receptors are further away from the Wind Farm. Therefore the argument above (sufficient noise attenuation due to geometric divergence and large distance from source) holds for all them, and the result is that the noise level introduced by the ECOCAS Wind Farm during its operation can be considered within the limits of the simplified assessment method even when the noisiest working mode is adopted.

Receptor name	Distance from nearest turbine (m)	Predicted maximum combined noise level from all ECOCAS turbines with 10m/s wind speeds (dB LAeq)
Lleustuchaf	730	34.4
Blaen-y-cwm	780	33.6
Cefn Brith	910	25.1
Llanerch	1010	15.1
Llyn mawr	1085	27.8
cwm-yr-annel	1170	23.9
Pen-y-banc (currently unoccupied)	1175	19.9
Ty-uchaf	1220	25.4
Pantygesail	1390	21.6
Lanerch isaf	1440	16.9
Cwm-gerwyn	1505	24.2
Lluestycerrig (currently unoccupied)	1610	25.1
Rhyd	1610	20.6
Rhyd-y-Biswal	1650	21.0
Rhosfach	1670	20.6
Bedswyth	1700	19.0
New House	1725	20.9
Ty-gwyn	1780	22.9
Cammlas (currently unoccupied)	1785	25.1
Parc-y-rhiw	1785	6.3
Lluast-y-greolen	1825	7.7
Esgair Ddu (currently unoccupied)	1935	23.8

Table 15.1 Noise levels at the sensitive receptors within 2 km from the ECOCAS Wind Farm

15.6 Conclusions

An assessment of the noise produced by the ECOCAS Wind Farm during the three main phases of the project shows that the levels expected at the installation and decommissioning phases can be considered of temporary nature and mitigation measures will be introduced to reduce the effects to a minimal level. Regarding the operating phase, where the noise levels are considered of permanent nature, the assessment shows how the effects on the nearest sensitive receptors, considering a worst case scenario for the sound attenuation and the noisiest operating mode of the turbines, can be considered insignificant.

16 Shadow Flicker

16.1 Introduction

Shadow flicker is the name given to the casting of shadows on domestic dwellings by the rotation of the turbine blades on a clear windy day when the turbine is between a particular domestic residence and a rising or setting sun.

The properties that may be affected by shadow flicker can be predicted by computer modelling which can also predict date, time and duration of the possible flicker event. The likelihood of any particular property being affected by shadow flicker is a function of:

- The direction of the residence in relation to the turbine plant
- The direction of the wind in relation to the affected residence
- The distance from the turbine plant
- The hub height and rotor diameter of the turbine plant
- The latitude of the turbine plant location
- The time of the year
- The number of sunlight hours per annum at the plant location
- The number of hours per annum that the turbine plant is operational

16.2 Methodology

There are some properties in and around the Site that may be exposed to shadow flicker for short periods of time throughout the year. These properties are identified according to the PPS 22 Guidance Companion – point 76, which states "Flicker effects have been proven to occur only within ten rotor diameters of a turbine". In the case of the proposed ECOCAS Wind Farm the rotor diameter of the turbines is 90 m, and therefore all the area within 900 m from each turbine should be considered. In order to take into account all the properties within the 900 m limit, including those only partly located within this distance, the conservative distance of 1,000 m from each turbine has been adopted. The map of the shadow flicker study area is shown in Volume 5, Figure 28.

Although for distances larger than the 10 rotor diameter limit the effect on the population can be considered negligible "At distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow", (PPS 22 – point 75). The shadow flicker effect can, however, still be present at larger distances. A map showing the possible full extent of shadow flicker is given in Volume 5, Figure 29.

16.3 Results

The map is colour-coded according to the number of hours per year the shadow flicker effect is likely to occur, with the pink area representing 51-758 hours, the red area 41-50 hours and so on, as per the map legend. It can be seen that there are no residential properties in the core of the pink area while IPS has identified five dwellings which may be affected by the shadow flicker effect and which are located on the border between the pink and red areas. Table 16.1 shows the locations in which properties may be affected, along with the average number of hours that properties may be affected by shadow flicker.

Property (ID - name)	**Average Annual Exposure (Hours)**	**Worst day of the year and period of likely effect**
Pink Band		
10 – Cefn Brith	51	03/02 – 40 mins
40 – Blaen-y-Cwm	64	13/05 – 40 mins
Red Band		
9 – Llenerch	44	16/01 – 40 mins
29 – Lluestuchaf	49	03/06 – 60 mins
30 – Ty-uchaf	50	17/09 – 40 mins

Table 16.1 Locations and potential number of hours of shadow flicker effect

Of course, for shadow flicker to occur the sun must be shining and the wind blowing at the same time. In addition, the direction of the wind must be within a small angle from the direction of the ideal line connecting the viewing point and the turbine(s), otherwise the full plane of the turbine blades will not be exposed and no shadow will be cast on the viewing point. Further points to consider are the presence and dimension of windows towards the

direction of the shadow flicker effect, the use of the rooms with potentially affected windows and the effects of intervening topography or vegetation on the line of sight, all of which can further reduce any possible inconvenience of the shadow flicker effect.

Table 16.2 shows the direction of potentially affected windows on the individual dwellings together with the local main direction of the potential shadow flicker effect. The letters shown refer to the four directions North, East, South and West and intermediate angles, with the black letters indicating the presence of a window and the red letters the absence of any window towards that direction. Missing directions are due to the presence of obstacles or vegetation hiding the dwelling from view at the time IPS made the on-site visit.

Property (ID - name)	**Directions of Potentially Affected Windows**	**Shadow Flicker Main Direction**
Pink Band		
10 – Cefn Brith	NE, NW, SE	SE
40 – Blaen-y-Cwm	N, E	ENE
Red Band		
9 – Llenerch	N, S, E	SE
29 – Lluestuchaf	N, E	WNW
30 – Ty-uchaf	NW, W	WSW

Table 16.2 Directions of potentially affected windows and shadow flicker main direction at each dwelling

Considering only the light hours factor, there are 4,480 hours of light in a year in Cardiff (taken as reference for Wales, and therefore for Powys). Moreover, the average number of sunshine hours per annum is approximately 1,553. Therefore, the probability of the sun shining is (1,553/4,480) x 100 = 34.7%.

As the total number of hours each year is 8,760 and the turbines will be expected to operate for 7,000 hours on average, the likelihood of the turbine operating (and so the blades rotating) is (7,000/8,760) x 100 = 80%.

Therefore the combined probability of the sun shining and the blades rotating to create a shadow flicker event is (0.347 x 0.8) x 100 = 27.8%.

The probable hours of shadow flicker exposure for each property is shown in Table 16.3.

Property (ID - name)	**Average Annual Exposure (Hours)**	**Probable Annual Shadow Flicker (Hours)**
Pink Band		
10 – Cefn Brith	51	14
40 – Blaen-y-Cwm	64	18
Red Band		
9 – Llenerch	44	12
29 – Lluestuchaf	49	14
30 – Ty-uchaf	50	14

Table 16.3 Probable hours of shadow flicker exposure

16.4 Conclusion

These probable levels of exposure to shadow flicker are not considered to be of significant nuisance and therefore we conclude that the environmental impact of shadow flicker is not significant. However, in the event that shadow flicker does occur and is deemed to cause a significant nuisance then mitigating measures will be implemented. If a complaint is received, either by the Local Planning Authority or the developer then, following evaluation, procedures to mitigate against any nuisance caused by shadow flicker will be undertaken.

17 Aircraft Radar, Telecommunications and Television Reception

17.1 Aircraft Radar

Wind turbines can affect military and civil air traffic movement by the physical obstruction to low flying aircraft and through the effects on aeronautical radar systems. Wind turbines can appear on radar screens as 'radar clutter' and such 'radar returns' from a number of turbines can sometimes be interpreted as fast moving objects, mimicking the returns from aircraft themselves. Accordingly, the following organisations were informed of the proposed ECOCAS Wind Farm development and were sent the Civil Aviation and Ministry of Defence Safeguarding Wind Farm Developers Application proforma. The proforma as prepared is shown at Volume 4, Appendix 4, Pages 8.1-8.7.

- National Air Traffic Systems (NATS)
- Ministry of Defence (MoD)
- Civil Aviation Authority (CAA)

NATS were consulted through the DTI during the scoping phase and responded on the 17th October 2006 (see Volume 4, Appendix 4, Page 1.31), "Given our preliminary findings the proposed development does conflict with our safeguarding criteria. Accordingly NATS (En Route) Plc objects to the proposal.". After further technical investigations by NATS they responded on the 4th December 2006 (see Volume 4, Appendix 4, Page 1.32), "The proposed development has been examined by our technical and operational safeguarding teams and although the proposed development is likely to impact our electronic infrastructure NATS (En Route) Plc ("NERL") has no safeguarding objections to the proposal.".

The MOD were consulted on the 25th September 2008 (see Volume 4, Appendix 4, Page 6.1) and responded on the 16th October 2008 (see Volume 4, Appendix 4, Pages 6.2-6.3), "the MOD has no concerns with the proposal as set out in your proforma…".

The CAA were consulted twice, once in October 2006 during the scoping phase where they responded saying that "we have studied the information provided and do not believe that the CAA would need to make any site-specific or aerodrome related observations." (Volume 4, Appendix 4, Pages 1.29-1.30). At this stage of scoping the CAA also requested that a Civil Aviation and Ministry of Defence Safeguarding Wind Farm Developers Application pro forma be submitted for further consultation. A letter was sent to the CAA dated 25th September 2008 (see Volume 4, Appendix 4, Page 7.1) to clarify the CAA's position on the development and a response was received from the CAA on the 20th October 2008 indicating that "This directorate has no observations.". (Volume 4, Appendix 4, Page 7.4).

None of the three organisations have declared any objections to the construction of the proposed ECOCAS Wind Farm. The CAA did state that there may be a need to install aviation obstruction lighting to some or all of the associated wind turbines, especially if there were concerns expressed by other elements of the aviation industry. They also advised that there is a civil aviation requirement in the UK for all structures over 300 feet high to be charted on civil aviation maps. Therefore, once planning has been granted, written confirmation of the turbine locations and details will be provided to NATS, CAA and the MOD. This will give them the opportunity to also advise specifically on lighting issues and other requirements then in force.

17.2 Telecommunications

Ofcom were contacted in October 2006 (see Volume 4, Appendix 4, Page 9.2) and again on the 25th September 2008 (see Volume 4, Appendix 4, Page 9.1) to inform them of the intention to submit a planning application for the construction of a Wind Farm at Esgair Cwmowen as they manage fixed microwave links across the UK on behalf of individual telecommunication organisations. Ofcom responded on the 29th September 2008 indicating that "Ofcom have found that within the fixed link frequency bands, there are currently no fixed end(s) within or fixed link paths that cross your requested coordination area." (see Volume 4, Appendix 4, Pages 9.3-9.4). Ofcom also forwarded the email from IPS regarding the proposed Wind Farm to CSS Spectrum Management Services Ltd and to the Joint Radio Company (JRC) for their responses. The CSS responded on the 6th October 2008 with "…NO OBJECTION to the proposed Wind Farm." (see Volume 4, Appendix 4, Page 9.7), whilst the JRC responded on the 27th October 2008 saying that "…the JRC does not foresee

any potential problems based on known interference scenarios." (see Volume 4, Appendix 4, Pages 9.5-9.6).

17.3 Television Reception

The results from the BBC online assessment can be found in Volume 4, Appendix 4, Page 12.1. The assessment details that the ECOCAS Wind Farm will not affect any television reception in the surrounding area. The only transmitter that may be affected by the Wind Farm is Carno. It is proposed that after planning consent has been granted, but prior to the construction of the Wind Farm, a TV Signal Reception Survey in the locality of the site will be carried out to ensure that there is no impact on local receptors. After the construction of the ECOCAS Wind Farm any complaints about interference to TV reception thought to be caused by the Wind Farm will be investigated using the TV Signal Reception Survey as the baseline. Any interference to TV reception at a particular property that is proven beyond reasonable doubt to have been caused by the operation of the ECOCAS Wind Farm will be made good using the most cost effective means possible.

17.4 Conclusion

The responses from consultation and assessments indicate that the ECOCAS Wind Farm will have no impacts on aircraft radar, telecommunications, or television reception. Any impacts that occur as a result of the Wind Farm will be mitigated accordingly through consultation with the relevant parties to determine a suitable solution.

18 Socio-Economics

18.1 Introduction

This chapter of the Environmental Statement (ES) evaluates the possible impact of the ECOCAS Wind Farm on the socio-economic aspects of the immediate area containing the development and also considers the implications over a wider area. The main issues addressed in this chapter are the impacts on the local economy, leisure pursuits and public access to the land.

18.2 Consultation

A scoping letter was sent to Gary Mohammed at the Department of Trade and Industry (DTI) on the 28th September 2006, see Volume 4, Appendix 4, Pages 1.1-1.6. This scoping letter detailed the intentions of the two local farmers, Messrs Watkins and Jones, to develop a wind farm in the area north of Carno in Montgomeryshire. Included was a section which addressed the socio-economic aspects of the proposals,

"The socio-economic benefits of the project including the effect on local employment during construction and operation of the project will be provided.".

The main response received detailing the need to assess the socio and economic impacts came from Ken Perry at the Countryside Council for Wales (CCW).

"Since the application site includes some access land and there are a number of public rights of ways crossing the site, including a number of bridleways, CCW consider it essential that there is some consideration given to the impacts on recreational users of these rights is considered, especially since some of the turbines appear to be close to these routes.".

As a result of the consultation it was deemed necessary to assess the impacts on recreational users using the rights of way across the Site, as the Welsh countryside makes a valuable contribution to the Welsh economy. Therefore it is necessary to consider the potential impacts on people's enjoyment of the countryside both within the application Site and in the surrounding area.

18.3 Methodology

As a result of the consultation processes the assessment of the socio-economic impacts has taken into account the possible effects on:

- People, including public perception of wind farms and their effects
- Local economy, including work prospects, education
- Leisure pursuits and activities
- Land use and public access

The assessment of the socio-economic impacts has been carried out using desktop surveys and an assessment of the potential impacts against the relevant planning policies and plans.

18.4 Guidance

The main guidance for planning in Wales is TAN 8 which encourages developers and local authorities to enter into constructive dialogue over the positive provision for visitors to wind power projects and ways in which any negative impacts can be minimised or mitigated.

Within the area of Powys the guidance for determining planning applications is the Unitary Development Plan (UDP). The UDP provides a policy framework for positive planning, proposals and allocations for future developments. The relevant policies within the UDP relating to the socio-economic aspects are detailed further.

Policy E3 Wind Power

Policy E3 specifically relates to wind farm developments and sets out the criteria that should be met including taking into account the landscape, cultural heritage, habitat and ecology, noise and shadow flicker, access including public rights of way and mitigation measures. Part of this policy states that the development should not compromise the enjoyment or the safe use of the public rights of way including bridleways.

Policy RL6: Rights of Way and Access to the Countryside

This policy encourages appropriate proposals that improve access to the countryside for the public and the continued maintenance and enhancement of existing rights of way.

18.5 Baseline

18.5.1 Socio-economics

The Office for National Statistics (ONS) released a mid-year population estimate for Powys in 2008. The population of Powys was estimated as being 132,600 in June 2008 which represents an increase of 650 (0.48%) from mid 2007 to mid 2008. The population of Powys is predominantly an ageing one as the retired population rose to 34,100 in mid 2008 from 33,200 in mid 2007 whilst the number of working age remained almost constant at 75,000 in mid 2008 compared with 75,100 in mid 2007. In July 2009 there were 2,094 people unemployed in Powys with the highest unemployment rates in Ysradgynlais (4.7%), Landrindod Wells (4.1%) and Newtown (3.9%).

The economy of Powys is predominantly based on agriculture and tourism. Tourism clearly makes a substantial contribution to the Powys economy, supporting over 4,300 jobs and over 3,000 tourism related businesses in Powys. Tourism related employment within Wales accounts for 100,400 full and part time employees in 2005, that being 8.4% of all employees in employment in Wales. As of 2007 there were 104,000 employee jobs in tourism related industries. Tourism is a substantial sector of the region's economy, spreading employment and income throughout Powys. The United Kingdom Tourism Survey 2008 indicates that 1.42 million trips were taken in Mid Wales, spending £24.150 million in the local economy. Tourism in Powys also helps to support other industries such as agriculture, crafts and local services which in turn support the tourism industry, transport and local services.

There are around 449,300 hectares of agricultural land in Powys, 28% of the Welsh total agricultural land and Powys has the largest sheep breeding area (37% of the total number of ewes in Wales) and is the most important beef producing area (accounting for 34% of the total number of beef cows in Wales). The number of jobs in sectors such as catering and hotels now provides over 20% of the jobs in Powys. Agriculture and those industries that

support it are clearly important to the economy of Powys and therefore supporting local farmers in the local community is important for the future.

18.5.2 Recreation and Tourism

The County of Powys covers around a quarter of the landmass in Wales and contains the source of both the river Wye and the Severn. The landscape of Powys is varied and diverse with distinctive landscapes supporting a range of species and habitats. The southern part of the County boundary lies within the Brecon Beacons National Park and the north western area borders the Snowdonia National Park. Tourism within Wales is well developed and one of the main sources of revenue with over £8 million a day spent on trips to Wales which amounts to £3 billion a year.

The landscape and environmental resources which draw tourists to Powys are a result of the north and south boundaries of the region which encompass resources and attractions within the Snowdonia and Brecon Beacons National Parks. The varying landscape throughout the area is also a basic attraction providing suitable settings for a variety of holiday experiences.

The Welsh Outdoor Recreation Survey 2008 which was undertaken between 21st January 2008 and 20th January 2009 is the first survey of outdoor recreation undertaken of residents in Wales. The CCW and the Forestry Commission Wales plan to repeat this survey every three years. A total of 6045 telephone interviews were carried out with adults aged 16+ living in Wales. The survey covers the responses from Welsh residents (multiple answers were allowed) on their attitudes and feeling towards the following:

- The use of the outdoors
- Places visited, including woodlands
- The motivations for using the outdoors
- Barriers to visiting the outdoors
- The 'latent demand' for outdoor recreation

The results of the survey found that the most commonly undertaken activities were walking (86% of the population of Wales), sightseeing (71%), picnicking (46%) and visiting playgrounds (43%). The main type of place visited was most often the local park (15%), followed by woodlands or forests (14%), roadside pavements (12%) and hills / moorland

(11%). Less than one in 10 visits (8%) were to farmland, rivers / lakes / canals, and local open space. The main barriers cited by those who had not participated in any activity were physical disability (31% of non-participants), other health reason (24%) and old age (22%). The most common reasons stated as the motivation for undertaking a visit into the countryside were:

- 'for health or exercise' (36% of visits)
- 'to exercise my dog' (26%)
- 'for fresh air / enjoy pleasant weather' (22%)
- 'to participate in my hobby' (20%).

Multiple choices were allowed therefore the above adds up to over 100%

Reasons cited less often were:

- 'to enjoy scenery and wildlife' (9% of visits)
- 'to entertain children' (8%)
- 'to relax and unwind' (7%)
- 'for peace and quiet' (2%)
- 'to learn something about the outdoors' (2%)

In May 2005 the Countryside and Rights of Way Act (CRoW) came into force which identified the open access land in Wales and illustrates the opportunities in the countryside for everyone. As a result, people now enjoy greater opportunities for access to the countryside. There are three areas around the site that are areas of statutory access including open country, registered common land and public forests. There is one area of open country to the east of the site where three of the proposed turbines are sited, but evidence is that wind turbines do not interfere with people's enjoyment of the countryside, as indicated in the surveys; see Section 18.5.3 below.

18.5.3 Perceptions of Wind Farms

The attitudes towards wind farms have changed due to the increased media attention, a greater awareness of the impacts of climate change and the obvious need for renewable energy to combat this.

A survey on public attitudes to wind energy in Wales (2002) carried out by the Friends of the Earth Cymru found that when members of the public were asked if the would support the doubling of wind turbines on land in Wales over 71% of Welsh adults stated that they would. Research carried out by the Wales Tourist Board in 2003 on visitors indicated that over two thirds of visitors said that an increase of wind farms would make no difference to their likelihood of taking holidays in the Welsh Countryside.

ICM research of 1,000 adults in 2004, carried out on behalf of Greenpeace, also indicated that 80% of those surveyed supported government plans to increase wind turbines and that 70% would support a development in their local area. Climate Concern Cymry also carried out a survey in 2004 and found that three times as many people were likely to be in favour of onshore wind turbines than to those who opposed them.

BWEA findings in 2005 found that 80% of 1,000 adults surveyed agreed that wind farms are necessary to produce renewable energy with only 8% disagreeing, 62% also agreed that wind farms are necessary for the future and did not find that what they looked like was important.

The BERR report on renewable energy awareness and attitudes 2008 indicates that the public support for renewable energy remains high. It found that 84% of the general public support the use of renewable energy with 80% being in favour of the use of wind power and 64% being happy to live within three miles of a wind power development.

18.6 Assessment and Mitigation Measures

18.6.1 Socio-economics

The ECOCAS Wind Farm development will offer a wide range of benefits to the local community including the employment of local businesses. It is proposed that the cement needed on Site be sourced from a local company close to the construction Site, thus

reducing traffic movements and also involving local companies. Local businesses in the area of Carno and Newtown will also benefit from the influx of staff working on the Site who may require the local shops, local B&Bs and other such facilities.

The ECOCAS Wind Farm will also benefit the sponsors of the project who are local farmers in the area. Messrs Watkins and Jones are both wholly independent of any organisation, making the project a totally locally funded planning application for a wind farm development. Both of them have spent all of their lives in and around Newtown and Carno and, with their families, farm the hills above Carno, mainly sheep rearing, with some supporting livestock together with growing and harvesting crops for animal feed. Some of the land is also used for forestry, including where possible, because of the nature of the land, native deciduous trees. It should be further emphasised that the actual area of land 'disturbed' during construction of the wind turbines will be approximately 4% of the total site area; this percentage will also be lower if consideration is given to the need to restore, for example, cable trenches and turbine foundations. The area of 'disturbed' ground includes all internal site access roads, drainage channels, cable trenches, crane pads and lay down areas, wind turbine foundations and substation with associated facilities.

18.6.2 Recreation and Tourism

There are a number of footpaths and bridleways that cross the ECOCAS site (see Volume 5, Figure 30) and although three of the turbines are located on an area of open access people will still be able to use the area once construction has been completed. Research has shown that the majority of people do not come out for the quiet and peace (only 2% stated this as a reason for going out in the countryside) and that the majority of visitors do not come to the uplands (only 11%). Therefore although there are a number of footpaths and bridleways that cross the site the impact of the development on the recreational use of the area is not significant.

The detailed position of each turbine on the Site will be subject to micro siting of up to 50 m and this will be taken into consideration if any of the footpaths or bridleways seem likely to be over flown by the blades of any of the turbines. It is acknowledged that during the construction process there will be some disturbance of footpaths and bridleways on the Site, as some of the original tracks on Site will be utilised and built on to provide access to the site for the vehicles bringing the turbines. Although this will mean disturbance during

construction those footpaths and bridleways that are being used as access tracks will be of a good quality once construction has been completed and this will allow better access for the general public.

Part I of the Countryside and Rights of Way Act (CRoW) 2000, Access Appeals (Wales) Act includes provisions for landowners to exclude or restrict access for any reason for up to 28 days a year. Landowners will also be able to seek further exclusions or restrictions on access for reasons of land management, fire prevention and to avoid danger to the public. The footpaths and bridleways on-site will either be redirected as necessary or this Act will be used to allow construction to continue safely. The CCW will be consulted before construction to give directions as how best to proceed. If for reasons of public safety it is agreed that the footpaths should be permanently re-directed this will also be done in agreement with the local council and CCW with appropriate signage. The maintenance of the footpaths across the site will be carried out during the construction process ensuring that there are new stiles and gate access that can be used by members of the public once construction of the Wind Farm has been completed.

The ECOCAS Wind Farm will open up the area of Esgair Cwmowen and give greater access to those who want to experience the outdoors more. The main barrier cited by those who had not participated in any activity outdoors in the survey were physical disability (31% of non-participants). Therefore the ECOCAS Wind Farm will allow a greater proportion of people to experience the countryside as the access roads will be of a good nature and quality allowing greater access for all.

18.7 Conclusion

The ECOCAS Wind Farm development will have an overall positive net impact on socio-economic issues. During construction some footpaths may be closed or redirected for health and safety reasons, as affecting the general public and this may cause some temporary disruption. This negative impact will primarily occur during the construction phase and will therefore be short lived. The ECOCAS Wind Farm development will positively impact upon some local businesses during the construction phase including the provision of construction materials and services including use of B&Bs, restaurants and local shopping outlets. Further, the development should also stimulate local employment, job retention and provide a stimulus to general economic activity in the Carno/Newtown area over the 25 year life of

the project. In terms of recreation, the development will allow greater access to the countryside for walkers, runners and cyclists and provide improved vehicular routes for those less able to access the outdoors. The ECOCAS Wind Farm will, therefore, have a net beneficial impact on the socio-economic environment of the local area and Wales generally.