Document details

Publisher: INIS Environmental Consultants Ltd.
Planning and Environmental Consultants,
Edenvale, Ennis, County Clare, Ireland.
T: +353 (0) 65 6842465
M: +353 (0) 87 2831725
+353 (0) 86 3966868
E: info@inisenv.ie
W: www.inisenv.ie

Inis

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NON-TECHNICAL SUMMARY
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1 INTRODUCTION

McMahon Finn Wind Acquisitions Ltd wishes to develop a wind farm at Coor and Shanavogh, County Clare. The townlands for the Coor Shanavogh Wind farm project are Coor East & West, Shanavogh East & West and Killernan. This EIS is an assessment for a six turbine wind farm at Coor and Shanavogh, Co. Clare, from here on referred to as the 'Coor Shanavogh Wind Farm Project' and/ or 'the Project').

INIS Environmental Consultants Ltd have prepared an Environmental Impact Statement (EIS) on behalf of McMahon Finn Wind Acquisitions Ltd. The EIS has been prepared in accordance with the European Communities (Environmental Impact Assessment) Regulations.
Cumulative impact effects are also considered in conjunction with the consented wind farms at High Street and Glenmore, Boolynaglereagh, Booltiagh, Cahermurphy and the proposal at Slievecallan. The EIS is presented as Volume II within the overall submission. This Non-Technical Summary (NTS) of the EIS forms Volume I of the submission. Appendices are presented in Volume III, the Visual Assessment Photomontages and Visibility Maps (ZTV maps) are presented as Volume IV and the Scaled Planning Drawings are presented as Volume V.

A previous EIS (Planning Reference 10720) drafted for a larger wind farm project at Coor Shanavogh was submitted during 2010 by McMahon Finn Wind Acquisitions Ltd. The 2010 application (now withdrawn from the planning process) comprised of 12 wind turbines. This application was withdrawn following consultation as its proposed layout and extent were considered unsuitable.

This revised development for Coor Shanavogh is significantly scaled down in both layout and size and comprises 6 Enercon E82 electricity generating wind turbines with surrounding hard standing areas for construction and maintenance, an electrical compound, substation

operation building and associated equipment, associated excavation of borrow pits, new internal site tracks, upgrading of existing site tracks, and underground cables. An outline of the basic physical dimensions of the Enercon E82 is as follows:

- Rated power 2,300kW,
- Rotor Diameter 82m,
- Hub height 84.6m,
- Gearless, variable speed, single blade adjustment.

Specific project construction details are provided in Chapter 2 – Project Description (EIS Volume II) and in the relevant assessment Chapters. Pertinent characteristics of the project are as follows:

- The Proposed Coor Shanavogh Wind farm Project is located within the area designated by Clare County Council as *'Acceptable in Principal'*, Clare Wind Energy Strategy 2011-2017;
- The project landholding is 90.7 Hectares (224.1 Acres);
- The site planning application area/ size is 10.51 Hectares (25.97 Acres).

The Environmental Impact Statement (EIS) is submitted according to the following schedule of documents:

Volume I: Non-Technical Summary.
Volume II: EIS Text with individual Assessment Chapters.
Volume III: Appendices which include reports, figures and various technical information sheets etc.
Volume IV: Landscape Character Photomontages and Visibility maps.
Volume V: Scaled Project Planning Drawings.

2 PROJECT DESCRIPTION

The development will comprise of 6 Enercon E82 2.3 MW electricity generating wind turbines with surrounding hard standing areas for construction and maintenance, an electrical compound, substation operation building and associated equipment, associated excavation of borrow pits, new internal site tracks, upgrading of existing site tracks and underground cables. The site application area is 10.51 hectares. The proposed output capacity of the wind farm is 13.8 MW. The project site is located within the townlands of Coor West, Shanavogh East and Shanavogh West, in west County Clare. The proposed six turbine wind farm will be connected by underground cables to the proposed Coor Shanavogh wind farm substation. No additional substation compound or buildings will be required. The connection route, for the Coor Shanavogh wind farm will commence from this substation. The connection of the wind farm to the grid is being assessed in a separate grid connection study.

Project Outline

The project consists of 6 turbines in the 2 – 2.5 MW class; the Enercon E82 2.3 MW wind turbine has been chosen for this project. The turbines are sited within the site boundaries taking into account factors like minimum distance between turbines, maximising the yield of the turbines and making use of existing infrastructure, human habitation, noise limitations and shadow flicker limitations have been the primary constraints applied to turbine siting.

The hub height of the turbines is 84.58m exactly (rounded up to 85m) and the rotor diameter will be 82 meters resulting in a tip height of 125.58 m exactly (rounded up to 126 m). The site is located within an area designated by Clare County Council as *'Acceptable in Principal'*.

The turbines will be located upon wet grassland and immature forestry stands and will use the main Coor Shanavogh wind farm infrastructure – site entrance(s) and turbine access roads. The present land uses will continue after erection of the wind turbines and beyond the life of the machines. The locations of the six turbine sites have been chosen so that all machines are situated within areas which use the topography to minimise the visual impact of the turbines as much as possible.

The application is being made by McMahon Finn Wind Acquisitions Ltd and the new development involves six local landowners.

Existing Environment

The site of the Coor Shanavogh wind farm is in the Townlands of Coor and Shanavogh, near Mullagh and the Hand Crossroads in West Clare. The proposed site is located approximately 9 kilometres from the Atlantic Coast at Quilty County Clare and a little over 20 kilometres from the nearest major town of Ennis, County Clare.

The general area is upland and hilly in nature with elevations generally above 110 mOD. Two unnamed streams drain the general location within which the proposed site sits. To the north east of the site is the local mountain top high of Slievecallan at 390 mOD. To the south of the site the dominant natural feature of Doo Lough sits at an elevation of around 83 mOD. Ben Dash at 267mOD is the next highest peak located about 9 kilometres to the south east of the site location.

Land cover on site consists of mostly wet grassland and first rotation coniferous forestry. Some areas of land are agriculturally managed and can be described as improved agricultural grassland.

Irish grid reference coordinates for the approximate central location of the site are 510612, 674756.

County Development Plan 2011 – 2017

The County Development Plan 2011-2017 (enacted 7th February 2011) is a six-year plan for the County that sets out planning policy and objectives for that period. This Draft Clare County Development Plan 2011-2017 sets out a clear vision for County Clare which provides for an overall strategy for the social, economic, cultural and physical development of the County up to 2017. The vision will be achieved by the delivery of 20 Goals supported by strategic aims and objectives that are set out within the chapters of the Plan.

Goal 8 of the 2011-2017 CDP relates to the Environment, Goal 9 of the 2011-2017 CDP relates to Energy and Communication, while Goal 15 relates to Landscape. The most relevant policies of this document relating to wind/ renewable energy are summarized in 1.8 below. It should be noted that the development of the 6 turbine wind farm at Coor Shanavogh helps achieve these 2011-2017 CDP polices and the proposed Coor Shanavogh Wind Farm therefore helps satisfy many of the objectives set out in the Clare 2011-2017 CDP vision for social, economic, cultural and physical development of the County up to 2017.

Table 1.1 Relevant Policies of the Clare County Development Plan 2011 – 2017.

Policy	Description
CDP 6.5 Energy Supply:	It is an objective of Clare County Council to contribute to the economic development and enhanced employment opportunities in the County: a) by facilitating the development of a self-sustaining, secure, reliable and efficient renewable energy supply and storage for the County. b) by facilitating the County to become a leader in the production of sustainable and renewable energy for National and International consumption through Research, Technology Development and Innovation.

CPD 6.3.9 Natural Resources	It is an objective of Clare County Council to facilitate, encourage and appropriately manage the development of natural resources of the County.
CPD 9.13 Climate Change	It is an objective of Clare County Council: a) To have regard to the National Climate Change Strategy 2007-2012 and Limerick Clare Climate Change Strategy 2006. b) To facilitate measures which seek to establish a low carbon economy and society by 2020. c) To facilitate measures which seek to reduce emissions of greenhouse gases. d) To adopt sustainable planning strategies through integrating land use and transportation and by facilitating mixed use developments as a means to reducing greenhouse emissions.
CDP 10.1 Development of Low Carbon Economy	It is an objective of Clare County Council: a) To promote County Clare as a low carbon County by 2017 as a means of attracting inward investment to the County and the Mid-West region. b) To facilitate the development of energy sources which will achieve low carbon outputs.
CDP 10.2 Renewable Energy	It is an objective of Clare County Council to encourage and to favourably consider proposals for renewable energy developments and ancillary facilities.
CDP 10.3 Wind Energy Development	It is an objective of the development plan to promote and facilitate wind energy production in the County. Proposals for the development of infrastructure for the production and distribution of electricity through the harnessing of wind energy will be determined by reference to the County Wind Energy Strategy.
CDP 13.11 Wind Energy Development	It is an objective of the development plan to facilitate the development of Wind Energy developments in rural areas in accordance with the Wind Energy Strategy 2011-2017.
CDP 16.2 Settled Landscapes	It is an objective of the development plan: a) To permit development in areas designated as 'settled landscapes' to sustain and enhance quality of life and residential amenity and promote economic activity subject to: i) Conformity with all other relevant provisions

	of the Draft Plan and the availability and protection of resources ii) Selection of appropriate sites in the first instance within this landscape together with consideration of the details of siting and design, are directed towards minimising visual impacts. iii) Particular regard should be given to avoiding intrusions on scenic routes and on ridges or shorelines. Developments in these areas will be required to demonstrate: - That sites have been selected to avoid visually prominent locations. - That site layouts avail of existing topography and vegetation to reduce visibility from scenic routes, walking trails, water bodies, public amenities and roads. - That design for buildings and structures reduce visual impact through careful choice of forms, finishes and colours, and that any site works seek to reduce visual impact.
CDP 17.8 Non-designated Sites	It is an objective of Clare County Council: a) to ensure the protection and conservation of habitats and species of importance outside of designated sites throughout the County; b) to complete the Habitat Mapping of the County (in accordance with "*A Guide to Habitats in Ireland*" – The Heritage Council 2007) in order to identify and record the natural habitat of the County at a detailed level and afford appropriate protection to areas of importance, as required.

The above policies and guidelines were taken into consideration when designing the proposed wind energy development at Coor Shanavogh.

Wind Energy Development

Section 13.3.12 of the 2011 – 2017 CDP states that:

> "*There is significant potential for the development of wind energy in the County. County Clare has one of the best wind resources in the world – almost the entire county has either excellent or very good wind energy resource. As the economics of wind energy*

projects become more favorable many more rural areas across the County will be suitable for wind turbines. The development and siting of wind energy projects will need to be balanced with the potential impacts on the landscape and ecology. There are certain planning exemptions for small scale agricultural turbines."

Clare County Council has produced a Wind Energy Strategy for the County (please see Section 1.11.1.2.3.5 below). It sets out areas for wind energy development that are of local, county, regional and national importance and plans for technological advances in wind farms that may occur in the future.

The Development Plan for 2011-2017 has adopted four separate Wind Energy Designations, as outlined in Map D, Volume 2 of the document. These include:

- Strategic Areas,
- Acceptable in Principal,
- Open to Consideration, and
- Not Normally Permissible.

The proposed Coor Shanavogh Wind Farm is located in an area designated as '*Acceptable in Principal*'. Please see Section 1.1.1.2.4.4 – Wind Energy Strategy (Chapter 1 Introduction, Assessment Chapters, EIS Volume 2, for further details.

The Applicant

McMahon Finn Wind Acquisitions Ltd., as promoters of this project started the journey when the land was zoned under the County Development Plan 2005/ 2010. One of the three promoters relatives own the first land block. McMahon Finn was then approached by adjoining land owners to see if they could become involved. Because of the local connection it was very important to McMahon Finn to make sure the

greater community concerns were taken on board. McMahon Finn Wind Ltd (MFW Ltd) has invested significantly in preparing a project that complied with all current local/ national planning guidelines.

The landowners

1. *Elizabeth Sexton*
2. *John MacMahon*
3. *PJ Hennessy*
4. *Michael Glynn*
5. *Michael and Christina Scanlon*
6. *Cyril McMahon*

Assessment Quotations

Environmental Impact Statements by their nature contain statements about the proposed development, some of which are positive, and some are negative. Selective quotation or quotations out of context can give a very misleading impression of the findings of the study. Quotations should where reasonably possible be taken from the conclusions of specialists' sections or from the non-technical summary and not selectively.

Alternatives Considered

The initial alternative sites included the present landholding and lands to the west. In addition an additional larger landholding was initially established as a proposed site to the south of the final site location. This large landholding was submitted as part of the original application which was subsequently withdrawn and scrapped because INIS Environmental Consultants ltd studies found that these lands were not as suitable for wind farm development with the proposed layout. Three initial landholding sites were eventually disregarded and the final landholding outlined within this application was identified as the most suitable location for wind farm development. Following this several site layouts have been applied to the

land holding and assessment in terms of their suitability. We have had in total 7 proposed site layouts. Following extensive studies for prediction of potential environmental impacts for the various assessment criteria e.g. noise, shadow flicker, landscape and geo-technical considerations. In this application we have finalised a layout which sacrifices energy efficiency and power output to accommodate a significantly reduced impact on the environment. The original layout and the previous application included for 12 turbines; this application has now reduced that number to 6 turbines. This final layout satisfies all environmental safety and protection thresholds. Figures outlining previous proposed site layouts are not provided as they are not considered necessary or relevant and may lead to unwanted confusion.

The site layout has implemented absolute worst case scenarios for all assessment criteria:

- The site layout ensures that there will be no noise impact at any private dwelling and/ or structures;
- There will be no significant shadow flicker at any private houses;
- There will be no EMI at any private houses, any potential EMI will be dealt with according to RTNL protocol;
- There will be a significantly reduced visual impact from the turbine on the surrounding locality;
- No protected habitats or habitats of national or international value will be affected;
- No environmental designations will be affected;
- No watercourse's will require any re-routing, nor will any watercourses be under any significant negative impact;
- Local traffic will not be significantly affected as on-site borrow pits will provide the majority of construction materials;
- Water quality will not be affected;
- Ground water supplies or ground water quality will not be affected,
- There will be no impact on breeding/wintering/migrating birds.

Various site criteria and site constraint criteria were applied as part of the process. Some of the main criterion and constraint criteria applied as part of the overall site selection process included:

- Adherence to the Department of the Environment, Clare County Council and Irish Wind Association best practice guidelines, feasibility reports and planning regulations,
- Density and location of private dwellings,
- Density and location of various structures associated with human beings',
- Avoidance of noise levels from the project at any private structures/ dwellings',
- Avoidance of shadow flicker at any private dwelling/ structures,
- Economical capture of wind resource, estimated wind speed of 7.5 - 8 m/s (metres per second) are required,
- Proximity to a connection point with the electricity grid,
- Avoidance of excessive and/ or unacceptable visual presence in the landscape,
- Avoidance of excessive impact on hen harrier flight activity,
- Avoidance of ecological impacts,
- No special designations which would be significantly affected,
- Avoidance of Archaeological impacts,
- Reasonable road access,
- Topographical landscape suitable for construction,
- Adherence to DOE, CCC and IWA best practice guidelines, feasibility reports and planning regulations,
- In an area where it may be possible to obtain planning permission and
- An area where there are Low potential for electromagnetic interference and sufficient distance from housing.

A number of the other sites reviewed met some of the criteria required, but were either sensitively close to scenic areas or too far from the Grid. The site at Coor Shanavogh met all the criteria necessary.

Grid Connection Offers and Status

The finalised wind farm must have a location to connect to the electricity grid. The application for this and the finalised decision of where to connect is a separate process to the production of the EIS for the wind farm. Both the County Development Plan and the Local Area plan give policy consideration to the infrastructure requirements of wind farms and in particular the location of the National Grid. However, in practice whilst proximity is clearly a factor with respect to build costs and environmental planning considerations it is the actual availability of electrical grid capacity within the system which determines whether a project can be constructed in the network.

McMahon Finn Wind Acquisitions Ltd has received a letter (dated 16/07/2009) from ESB Networks Ltd acknowledging that a connection application has been received. The grid connection application has been deemed valid and is currently being processed. Further information regarding the connection details will be outlined as the roll out of offers continues to June 2011. It is not possible at this stage to say where the project will connect. That will be at the discretion of ESB and Eirgrid at the time of connection offer and will be based on the Least Cost Technically Acceptable principle to the group of projects being considered at that stage and in that Gate. This may or may not include the Mount Callan project but there are a number of other projects in the area which are outside the Gate 3 process. The application has been made to ESB and the final grid connection route and location will be at the discretion and jurisdiction of ESB, and this will be the subject of a separate planning application.

3 HUMAN BEINGS

The Human Beings section examines the relevant socio-economic context of the proposed development. It examines the impact on human beings, focusing on issues such as existing economic activity, land use, road traffic, tourism, amenity, health and safety, in so far as they relate to or are likely to have effects on the environment. In addition the Human Being Chapter includes an Assessment of Material Assets for the locality and all potential impacts on Material Assets are identified.

Tourism

The areas around Coor, Shanavogh, Slievecallan and Ben Dash has not been identified in the County Development Plan as being of particular importance for tourism, however there is a scenic route (The Mid Clare Way) approximately 9km to the south east with views directed toward Ben Dash and Slievecallan. More detailed assessment is provided in the Landscape and Visual Impact Assessment Chapter. The closest amenity Lough is Doo Lough 2.5 km to the south which is stocked with trout and fished by the Kilmaley and District Angling Association. Potential and perceived adverse impacts with respect to the effect on tourism and quality of life (local amenity) are dealt with in the EIS but based on the results of survey data are not considered to be significant.

Potential Impacts

Wind farms, regardless of location, have the potential for significant positive economic impact on the local economy both directly and indirectly. This is reviewed within the ES but summarised below.

Conclusions on Human Environment

In terms of socio-economics, the development is expected to have a positive impact, especially during the construction phase. The proposed development will enhance energy independence and security to a degree. It will exploit a sustainable resource while not diminishing material assets in the area. The wind farm is not expected to have any significant or adverse effect on tourism in the area or result in a critically adverse landscape impact. The proposed development does not lie within or adjacent to any tourist routes or significant sites of interest. There are no negative impacts on surrounding land use. The conversion of site land use to turbines and infrastructure is limited to approximately 2% of the total landholding.

There will be a temporary increase in local traffic during the construction phase of the project. The construction phase traffic will be managed and planned for in accordance will all regulations and requests of the Council. After construction is complete, the increase in traffic will be negligible.
The movement of oversized loads will require carful co-ordination with the Gardaí and the County Council. There will be no long term effects on the level of service experienced by road-users or the capacity of the road network in the area.

The health and safety implications of the proposed development from the design phase through to construction and operation of the wind farm have been taken into account. The construction phase is deemed the most hazardous stage of the proposed development. This will be addressed by the developer who will identify a site manager with responsibility for co-ordinating good environmental and health and safety practices during construction.

A 2007 survey by the Royal Institute of Chartered Surveyors on the potential impact of wind farms on house prices concluded that "proximity to a wind farm simply was not an issue." the worlds most comprehensive

study on the subject to date, the USA's Renewable Energy Policy Project compiled a survey of house values in the vicinity of wind turbines compared with those with no turbines in the vicinity. They examined 24,300 property transactions from 10 locations within the US over a period of six years; and concluded that there was no evidence to suggest that wind turbines sited within a five mile radius of property had a negative impact on value. In fact, property values appeared to rise above the regional average within the case study locations, suggesting that wind turbines actually had a positive effect on value. Given the well documented trends in Irish property and its relationship with national economic decline it could be argued that the most crucial indirect driver which will determine the future valuations of Irish property is the control of security of energy supply, energy supply diversification and energy cost. Unless a diversification of Irish energy reliance is achieved and energy costs are controlled or lowered then the economic climate will continue to suffer, consequently so too will property evaluations. On this basis it is clear that the provision of renewable energy to the Irish supply mix is indirectly crucial to the value of all Irish property.

4 FLORA AND FAUNA

An ecological assessment of the proposed wind farm site (including the substation, meteorological mast and borrow pit) at Coor, Shanavogh and Kilernan, Mullagh, Co. Clare was carried out by Openfield Ecological Services during June and July 2010. An Article 6 Screening Assessment was also carried out by Openfield during June and July 2010. The study evaluated the existing environment in terms of habitats and flora and the wind farm layout as proposed in 2010.

The proposed wind farm layout has since been significantly scaled back and a new layout has been proposed; nevertheless works carried out by Openfield are still relevant and useful as part of the now revised Flora and Fauna Assessment.

This chapter reviews the findings of the previous ecological assessments and investigates any significant effects of the proposed development on existing flora and fauna. The new turbine layout is assessed within this Flora and Fauna Chapter. Avifauna is dealt with in a separate chapter (Chapter 5).

Proposal:

The proposed development at Coor Shanavogh consists of six turbines and associated hardstands, a substation, three proposed borrow pits, a temporary site compound, underground cabling and access roads. The project landholding comprises a total area of 90.7Ha. Of this, the proposed temporary and permanent wind farm infrastructure will comprise just 7.3Ha, or 8% of the total landholding.

General Goals of the Assessment

The purpose of the study was:

- to undertake a desktop study of available ecological data for the site and area, including a review of designated sites within 10km of the site;
- to review the findings of the Openfield ecological field surveys of the site and surrounding land;
- to evaluate the ecological significance of the site in relation the existing flora and fauna present on the site and surrounding lands;
- to assess the potential impact(s) of the proposed wind farm development on the ecology of the site and surrounding areas;
- to recommend mitigation measures to reduce the potential negative impact(s) of the proposed wind farm development on the ecology of the site and surrounding land;
- to reassess the Article 6 Screening Assessment for the new turbine locations and site infrastructural layout.

The Existing Environment

Designated Sites:
The site is not immediately adjacent to or within, either wholly or partially, any areas designated for nature conservation including SAC, SPA, NHA, pNHA, National Nature Reserve, National Park, UNESCO Biosphere Reserve or RAMSAR Site.

There are two NHAs within a 5km radius of the proposed Coor Shanavogh Wind Farm:

- Slievecallan Mountain Bog NHA (site code 2397) is an area of upland blanket bog with important plant assemblages and breeding pairs of golden plover *Pluvialis apricaria* and hen harrier *Circus cyaneus*. Both of these birds are listed on Annex I of the EU

Birds Directive and are listed as Red and Amber conservation concern respectively (Lynas et al., 2007).

- Cragnashingaun Bog NHA (site code 2400) is of conservation value as it is a good example of both upland and lowland blanket bog in which both hen harrier and red grouse *Lagopus lagopus hibernicus* are recorded.

The Mid-Clare Coast is the nearest SPA (site code 4182). It encompasses a coastal area from Spanish Point south to Doonbeg and at its nearest point is 6km from the wind farm site (see Plate 4.1). It is important for a range of wetland and wading birds that over-winter here. The largely coincident Carrowmore Point to Spanish Point and Islands SAC (site code 1021) is designated for a number of coastal habitats that are listed under Annex I of the Habitats Directive.

Results

Habitats:
No rare or protected species of plant was recorded (Flora Protection Order; Curtis & McGough, 1988). A full flora species list for each habitat surveyed is provided in Appendix 4.1 of this chapter. All habitats identified and assessed within the site area are considered locally abundant and are commonly found throughout County Clare. Following site assessments the following habitats, which are classified in accordance with "*A Guide to Habitat Types in Ireland*" (Fossit, 2000), were found to exist within the proposed wind farm land holding areas:

Improved Agricultural Grassland – GA1:
Turbine 1 is located within Improved Agricultural Grassland, along with approximately 1,797m^2 of proposed new access road and one small borrow pit (Borrow Pit 3) comprising 900m^2. A total of approximately 4,421m^2, or 1.1 acre, of Improved Agricultural Grassland will be lost during the construction of the development. Of this, 0.8 acres will be permanent, for the lifetime of the windfarm. This habitat is the most

widespread habitat type in Ireland, highly modified and is of low biodiversity and conservation value.

Wet Grassland – GS4:

Turbine 2, the substation, Borrow Pit 1, the temporary site compound and approximately 2708m^2 of access road are located within this Wet Grassland habitat. Due to the species-poor nature of this habitat and it's highly altered state it is considered of low biodiversity value.

Conifer Plantation – WD4:

The majority of the proposed development is located within Conifer Plantation, including Turbines 3, 4, 5 and 6 and approximately 7806m^2 of access road. WD4 species diversity in the forest is very low. For this reason it is a habitat of low biodiversity value

Wet Heath – HH3:

Within the study area it can be seen that much of the land that is now conifer plantation was peatlands and likely to have been wet heath or blanket bog. The remaining areas here are small amounting to only 1ha in extent. They have been drained and turf has been extracted from them, leaving them in a highly degraded state.

Despite its poor condition wet heath habitat is of high local biodiversity value because of its listing on Annex I of the Habitats Directive. Turbine 6 is located at the edge of the conifer plantation to the south of the site where the habitat grades between wet grassland and wet heath just north of the Coor Shanavogh stream. The total habitat loss as a result will be extremely minimal, less than 0.1 acres.

Eroding River – FW1:

The Coor Shanavogh stream runs east to west along the south of the proposed site. It is no more than 1.5 meters wide at most and narrower towards the east. In places it is totally overgrown by bramble and willow *Salix cinerea*. Two turbines and access roads are located between approximately 22-350m from this stream. Turbine 6 is the closest

proposed turbine to this stream. The proposed access road will cross the Coor Shanavogh stream at one location to the southeast of the site between Turbine 3 and the substation.

A second waterbody, the Caheraran River, runs east to west to the north of the site and forms the site boundary for approximately 200m. This river eventually joins the Annagh River and flows into the Atlantic south of Spanish Point. All proposed new development works will be located at least 300m from this river. The hydrology of the site is discussed further in Water & Geology Chapters 8 and 7 respectively in Volume II of this EIS.

Drainage Ditches – FW4:

Drainage ditches are common in this area and all are man made. These have varying volumes of flowing or standing water and varying degrees of vegetation. No drainage ditches will be traversed or modified by the proposed development works

Spoil and Bare Ground – ED3:

There is a small areas of bare ground located Borrow Pit 1, Borrow pit 2 and at Borrow pit 3. This is a habitat classification where vegetation cover is less than 50% and there are a range of species such as foxglove *Digitalis purpurea*, bramble, ribwort plantain *Plantago lanceolata* and gorse.

Hedgerow – WL1:

Hedgerows are generally managed i.e. periodically cut back, to maintain a stock-proof barrier and are under 5m in height. Hedgerows border the river as well as fields. The hedgerows within the locality are generally of poor quality with many having spare and stunted vegetation. No hedgerows will be lost as a result of the proposed development.

Earth Banks – BL2 and Stone Walls – BL1:

An earth bank is little more than a heap of soil but may have been in place for considerable time. Stone walls are characteristic of the west of

Ireland landscape and can harbour a number of distinct species. Species diversity can be high along earth banks or hedgerows and while the quality from an ecological point of view is variable they should be seen as a network, laced across the landscape and providing refuges for large numbers of plants and animals. No stone walls will be impacted by the proposed development. The proposed access road will disect earth banks in two locations only, along the spur road to Turbine 1. This will involve the removal of no more than approximately 10m of earthbank.

Invasive Species

There are no records of alien invasive species in the area and none were recorded during site visits.

Fauna in the Existing Environment

Bat Survey

A dedicated bat survey was carried out by INIS Environmental Consultants Ltd in November 2010.

Two days and two nights were applied to field surveys. These survey bouts were carried out in November 2010, and as such survey conditions were not optimal. However, it should be noted that survey by an experienced ecologist outside the optimal survey season still allows for the assessment of the suitability of the locality for specific bat species via the presence/ absence of suitable feeding and roosting habitat. The initial reconnaissance field survey visit was completed over one full day for site investigations, site familiarization, and potential roost investigations/ transect inspections. All OS maps, site layout maps and aerial photographs were used to guide and aid this preliminary investigation and further field survey investigations. During survey investigations one ecologist worked using the most modern bat detection and recording equipment available. An Anabat was left stationary for remote recording on each night at different locations that showed potential for bat activity. The surveys where carried out according to all relevant bat survey

guidelines identified in the above guideline literature. The aim of the field survey was to:

- Carry out day investigations to ensure any transects proposed to be walked and roost/ potential roosts are still accessible prior to night walks;
- Carry out day investigations to check for evidence of bats at roosts/ potential roosts;
- Identify further suitable bat habitat during daylight hours. Transects used cover all habitat types on site and within the zone of interaction. It was also decided that most transects should start at a potential roost and end at or pass by a turbine location;
- Inspect and record potential roosts during night time hours;
- Carry out dawn bat surveys at identified bat roosts;
- Carry out emergence bat surveys at identified bat roosts;
- Carry out Daubenton's bat pass surveys at streams/ rivers on site;
- Identify the range of bat species present on site and proximal to the site;
- Develop a cursory approximate of bat populations and bat species diversity on site.

Badger

A well-used badger sett was recorded during the Openfield ecological survey approximately 1km south of the proposed Coor Shanavogh Wind Farm. No badger activity or badger setts were noted within the proposed wind farm site. Badgers may utilise the site occasionally however.

Irish Hare

Numerous sightings of Irish hare were made throughout the Openfield survey but confined to areas of grassland. They are likely to be using the conifer plantation. The Irish have is listed as of 'international importance' in the Red Data Book (Whilde, 1993).

Pine Martin

In Ireland pine martins are associated with areas of forest as well as open, rocky landscapes. While there have been suggestions that the expansion of conifer plantations in recent years have been in their favour, studies in the UK suggest that this is very much dependent on the nature of these forests and the availability of prey (NPWS, 2008; Birks, 2002). Pine martens are recorded from this region and it is possible that they are present in the conifer plantation habitat. They too are listed as of 'international importance' in the Red Data Book (Whilde, 1993).

Red Squirrel

The red squirrel is protected under the Wildlife (Amendment) Act 2000 in the Republic of Ireland. It is also on Schedule III of the Berne Convention. The red squirrel is exclusively a woodland species that occupies a wide range of woodland types across much of Ireland. There are an estimated 40,000 red squirrels in Ireland, across a fragmented range (NPWS/ Environment and Heritage Service, 2008). This species is scarce along western and northern coasts. Although not previously recorded in the immediate area of the site (Carey et al., 2007), they have, however, been recorded approximately 6km southeast of Doo Lough near Greygrove and within north Clare (National Biodiversity Data Centre

http://maps.biodiversityireland.ie). Given the presence of suitable habitat on site, it is possible that this species may be present in low numbers.

Amphibians and Reptiles

Both common frog *Rana temporaria* and the smooth newt *Triturus vulgaris* are protected under the Wildlife (Amendment) Act 2000, while the frog is also protected under Annex V of the Habitats Directive. During the May survey, tadpoles were observed in drainage ditches in a number of locations. Ponds are the preferred habitat of the Smooth newt (Marnell, 1998) while the common frog can be found in a wide variety of habitats (NPWS, 2008). No ponds exist across the site due to the gradients which favour fast surface water runoff. Other potential habitat includes drainage ditches. No drainage ditches are expected to be altered as part of the proposed wind farm works.

The common lizard *Lacerta vivipara* is Ireland's only native reptile species and is protected under the Wildlife (Amendment) Act 2000. It is known from a wide range of habitats in Ireland, including woodland and hedgerows, and they are thought to be widespread (Curran & Fagan, unknown year). The common lizard is not expected at the Coor site.

Fish and Water Quality

The small stream flowing through the site is not known to be of salmonid quality but it can be considered to be of salmonid potential i.e. suitable for Atlantic salmon *Salmo salar* or brown trout *S. trutta*. While macroinvertebrate sampling was not undertaken, in-stream conditions suggest that this stream is slightly polluted due to large growths of the algae *Cladophora sp.* and extensive 'tunnelling' i.e. the near total overshadowing of the water by vegetation (Toner et al., 2005). There is EPA water quality available for the upstream parts of the Coor Shanavogh water course close to Mullagh and the Drehidnacarriga bridge. The water quality rating here is Q4 – Good status. An additional sample site exists closer to Quilty where the stream flows into the sea. The Q-Value here is also Q4.

Invertebrates

A large number of insect species, both terrestrial and aquatic, are likely to be present on the site. Areas with a diversity of habitats are known to be rich in insect life. Due to the limited number of protected invertebrates in Ireland and a similarly poor level of data, it is unlikely that protected insect species are present on the site. The marsh fritillary butterfly *Euphydryas aurinia* is the only protected insect in Ireland, listed in Annex II of the Habitats Directive. It is not recorded from this part of west Clare (Fox et al., 2006). In addition, the food plant of its caterpillar life stage, the Devil's-bit scabious *Succisa pratensis*, was not recorded during field surveys.

A number of non-insect invertebrates are of conservation importance and are protected under European legislation. The white-clawed crayfish *Austrophtamobios pallipes* is not recorded from streams in west Clare (Souty-Grosset et al., 2006). The freshwater pearl mussel *Margaritifera margaritifera* in Clare is only present in the Fergus catchment (Moorkens, 1999). County Clare is outside the range of the Kerry slug *Geomalacus maculosus* (NPWS, 2008). Of the three protected whorl snails, only the nattow-mouthed whorl snail *Vertigo angustior* is to be found in Clare. This population is confined to the coastal grasslands around Doonbeg (Kerney, 1999).

Potential Impacts to Bats

It is our opinion that bat foraging habitat within the general locality is not of the highest quality and large bat populations/ numbers are not expected. There will be no significant impact to bat species or abundance. Bat activity during optimal feeding (weather) conditions is expected to be low due to the lack of high quality feed habitat available. In addition bats are not expected to commute at the rotor heights, the site is elevated and exposed and any bats which may be using the area are expected to conserve their energy and fly close to the vegetation and within sheltered areas.

Potential Impacts on Designated Sites

There are no designated sites located within the boundaries of the proposed wind farm site. However, two designated sites are located within a 5km radius; these include Slievecallan Mountain Bog NHA and Cragnashinguan Bog NHA. These sites are important because they still contain good examples of blanket bog habitat listed as Annex I Habitat, and the hen harrier listed on Annex I of the Birds Directive. The Mid-Clare Coast SPA and the Carrowmore Point to Spanish Point and Islands SAC share much of the same boundary and are located approximately 10km down stream of the proposed Coor Shanavogh Wind Farm on the west Clare coastline.

The only potential indirect impact which may affect the qualifying interests of the Slieve callan NHA is in relation to the hen harrier. Potential impacts on hen harrier are discussed in detail in Chapter 5.

There will **no direct impact** to the Cargnashinguan Bogs NHA during the construction or operation of the wind farm on habitats within this NHA. The only potential indirect impact which may affect the qualifying interests of this NHA is in relation to the hen harrier.

The only potential impact on the mid-Clare coast SPA from the proposed development is water quality impacts during construction works as the small stream on site drains into this SPA. However, the SPA is located at least 10km downstream of the Coor Shanavogh Wind Farm, and given the localised nature of the works, the distance from the SPA and best management practices employed to protect water quality, the potential impact on the SPA is considered **not significant.**

The only potential impact on the Carrowmore Point to Spanish Point and Island SAC from the proposed development is water quality impacts during construction works as the small stream on site drains into this SAC. However, the SAC is located at least 10km downstream of the Coor Shanavogh Wind Farm, and given the localised temporary nature of the works, the distance from the SAC and best management practices employed to protect water quality, the potential impact on the SAC is considered **not significant.**

Potential Cumulative Impact

Certain impacts in relation to biodiversity are particularly susceptible to cumulative effects. For instance, multiple small reductions in the length of hedgerow can result in long-term losses in species' populations and biodiversity. As these changes occur over long periods of time they frequently go unnoticed.

It is possible that there may be cumulative impacts on flora and fauna at the proposed Coor Shanavogh Wind Farm due to the presence of several other existing and proposed wind farms in the surrounding area. Potential impacts of isolated wind farms in areas where extensive alternative (undisturbed) habitat are available to wildlife can generally be considered to be lower than where alternative habitats are disturbed by existing developments. This can particularly be the case where flight lines of sensitive species such as wintering waterfowl are obstructed. This is discussed in further detail in Chapter 5, Avifauna. The primary species of concern when addressing cumulative impact of operational wind farm are birds and bats. Cumulative impacts on birds is addressed in Chapter 5. Field surveys showed that the Coor Shanavogh site does not contain large populations of any bat species and it is therefore not expected that there will be any significant cumulative impacts on the local bat communities.

Conclusions

This survey details the flora and fauna community occurring within the proposed wind farm site. The habitats on the site were dominated improved agricultural grassland, conifer plantation and wet grassland, none of which are of high conservational value. One small headwater stream flows to the south of the site. It has been evaluated as of low ecological importance; stretches further downstream do have salmonid potential.

In general the diversity of flora and fauna species on the site is low and the species and habitats recorded during field surveys are well represented in the surrounding area. With the successful application of mitigating measures and best practice construction techniques, Coor Shanavogh Wind Farm will not have any long term negative impacts on the habitats or locally occurring wildlife on the site.

With the successful application of mitigating measures the residual impacts post construction would be negligible.

5 AVIFAUNA

This section presents the results of an avifauna survey, which was carried out in order to determine the general nature of the avifauna present on site, and to identify any specific issues with regard to the potential significant impacts of the development of six wind turbines and associated works at Coor Shanavogh, Co. Clare. It has been compiled in compliance with the European Communities (Environmental Impact Assessment) Regulations 1989 – 2000 and follows Guidelines on the Information to be contained in Environmental Impact Statements (Environmental Protection Agency, 2002). This chapter also incorporates ornithological predicted impacts and suggested mitigation

Statement of Authority

Qualified ecologist Howard Williams CEnv CBiol MBiol MIEEM completed his B.Sc. in Biological Sciences, National University of Ireland Cork, in June 1997. Following his degree he worked as a biologist for three years (1997-2000). Mr. Williams has acted as lead ecologist on thirty two wind farm developments in Ireland and the UK since 2000.

Mr. Williams is a full member of the Institute of Ecology and Environmental Management (IEEM). He is a Chartered Environmentalist (CEnv) with the Society for the Environment (Soc Env) and a Chartered Biologist (CBiol) with the Society of Biology. Mr. Williams is principal ecologist with INIS Environmental Consultants Ltd and currently project manager on all INIS projects in the Republic of Ireland and the UK.

Christopher Cullen AIEEM is a qualified ecologist (Dip. In Field Ecology) and a graduate of UCC. In recent years he has worked on numerous bird surveys, both voluntary and non-voluntary. He has also been employed by BirdWatch Ireland as an avian surveyor, and completed the national red grouse survey. He has worked for UCC as an avian researcher on hen harriers, and as an avian surveyor for the Environmental Research

Institute. He has had work published in peer-reviewed journals such as Irish Birds and the Irish Naturalists Journal. He has also co-authored work in Irish Birds and Ringing and Migration. Mr. Cullen is the Project Manager for Bird Survey Ireland, a wholly owned subsidiary of INIS Environmental Consultants Ltd.

Stephanie Murphy B.Sc., M.Sc., MIEEM is a qualified Ecologist with a degree in Biological Sciences, National University of Ireland, Cork, received in 2002 and a Masters in Biodiversity and Conservation received from Leeds University in 2004. Stephanie has been involved in ecological surveys in Ireland since 2007, particularly in relation to the wind energy industry. She has had work published in *Irish Birds* and *Irish Naturalists' Journal.* Stephanie is senior ecologist with INIS Environmental Consultants Ltd.

Target Species included:

- Hen Harrier,
- Merlin,
- Barn Owl,
- Whooper Swan,
- Red Grouse.

Potential Impact on Hen Harrier

Hen Harriers are known to favour nest sites in tall stands of mature heather in upland habitat, or areas of early second-rotation clear fell forestry which border areas of heather moorland (or heather and rough grassland mosaic) (Wilson et al. 2009). Whilst there is young conifer plantation within the subject site boundary, only a small amount of what could be classed as heather moorland (in the form of wet heath) is present. This is further degraded in the southern section of the site and is unlikely to attract nesting Harriers as there are large expanses of suitable habitat to the east and north of the subject site. Parts of the subject site

containing wet heath and wet grassland may be utilised by foraging Harriers from territories proximal to the subject site.

On-going survey work at the subject site, including full Breeding Season Hen Harrier Surveys as per SNH guidelines will provide information into levels of usage of the proposed site for both foraging and breeding.

Consultation with local experts and with Dr Marc Ruddock of the Northern Ireland Raptor Study Group indicates that the nearest known breeding attempt to the subject site in 2010 was c.2.5km south of the subject site. As typical foraging rates for harriers can be up to 3-4km from the nest site (Arroyo et al., 2006), this clearly puts the subject site within the foraging range of this territory.

In a study of wind farms in the United Kingdom (Pearce-Higgins et al., 2009), hereafter referred to as Pearce-Higgins 2009, it was found that critical distances exist within which birds may be adversely affected by developments such as wind farms. In the case of the Hen Harrier the distance within which breeding bird density seemed to be adversely affected by turbines was 500m whilst it was also found that, in the case of wind farm infrastructure such as tracks there was no significant effect on Hen Harrier distribution due to proximity. As there is no known nest site within 500m of the subject site then we believe that the proposed development will have no significant impact on breeding bird density in the area.

With regard to any potential impact on foraging breeding hen harrier which are nesting outside the subject site, according to research (Arroyo et al., 2006) the maximum foraging range for a breeding male Hen Harrier is between 3 and 4 km, however approximately 75% of foraging occurs within 2km of the nest (the same research reports that females forage almost entirely within 2km of the nest).
One Irish case study which has been published refers to the Derrybrien Wind Farm, Co. Galway (Madden & Porter 2007), which continued to see

usage by Hen Harrier post construction. INIS surveyors have also personally observed Hen Harriers utilizing wind farm sites for foraging.

The next potential impact is on non-breeding birds, including juveniles dispersing following fledging and wintering birds. The current study has found usage of the site in November 2010 by a single Harrier- further usage may have been curtailed by the extremely cold conditions prevalent from December 2010 through to January 2011. However this may also be reflective of typical winter usage of the site.

In regard to collision risk, given the fact that the site to date exhibits very low usage by foraging Hen Harrier and also that there has been only one documented case of collision in Ireland (Scott & McHaffie 2008) we believe the chance of collision on this site is low, INIS has compiled numerous CRM models on sites with very high activity which showed no collisions in the 25 year lifetime of the wind farm in every case (INIS Environmental Consultants Ltd. 2008).

Potential impact on Breeding Birds

General Breeding Birds

The preliminary breeding bird study carried out in 2010 found only 19 species present, with only 2 species classified as Amber, namely Skylark and Starling.

In the case of Skylark, there is suitable habitat on site for a number of pairs. Pearce-Higgins 2009 found that while some species were significantly affected by wind farms, Skylark is largely unaffected. The following is quoted from same; "the effects of turbine proximity on skylark were of marginal significance". It is therefore thought unlikely that the number of breeding pairs of this species will be affected by development.

Starlings were only recorded flying through the site; however it is likely that birds breed at nearby farm buildings. Meadow Pipits were also

recorded in song. However Pearce-Higgins 2009 states that there is little evidence of any effect of wind turbine proximity on passerines. Given the amount of suitable habitat for both these species in the vicinity of the subject site we foresee no significant impact as a result of the proposed development.

Barn Owl

Given the low number of potential breeding sites found within the hinterland of the subject site during searches in January 2011, we foresee that the likelihood of breeding Barn Owl being in the area and therefore affected by the proposed development is low. Ongoing studies will provide additional information on occupancy levels of buildings identified as potential nest/roost sites.

Red Grouse

No Red Grouse were recorded from the subject site during the preliminary breeding survey in 2010 or the winter survey in 2010/2011. Though small amounts of wet heath are present it is unlikely to attract breeding birds and therefore the only likelihood of occurrence would be of dispersing birds from nearby natal areas.

In the case of Red Grouse, Pearce-Higgins 2009, found no evidence of turbine avoidance by Red Grouse however the study found that the only significant effect of proximity of wind farm infrastructure on Red Grouse distribution was that there was a greater occurrence of Red Grouse (analysed at the large scale) close to tracks. Red Grouse naturally eat available grit to aid in the physical digestion of heather. They regularly pass out grit and replace it on a daily basis. This demand for grit could explain the slightly higher occurrence close to tracks. We believe that the probability of long-term disturbance as a result of the construction of the proposed development on this species is low.

Potential Impact on Wintering Birds

Hen Harrier

Due to the low number of recorded flying bouts over the winter period 2010/2011 and total recorded flight time of just 97seconds we believe that there is no significant impact on hen harrier in the area during this period.

Wildfowl

Due to the low frequency of occurrence of any wildfowl species during the winter 2010/2011 season (total flight duration 20s at height interval of <10m) we believe that there is no significant impact on wildfowl as a result of the proposed development.

The low numbers of wildfowl found at surrounding water bodies also support this.

Wintering Raptors

The primary species of raptor present during the winter months is the Kestrel. As the total flight duration for this species was only 50s, we foresee no significant impact on this species during the winter period as a result of the proposed development.

Barn Owl

No observations were made of Barn Owl during dawn and dusk surveys conducted over the winter months. In addition, a hinterland search found no evidence of occupied sites within 1km of the subject site. Based on these findings we foresee no significant impact during the winter period on this species.

Merlin

No Merlin were recorded from the subject site during the dedicated Merlin survey conducted in January 2011. In addition no casual sightings were obtained from any of the visits between November 2010 and February 2011. We therefore foresee no significant impact on this species during the winter period as a result of the proposed development.

Mitigation

The overall footprint of the development has been minimised to reduce potential habitat loss. The layout of turbines and access tracks maximise the use of existing tracks in order to minimise habitat loss and disturbance to streams and known breeding areas. Important areas of heath/bog have been protected and the layout minimises loss of habitat that is important to species such as snipe and skylark.

Construction work for the turbines and access roads should be conducted outside the main breeding season (April to July) where possible. Where construction work is required in the breeding season, this should be undertaken following prior consultation with NPWS. Should works need to proceed during the breeding season a breeding bird survey should be conducted for ground nesting species on any area proposed for works and all nests identified and protected.

Construction works will be confined to the least area possible and off-road vehicle activity will be kept to a minimum.

The potential effects and mitigation measures are summarised in the Table 5.10.1. Volume II of the EIS. In all cases, provided the mitigation strategies are followed, the residual effects show no significant negative impacts.

Conclusions

The results of the 2010/2011 winter survey and the preliminary 2010 breeding season survey indicate that there are likely to be no significant impacts from the proposed development of this site on any birds of conservation concern.

Ongoing surveys following SNH recommended methodologies will further investigate levels of usage by species such as Hen Harrier (during the breeding season), Merlin, Barn Owl and Red Grouse, in addition to an assessment of hinterland usage by Hen Harrier. The results of these surveys shall also be reviewed in the context of recent literature, in particular, Pearce-Higgins 2009.

As part of an environmentally-responsible development scheme, the mitigation measures outlined in the current ES should be undertaken as part of a Construction and Environmental Management Plan (CEMP), including phased construction to avoid on-site works during the bird breeding season.

In conclusion the size and scale of the proposed works and (provisional) low frequency of occurrence of the conservation interest of the SPA (i.e. Hen Harrier), in addition to the implementation of meaningful mitigation measures will ensure that the proposed development will not have any significant impacts affecting the SPA or the conservation interest of the SPA.

6 LANDSAPE & VISUAL IMPACT ASSESSMENT

This chapter described the landscape context of a proposed wind farm at Coor and Shanavogh, County Clare and assesses the likely landscape and visual impacts of the scheme using a form of analysis which has been specifically developed for this environmental theme, the form of analysis is outlined in detail in Chapter 6 EIS Volume II. This analysis is based on scale of magnitude judgements for a set of criteria including landscape sensitivity, the visual presence of the scheme and also its aesthetic impact. Potential cumulative landscape and visual impacts in relation to other existing and permitted wind farms within the Study Area are also addressed.

The key objectives of this chapter are to assess the landscape and visual impacts of the proposed wind farm development at Coor and Shanavogh from a variety of receptor types, viewing angles and viewing distances. The following visual receptors are addressed:

- *Key views from sites of national or international importance;*
- *Designated scenic routes and views as set out in the relevant Local Authority developments plans;*
- *Local community views taking consideration of those people that live or work in close proximity to the proposed wind farm;*
- *Centres of population;*
- *Major routes;*
- *Amenity and heritage features.*

This assessment report was prepared by Richard Barker, Senior Landscape Architect, MosArt Landscape Architects, Wicklow. MosArt have extensive experience at project level and at the level of strategic planning for wind farms in Ireland. A summary of relevant experience is included in the Landscape and Visual Impact Assessment Chapter (Volume II, Coor Shanavogh EIS).

Visual Assessment Methodology

Production of this Landscape and Visual Impact Assessment involved desk studies and fieldwork comprising professional evaluation by landscape consultants. This entailed the following, reflecting the format of this report:

- Establishing a Study Area to reflect the potential visibility of the proposed development;
- Preparation of a Zone of Theoretical Visibility (ZTV) map to indicate areas from which the development is potentially visible in relation to terrain within the Study Area;
- Selection of potential Viewshed Reference Points (VRP) to be investigated during fieldwork for actual visibility and sensitivity (VRP's are the representative locations used as the basis for the landscape and visual assessment);
- Preparation of a VRP Selection Report to provide justification for the inclusion or exclusion of potential VRP's and to guide the visualisation specialist with regard to image capture for photomontages. The VRP Selection Report was finalised in consultation with Clare County Council to ensure VRP where selected following the considerations of the Local Authority;
- Description of proposed development and ancillary/ associated structures;
- Description of the geographic location and landscape context of the proposed wind farm site;

- General landscape description concerning essential 'Landscape Character' and salient features of the Study Area, discussed with respect to landform, vegetation, land use and structures;
- Consideration of design guidance, the planning context and relevant landscape designations.
- Semi-quantitative assessment of landscape sensitivity;
- Detailed assessment of photomontages produced by Macroworks Ltd;
- Estimation of the likely degree of impact on landscape; and
- Recommendation of mitigation measures where appropriate and possible.

Zone of Theoretical Visibility (ZTV)

Macroworks Ltd. carried out a computer automated study of the zone of theoretical visibility (ZTV – Volume 4). The purpose of this exercise is to identify the 'theoretical' extent and degree of visibility of turbines. This is a theoretical exercise because it is based on topography only at 10m contour intervals and does not allow for intermittent screening provided by, for example, hedgerows, forests or buildings and does not involve the actual height of crests (but using the nearest 10m contour below). Thus the ZTV map, assuming no screening, represents a worse than 'worse-case-scenario' with respect to viewing exposure. For the purposes of this project a radius of 20km was used for the ZTV as discussed earlier. A cumulative ZTV was also prepared, which indicates the intervisibility of other existing and permitted wind farms in conjunction with proposed scheme.

The following key points should be noted from the ZTV studies:

- The ZTV map indicates that the proposed wind farm will not be seen from the majority of the eastern half of the Study Area

beyond the Slieve Callan Uplands due to the screening effect of this landscape feature.

- The ZTV pattern covering much of the western half of the Study Area is fairly comprehensive indicating that this is a flat or only mildly undulating landscape that offers little in the way of terrain screening of the proposal.
- The ZTV map indicates that the beaches of Clare have a very limited view of the proposed scheme due to the immediate screening of the coastal dunes.
- The cumulative ZTV map indicates that there are no locations within the Study Area that would have a view of only the proposed Coor Wind Farm and no other wind farms.
- Only 15% of the Study Area has no theoretical view of any of the proposed, permitted or existing wind farms contained within the Study Area.
- 39% of the Study Area, predominantly within the coastal plains to the west of the Slieve Callan uplands, would have a view of the proposed scheme in conjunction with other existing and permitted wind farms.

Identification of Viewshed Reference Points as a Basis for Assessment

The results of the ZTV analysis provide the basis for selection of Viewshed Reference Points (VRP's), which are the locations used to study the landscape and visual impact of the proposed wind farm in detail. It is not warranted to include each and every single location that provides a view of this development as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the project. Instead, the assessors endeavoured to select a variety of location types that would provide views of the proposed wind farm from different distances, different angles and different contexts. This involves desk study analysis using the ZTV map and fieldwork to establish likely

visibility and the relative sensitivity of the VRP locations as well as the grid coordinates of positions from which photomontages can be prepared. The impact of the proposed development upon landscape is assessed using 6 distinct categories of receptor type as listed below:

- Key Views - from features of national or regional importance;
- Designated Scenic Routes and Views;
- Local Community views;
- Centres of Population;
- Major Routes; and
- Amenity and Heritage Features.

In the interests of providing a clear and concise report that focuses on the fundamental landscape and visual issues of the proposal, the VRP's will be grouped for assessment in relation to the above receptor types. Where a VRP might have been initially selected for more than one reason it will be assessed according to the primary criteria for which it was chosen, or alternatively, considered as a 'key view' due to its increased relevance.

The characteristics of each VRP receptor type are described in the Landscape and Visual Impact Assessment Chapter (Volume 2, Coor Shanvogh EIS). The MacroWorks Ltd., VRP photomontages are available for viewing in Volume IV.

Discussion and Conclusions

A summary table is provided below which collates the assessments of landscape sensitivity, visual presence, aesthetic impact and overall significance of impact of the proposed Coor Wind Farm from each of the 11 viewshed reference points used. A discussion of these results is provided thereafter, followed by a general conclusion on anticipated overall impact.

Overall Significance of Impact

On the basis of the judgements made in relation to landscape sensitivity, visual presence and aesthetic impact the majority of VRP's (6 out of 11) are attributed a Slight significance of impact. A Moderate significance of impact is applied to four of the VRP locations, but for slightly different reasons. In the case of DR1, LC2 and AF2, this results from the higher order of magnitude judgements that are made with respect to the sensitivity of the VRP location and the visual presence of the scheme. At CP3 a middling sensitivity rating and a Moderate Adverse aesthetic impact are responsible for the Moderate significance of impact judgement.

As the highest level of summary impact across the selection of VRP's is Moderate, the overall significance of impact for the proposed Coor Wind Farm is also considered to be Moderate. This is the median of five levels of impact significance available to the assessors and is defined earlier as 'An impact that changes the character of the environment in a manner that is consistent with existing and emerging trends'. If the majority of the currently permitted wind farms in the vicinity are constructed the significance of impact of the proposed Coor Wind Farm is likely to be diminished.

Proposed Mitigation Measures

A number of other general mitigation measures are included below:

- Matt non-reflective finishes should be used on all turbine components.
- Powerlines between individual turbines and the substation should be placed underground.
- Counter rotation of blade sets should be avoided.
- The number and extent of new track roads should be kept to a minimum and properly landscaped immediately following

completion of works. Such landscaping would include reinstating original vegetation along verges and repairing any wheel ruts. In addition, the colour of road material should be such as to minimise contrast with the surrounding land cover and include chippings coloured to match those in the immediate context.

- Special care should be taken to preserve any features which contribute to the landscape character of the Study Area. Any damage to existing hedgerows from transporting the turbines should be made good.
- The proposed development should, in so far as possible, not detract from the enjoyment of amenities, both visual and physical, within or adjacent to the site.
- A high standard of design should be applied to all structures associated with the substation considering not only its function but also the aesthetic quality, in order to minimise any sense of intrusion. The development should provide colour harmony and adequate screening of the substation using berms covered with scrub and ground vegetation in order to mitigate its impact. It is the intention of the developer to plant appropriate screening trees surrounding the substation compound.

7 SOILS AND GEOLOGY

Topsoil's overlay subsoil's and subsoil's overlay the underlying rock or geology. There are different types of soils, subsoil's and rock (geology), and they may be present in many variations across the site with specific environmental characteristics. Most importantly these characteristics determine the extent of (if any) engineering difficulties which may be encountered. Geotechnical ground investigations carried out as part of this report identify any risks which may exist onsite pertaining to peat, depths of peat and stability of peats and/ or soils. The results of the Geotechnical ground investigations have influenced the final layout of the site and determined various construction phase and residual phase (wind farm operating phase) recommendations. The geotechnical investigations (which were carried out by AGEC Ltd) have also been carried out parallel with the hydrological and hydrogeological assessment carried out by HES (Hydro Environmental Services Ltd). The following is a non-technical description of the soils and geology of the site and surrounding locality and its relevance to the proposed development.

Soils and Geology Assessment

The key objectives of the assessment were: -

- To identify the soils and key geological features of the site;
- To identify the potential impact of the proposed wind farm development on local soils and to identify primary and secondary characteristics of local geology which, may affect hydrology and hydrogeology;
- Trial Pitting by specialist contractor;
- Rotary coring by specialist contractor if necessary;
- detailed investigation and provision of geotechnical interpretative report of all ground investigations;

- Geotechnical report on ground conditions and foundation recommendations;
- To identify the potential impact of the local geology on the proposed wind farm development and its possible engineering constraints;
- To make recommendations for site infrastructures such as roads, passing bays, hard-standings, crane pads and turbine bases;
- To identify any areas of overburden which are part of environmental protection classification e.g. aquifer vulnerability classifications;
- To identify the secondary characteristics of local soils which may affect hydrology and hydrogeology;
- To identify the stability of peat soils on site via a Peat Stability Report;
- To create a management system for excavated soils;
- Cross reference assessment results with Hydrological and Hydrogeological assessment by HES;
- To recommend appropriate mitigation measures to minimise the impacts of the development;
- To identify potential borrow pit locations and provide peat and excess soil temporary storage and permanent deposition areas;
- To recommend appropriate mitigation measures to minimise the impacts of the development;
- To recommend appropriate mitigation measures and construction phase management protocols to minimise the construction phase and operational impacts of the development;
- To ensure complete protection of groundwater resources;
- To ensure complete protection of surface water resources.

Soils and subsoil's are dominated by wet peaty soils and peat. There are some areas of well drained sandstone derived soils (sandstone derived tills). The non-peat soils can be described as shale's and sandstone glacial till, chiefly derived from Namurian rock. The predominant form of on-site drainage is surface water run-off towards the few onsite bedrock

substrate streams. Groundwater movement is expected in the onsite soils. The proposed project is not expected to change surface water drainage in any significant way. This is addressed in more detail in the hydrology and hydrogeology section which was carried out by HES Ltd.

Peat Stability

No previous peat failures have been recorded at Coor (Geological Survey of Ireland (GSI), 2006). The nearest recorded peat failure is located some 20km to the north of the site within an upland area called Ballaghline. The failure recorded by Geological Survey of Ireland (GSI) occurred in 1900 however no description of the failure is given.

Site reconnaissance was carried out in March 2011 by AGEC Ltd. The conclusions of the study area reconnaissance are summarised below:

- The turbines are located in areas of relatively shallow peat and as such are not considered to be at risk from peat failure.
- Numerous exposures of mineral soil and outcrops of rock are evident across the site.
- Slope angles range from 1 to 5 degrees at turbine locations.
- No evidence of past failures or signs of instability were noted on site.

Site Investigations

Site Investigations comprised peat depth probing at and adjacent to proposed development footprint and at various locations across the study area. In situ peat strength measurements were also made.

Summary of Peat Depths and Distribution

Peat depths were contoured to create a peat depth map for the study area. See Figure 2 (Peat Thickness Zonation Plan) of Appendix X to this EIS, Report on Assessment of Peat Stability for Proposed Coor Wind Farm. Peat depths were recorded at each turbine location and along access tracks. At turbine locations peat depth varied from 0.4m (T6) to 0.7m (T3).

Drained and Undrained Peat 'Factor of Safety' Analysis

The results of the drained and undrained analysis are presented in Appendix D of AGEC's Report on Assessment of Peat Stability for Proposed Coor Wind Farm, included as Appendix X to this EIS.

In summary, the results of the undrained analysis for the study area are as follows:

i) Calculated FoS for load condition (1) is in excess of 1.3 for each location analysed with a range of FoS of 29 to in excess of 100 across the study area.

ii) Calculated FoS for load condition (2) is in excess of 1.3 for each location analysed, with a range of FoS of 15 to in excess of 10.

In summary, the results of the drained analysis for the study area are as follows:

i) Calculated FoS for load condition (1) is in excess of 1.30 for each location analysed, with a range of FoS of 2.4 to in excess of 10.

ii) Calculated FoS for load condition (2) is in excess of 1.3 for each location analysed, with a range of FoS of 2.1 to in excess of 10.

Peat slope Factors of Safety (FoS) Undrained for Condition 1, are mapped and have been contoured to create a FoS map for the area of the study area. See Figure 3 (Factor of Safety Plan) of AGEC's Report on Assessment of Peat Stability for Proposed Coor Wind Farm included in the Appendices of Volume III of this EIS.

Borrow pits

Three small and now dormant quarries exist throughout the site. These quarries were used for the small scale quarrying of sandstone rock for local building purposes. Site investigations indicate that bedrock is close to the surface (<1 meters below ground level - bgl) at most parts of the site landholding. Indeed rock is located within 0.5 mbgl at many locations; rock is outcropping at the existing quarry locations. These locations are obviously the most suitable candidate locations of the proposed borrow pits on-site.

The three proposed borrow pit extraction sizes and designs have been developed to not only provide the quantity of the rock necessary to develop on site roads, hard standings and other infrastructure, they have also been designed to cater for the deposition/ reinstatement of excess quantities of excavated peat and soils from turbine and road construction. The borrow pits will provided a sufficient stable storage area for all excavated peat and soils. The final reinstatement design is also complementary to the surrounding topographical environment. See scaled planning drawings, EIS Volume V.

In line with good practice existing peat will be used in immediate post-construction restoration works for track verges and at borrow pits. During excavations the upper layers of peat (which contain the seed bank) will be temporarily put to one side so it can be reinstated on top of reinstatement areas.

The borrow pits will not only provide on site construction material while reducing the need for additional HGV deliveries to the site, they will also provide reinstatement areas for excavated peat and soil.

Conclusions

In summary the following conclusions are given (please refer to the full text in Chapter 7 of the EIS Volume II for further explanation of any technical aspects:

(1) Peat depth across the sites ranges from 0 to 1.6m, which indicate that peat depths are shallow.
(2) Slope angles recorded for the site ranged from 1 to 14 degrees.
(3) Based on ground investigation the ground conditions were recorded as typically peaty topsoil over bedrock. The bedrock was Namurian Siltstone and Shale.
(4) Undrained shear strengths in the range 28 to 100 kPa were recorded in the Peat which would be typical of well drained Peat.
(5) An analysis of peat sliding instability was carried out for each of the turbine and structure locations across the site for both the drained and undrained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes and the mineral soil below the peat.
(6) For the undrained condition for the peat, the calculated FoS for load conditions (1) & (2) are in excess of 1.30 for each location analysed with a FoS of 2 or greater at all locations.
(7) For the drained condition for the peat, the calculated FoS for load conditions (1) & (2) are in excess of 1.30 for each location analysed with a FoS of 2 or greater at all locations.
(8) The risk assessment at each turbine (and structure locations) identified a number of control measures, see Appendix A of the Report on Assessment of Peat Stability for Proposed Coor Wind Farm by AGEC (included as an Appendix to this EIS in Volume III), to reduce the potential risk of peat failure. Access roads to turbines should be subject to the same control measures that apply to the nearest turbine.
(9) In summary, the stability analysis results show that the FoS's for the Coor site are acceptable and are greater than the required minimum

value of 1.3 from code of practice for earthworks BS 6031:1981 (BSI, 1981). The high FoS's determined for the peat slopes at the proposed site indicates that there is minimal potential for peat failure.

8 HYDROLOGY AND HYDROGEOLOGY

In the context of this assessment hydrology is the study of the movement, distribution, quantity and quality of water throughout a defined area, including the hydrologic cycle, water resources and environmental watershed with its associated features of drains, streams, rivers, lakes and wetland areas. Hydro-geology deals with the distribution and movement of water in the soil and rocks i.e. groundwater. When water/ groundwater are present within soils and or rock within a definable area, it is commonly referred to as an aquifer. The hydrological investigations were carried out by Hydro Environmental Services Ltd. The hydrological investigations have also been carried out parallel with the geotechnical and soil and geology assessment work. The following is a non technical description of the hydrology of the site and surrounding locality and its relevance to the proposed development.

Desk Study Review

The Geological Society of Ireland (GSI) and the Environmental Protection Agency (EPA) ENVision Geographical Information System (GIS) have identified the following for the site location and surrounding locality:

- The site is within the Miltown Mabay groundwater body delineation
- There are no wells within the site.
- There are no karst (underground cave, potholes, conduits, rivers, lakes etc) features.
- No gravel aquifers within the site or proximal to the site.
- No bedrock faults within the site or proximal to the site.
- The aquifer is classified as LI - 'Locally Important Aquifer – Bedrock which is moderately productive only in local zones.
- There is no groundwater 'Source Protection Zone' within the site or proximal to the site.

- The groundwater vulnerability rating is 'High to Extreme (rock near the surface)'.
- The site is within the hydrometric area identified as HA 28 Annageeragh – Annagh – Creegh - Coastal.
- The Annagh River flows East to west to the north of the site (the Annagh Rivers watershed catchment is outside of the site.
- The Annagh River has a water quality rating of Q3 (Poor staus) upstream and Q4 – Good Status further downstream.#
- The Annagh river flows to Spanish point beach a SAC/ SPA and NHA
- A 1st order stream (headwater) flows along the southern boundary of the site.
- The 1st order stream flows into Doonogan Lough
- The 1st order stream eventually flows to the sea just south of Quilty.
- There are no Water Framework Directive (WFD) Salmonid rivers present
- There are no Water Framework Directive (WFD) Nutrient sensitive rivers present
- There are no IPPC licensed facilities proximal
- There are no Waste facilities present.

Local and Regional Hydrology

A regional hydrology map is shown as Figure 8.4. The site is situated in two surface water catchments. The majority of the site drains into the Annagh River which flows in a south-westerly direction to the north of the site before entering the sea 1km south of Spanish Point (i.e. 6.3km down-gradient of the site). The Annagh catchment makes up approximately 57% of the total site area. There is no long term flow data available for this river which has a catchment area of approximately 9.8km^2 up-gradient of the site.

The southern section of the site (and most of the development area) drains into a small unnamed first order stream (S1) which flows in a westerly direction along the southern boundary of the site for much of its length before entering the sea 2km south of Quilty Town (i.e. 8.7km down-gradient of the site). The stream briefly flows through the site on the south-eastern section before forming the sites southern boundary. The stream flows within a deeply incised channel with a depth and width of 1.5m and 1m respectively. The stream channel is within mineral substrate subsoil and has bedrock bedding. The stream catchment makes up approximately 43% of the total site area. The stream catchment area up-gradient of the site is estimated to be 1.5km^2.

Proposed turbine locations T1, T2 and T5 and existing borrow pit no. 3 are located within the Annagh surface water catchment. Proposed turbines locations T3, T4, and T6 and existing borrow pits no. 3 and no. 2 are located within stream S1 surface water catchment.

Site Drainage

The only natural drainage feature within the site boundary is stream (S1) which briefly flows through the south-eastern section of the site prior to forming the sites southern boundary. Stream S1 is a small first order stream. Otherwise, the majority of the southern section of the site (with

the exception of the area to the south of stream S1) has shallow land drains present which are associated with the existing conifer plantation. The area to the south of stream S1 is poorly drained grassland. The conifer plantations are present predominately on the southern facing slopes of the catchment divide and therefore drain into stream (S1) along the southern boundary of the site. These shallow drains, which were noted to be dry on the day of the survey (25/03/2011), run 45° degrees to the topographic contours and are spaced approximately every 15m. The northern section of the site, which predominately slopes north towards the Annagh River, generally comprises agricultural land and therefore extensive drain networks are generally absent in this part of the site.

Flood Risk Assessment

OPW's indicative river and coastal flood map was consulted to identify those areas as being at risk of flooding. No areas within the site boundary were identified from the maps. A number of recurring flood incidents associated with tidal flooding are mapped on coastal areas downstream of the site. The available OPW flood report for this location is shown on www.flooding.ie.

Hydrogeology

The rocks of the Central Central Clare Group, which underlie the site are classified by the GSI (www.gsi.ie) as a Locally Important Aquifer, having bedrock which is generally unproductive except for local zones (Ll). The Namurian rocks of the Central Clare Group which comprises sequences of sandstones, siltstone and shale are generally devoid of intergranular permeability. Groundwater flow occurs only in fractures, joints and faults, except for the top few metres of the rock where the rocks are likely to be more fractured and/ or weathered. Bedrock fissures are generally poorly connected, with fissure permeability reducing rapidly with depth (GSI, 2003). Most flow is therefore expected to occur in the top 5 to 15m of the bedrock. Due to the low bedrock permeability, and low infiltration rates, a

high proportion of the rainwater will leave the site as surface runoff. Surface waters are therefore more at risk of contamination from any localised groundwater contamination. Base flow contribution to streams tends to be low, particularly in summer as the groundwater regime cannot sustain summer base flows due to low storativity with the aquifer. The stream hydrochemistry (Section 8.3.6) would indicate water which has a low residence time within the catchment. In winter, low permeabilities will lead to a high water table and potential water logging of soils which is consistent with the mapped soil type of the site (i.e. poorly drained mineral soil). Local groundwater flow directions will mimic topography whereby flow paths will be from topographic high points to lower elevated discharge areas at streams and rivers. Therefore, the anticipated local groundwater flow direction in the northern section of the site will be towards the Annagh River (i.e. northwest). The anticipated local groundwater flow direction in the southern section of the site will be towards stream S1 (i.e. south – southwest). The regional bedrock groundwater flow direction is likely to be to the southwest. The regional aquifer map is shown as Figure 8.5.

No wells are recorded in the GSI wells database (www.gsi.ie) within the site boundary. Three wells are recorded in the GSI wells database within ^{3}km of the site boundary. The two closest are at a distance of approximately 300 and 470m from the north-eastern boundary of the site. The third mapped well is located 780m to the south of the site. These are likely to be wells which serve single houses or farms within the area, but well yields would be expected to be small. None of these mapped wells are located hydraulically down-gradient of the proposed development (refer to Figure 8.5). Consequently the development does not have the potential to impact on the water supply of these wells. In addition no public supply wells or source protection zones occur within 5km of the study area.

Conclusions

The site is situated in two surface water catchments. The majority of the site drains into the Annagh River (57%) which flows in a south-westerly direction to the north of the site.

The closest turbine to the Annagh River will be located at a distance of approximately 320m.

The southern section of the site (43%) and most of the proposed development area drains into a small unnamed first order stream (S1) which flows in a westerly direction along the southern boundary of the site. The closest turbine to S1 is approximately 20m.

Mitigation measures will ensure that surface runoff from the developed areas of the site will be of a high quality and will therefore not impact on the quality of downstream surface water bodies. Any introduced drainage works at the site will mimic the existing hydrological regime thereby avoiding changes to flow volumes leaving the site.

Due to the distance of the Annagh River to the proposed development areas, negligible to no impact is anticipated for this water course after mitigation measures are put in place.

Direct, negative, slight to imperceptible, short term, low probability impacts on Stream S1 are anticipated during the construction phase. This relates primarily to tree felling and excavation work.

9 NOISE IMPACT ASSESSMENT

This chapter addresses the impact of noise emissions from the proposed development. This chapter is based on monitoring and modelling carried out by Biospheric Engineering Ltd. This chapter has been prepared by Biospheric Engineering Ltd., with the work undertaken principally by Eugene McKeown, BE, LLB, MSc, C Eng.

The main purpose of the study was to:

- Establish the existing noise levels in the environs prior to the proposed development;
- Project and assess all of the potential the noise levels which may be generated at different wind speeds by the proposed development;
- Provide a full potential noise impact assessment for all surrounding sensitive receptors such as private dwellings;
- Advise on appropriate mitigation measures.

The following guidelines where applied:

- Planning Guidelines for Wind Energy Developments, Department of Environment, Heritage and Local Government;
- Best Practice Guidelines for the Irish Wind Energy Industry, Irish Wind Energy Association, 2008.

Potential Noise Impacts

The potential impacts of the development can be broken down in two phases; noise impacts during construction and noise impacts during operation.

Potential noise during Construction

Potential noise impacts during construction of the proposed wind farm would include:

- The main activity associated with construction will involve road construction and the placing of turbines in-situ

- Construction noise levels tend to be loud for short periods coinciding with peak construction activity.

- Most of the noise sensitive locations are located several hundred meters from a turbine; the impact on any individual location is likely to be minimal.

- All construction will be carried out in accordance with BS 5228: Part 1: 1997 (Noise Control on Construction and Open Sites - Part 1. *Code of Practice for Basic Information and Procedures for Noise Control*).

- Accordingly all construction traffic to be used on site should have effective well-maintained silencers. Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery. Where possible the contractor will be instructed to use the least noisy equipment. With efficient use of well-maintained mobile equipment considerably lower noise levels (3-6 dBA) than those usually associated with construction projects can be attained.

- The increase in noise levels resulting from construction road traffic will be no more than marginal and there will be no night time traffic noise associated with the proposed development.

Potential Operational Phase Noise Impacts

Potential noise impacts during operation of the proposed wind farm would include:

- While the noise levels in the turbine area are elevated the levels reduce rapidly with distance.

- The geographical layout of the wind farm, the natural attenuation due to the ground contours also assist in mitigating the noise levels. Significant effort has been carried out to provide a very detailed topographical survey of the site; the final resolution is notably accurate. This topographical data has been input to the noise models.

- The models indicate that the proposed wind farm Guideline Noise Limits will be exceeded at noise sensitive properties at wind speeds of 6m/s and 7m/s.

- The noise levels are easily mitigated by de-rating the turbines indicated. De-rating is the process where individual turbines which may have the potential to cause a noise impact at a noise sensitive location are programmed to cut out i.e. reduce output or stop operating at certain wind speeds. Turbines are generally de-rated or programmed to stop working at low or intermediate wind speeds which have associated low background noise levels. This has an impact on Wind Farm output at intermediate wind speeds. The only locations with residual impacts are in the ownership of the Wind Farm developers.

- While these levels are within the acceptable limits this does not mean that the noise from the wind farm will be inaudible at all times. Certain adverse wind conditions could lead to some persons

(when outdoors) being able to hear a noise from the turbines. This will not generally be the case however, as in most conditions the wind farm will be inaudible at all noise sensitive locations in the locality.

- The wind farm therefore complies with the DoEH&LG guidelines (2008), complies with good practice and does not generate noise levels that are likely to cause a nuisance.

Mitigation Measures

Mitigation measures are required to ensure the wind farm is constructed and operated in compliance with the Department of Environment, Heritage and Local Government Guidelines (2008) during the construction and operational phases. A summary of the mitigation measure points is as follows:

- The site activity associated with the construction of the wind farm (placement of turbines) will result in maximum hourly L_{eq} values in the region of 65 dB (A) at the nearest residence during normal working hours, while for most of the construction period the Leq values will be considerably less than 55 dB (A).
- The gear box is generally the most significant form of noise from wind farm developments; however the chosen turbine for the Coor project is the Enercon E82. One of Enercon's key innovations is the gearless (direct drive) wind turbine in combination with an annular generator;
- Noise levels do not exceed the guideline figure of 37 dB at wind speeds below 7m/s and background plus 5dBA at wind speeds of 7m/s and above;
- Event of any malfunction of the turbines, which may cause a tonal or impulsive noise emission, immediate action will be taken to correct same. These action (if necessary) will form part of the

contractural maintenance works associated with the running and operation of the turbines;

- All proposed turbines are located at appropriate distances from all residences as part of the final site layout; Operational control measures (pre-programmed de-rating) on individual turbines will be implemented as required mitigating noise levels at higher wind speeds. These are required on turbines numbered T3, T4, T5 and T6;
- Following installation a long term noise monitoring programme will be agreed with the County Council to ensure compliance with the noise limits.

Conclusions

It should be noted that the gear box is generally the most significant form of noise from wind farm developments, however the chosen turbine for the Coor project is the Enercon E82, One of Enercon's key innovations is the gearless (direct drive) wind turbine in combination with an annular generator.

Noise emissions close to wind farms tend to equate to natural (non-man made) sounds and is normally characterised as wind generated noise, noise emanating from the wind effects on trees, shrubs etc. The noise characteristic will closely simulate noise emission from wind effects on trees / vegetation. When wind is away from residences, the noise emission should be indiscernible. In most rural areas the ambient noise environment is controlled in the main by the wind speed influences / interaction on wind on foliage / vegetation – the higher the wind speed the higher the noise levels generated. Level for level, wind turbine generated noise is less objectionable than industrial or road traffic noise. In elevated wind speeds, above 8m/s, the noise emissions from the wind farm will be masked either partially or totally. In periods of low wind speed the turbines will not operate, as the cut-in speed will be fixed. There will be no tonal or impulsive sounds contained in the wind farm noise emissions.

In summary the noise from the wind farm will not exceed the Wind Farm Planning Guidelines (2008) at any noise sensitive location for wind speeds below 6 m/s. At 6m/s and 7m/s mitigation measures comprising a de-rating of a limited number of turbines can easily control noise levels to within the guidelines.

The noise levels from the wind farm (37 dBA) are 8 dB below the permitted level of a fossil fuelled equivalent electrical generator.

10 AIR QUALITY AND CLIMACTIC CONDITIONS

This Chapter provides an assessment of baseline air quality at the proposed development locality and assesses air quality in terms of short term potential construction impacts (Construction Phase) and long term potential impacts following construction of the wind farm (Operational Phase). In addition the climatic environment for the locality is presented and applied for the assessment of air quality and local climactic factors.

Construction Phase Impacts

During construction, increased vehicular movement will result in locally increased levels of exhaust emissions and dust. These impacts will be local, of temporary duration and their impacts are not considered significant. The construction phase will have no impact on the local climactic environment. For the most part the wet local weather condition will interact with the construction phase in a positive way to alleviate any dust problems. During dry weather condition dust bowsers will be employed to ensure dust emissions are not excessive.

Operational Phase Impacts

When in operation the wind farm will have indirect, positive impact on air quality. The proposed development will result in the production of up to 13.8 MW of energy from a renewable source which, once fed into the National Grid, will avoid pollution that would have been caused had the energy been generated by other means, such as the combustion of fossil fuels. The operation of the wind turbine will not have any notable impact on local climactic conditions.

In combination and Cumulative Impacts

Locally there is the potential for strong winds and dry weather to combine during the construction phase leading to dust emissions off-site. There are no regional in combination or cumulative impacts possible.

Do Nothing Impact

If the proposed wind farm is not constructed, it is likely that the proposed site would remain as agricultural grassland, and conifer plantation. The cumulative effect of continued large-scale fossil fuel consumption and limited renewable energy development is likely to have serious consequences for global climatic conditions. If Ireland does not further reduce its emissions to meet the targets set down by the Kyoto Agreement, then the likely financial penalties will be substantial.

Mitigation Measures for Air Quality

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.

The majority of the dust emitting activities, which occur with all forms of civil engineering, are easily controllable by best practice measures. Depending on weather conditions at the time of works, best practice measures may include;

- wheel wash facilities and use of a mechanised road sweeper at the public road entrance if mud transfer is identified as an issue;
- dust suppression by water spray on access roads and other areas if dust becomes an issue;
- use of appropriately covered vehicles for transport of potential dust generating material such as sand and cement; and

- control of vehicle speeds on access tracks and other unsurfaced areas.

Conclusions

The development of the wind farm will itself have a direct, neutral impact on air quality. The generation of electricity from the wind farm will result in an avoidance of greenhouse gas emissions that would otherwise occur from fossil fuel power generating plants. The avoided emissions therefore result in a small indirect, positive impact.

The development of the wind farm will not have any notable or significant impact on local climactic factors of rainfall, sunshine, wind duration, direction or wind speeds.

11 CULTURAL HERITAGE AND ARCHEAOLOGY

For purposes of the assessment, the term 'Cultural Heritage' encompasses the archaeological, architectural and local heritage (place names, folklore etc.) resource. The Cultural heritage assessment and field archaeology was carried out by TVAS Ireland Ltd.

The TVAS archaeological assessment report is summarised in the section below, the relevant sections are re-presented and background headings are covered. Text form the TVAS report which is relevant to archaeological and cultural heritage assessment of the finalised wind farm project is identified and outlined here. The original report can be consulted in its entirety as a standalone report supplied in the Appendices of Volume III of the submission.

As the site layout was revised, TVAS were contacted by INIS to re-establish the assessment process. Upon finalisation of the site project layout the final project layout was superimposed on a geo-referenced map produced by TVAS Archaeological Services. This map detailed the areas of archaeological interest, the layering of the TVAS archaeological map and the final project site layout map allowed the assessment of the final layout in relation to archaeological features, this final overlaid map with site layout plans and archaeological details was resubmitted to TVAS for their comments. TVAS reassessed the new finalised site layout and provided their reassessment in a report letter, provided in the Appendices of Volume III of the submission.. The revised TVAS comments and recommendations are included below.

Desk Study

A desktop survey of cultural heritage sites within the study area was carried out in order to assess cultural heritage constraints. The Record of Monuments and Places (RMP) of Co. Clare, as published by the Archaeological Survey of Ireland, was the principal source for identifying

archaeological constraints. Additional information was gained from the Sites and Monuments Record (SMR) for the county and a review of local journals and publications. In addition the following sources were consulted:

- National Inventory of Architectural Heritage (NIAH) Survey Report for Co. Clare (2009),
- All available Ordnance Survey maps for the area,
- Clare County Development Plan 2005-2011,
- Archive material on Clare County Library website http://www.elarelibraryle,
- Excavations database (1970-2004) & Excavation Bulletins 2001, 2002, & 2003,
- Archaeological Impact Assessment of a proposed wind farm development at Coor Shanavogh. Unpublished report prepared by R. Crumlish in 2002! & submitted to Clare County Council.

Field Surveys

In addition to the desk-top research undertaken, and leading on from the results of that research, a field survey of the area of the proposed development was undertaken by two suitably qualified archaeologists/ built heritage specialists (TVAS Archaeological Services). The field survey was undertaken on Tuesday, 18th May 2010 under adverse weather conditions. The field inspection relates to the physical environment, the cultural landscape and the archaeological potential of the area of the proposed development. The primary purpose of the field assessment is the identification of potential low-visibility or previously unrecorded archaeological and/or historical features and areas of archaeological potential that may be impacted upon during development. Field inspection also aims to confirm the extent and location of recorded monuments, structures and features and considers the possible impacts of the proposed development on such. The field survey assesses the present topography and land-use and addresses the landscape potential

of the area by examining the recorded human activity in the past in relation to a particular landscape and considering the possible interactions between existing monuments or sites.

Final Site Layout – TVAS Comments

All areas were accessible and the site was assessed in terms of landscape, land use, vegetation cover, presence or lack of archaeological sites and potential for undetected archaeological sites/features. Upon finalisation of the site project layout the final project layout was superimposed on a geo-referenced map produced by TVAS Archaeological Services. This map detailed the areas of archaeological interest, the layering of the TVAS archaeological map and the final project site layout map allowed the assessment of the final layout in relation to archaeological features, this final overlaid map with site layout plans and archaeological details was resubmitted to TVAS for their comments. The final archaeological assessment conclusions/ results are outlined below.

Results & Conclusions

The finalised site layout has been reviewed by TVAS. The complete TVAS review report is supplied in the Appendices of Volume III of the submission. Summary of the TVAS comments (in italics) regarding the revised layout are as follows:

- *"The current proposed site layout is smaller than that under consideration in the 2010 assessment report, with the southern and western areas removed. The layout of the turbines and access roads has also been altered, with just six turbines included in the current proposal".*

- *"Just one monument listed on the Record of Monuments and Places (RMP) lies within the current site boundary - CL039-015, a ringfort/rath. According to the submitted plans, although construction activity is*

proposed for this part of the site, it is over 300m from the ringfort/rath. In addition 'Enclosure (site of)' is marked on the modern Ordnance Survey of Ireland (OSI) 1:5000 digital mapping immediately outside the site boundary, north of Turbine T1. This potential monument is not illustrated on any historic maps, nor is there any protected monument in this location on the RMP. It is not clear why the label has been placed on the OSI current map but there is no evidence that there is an archaeological monument here".

- *"It is recommended that all ground works associated with the construction be subject to archaeological monitoring. Particular attention should be paid to the area around Turbine T1 due to the uncertainty surrounding the 'Enclosure (site of)' nearby. Should any construction work take place within 200m of monument RMP CL039-015, the monument should be protected with secure fencing to prevent accidental damage".*

- *"Should any archaeological features or material be uncovered during the course of archaeological monitoring or any phase of the construction works, works will cease immediately, and the National Monuments Section of the Department of Environment, Heritage and Local Government should be informed. Time must be allowed for a suitably qualified archaeologist(s) to inspect and assess any such material. If it is established that archaeologically significant material is present full archaeological investigation and recording will be required. Archaeological excavation is the preservation by record of archaeological remains. Adequate financial and logistical provision should be made for any such archaeological excavation, related post-excavation, testing and/or conservation work and for the publication of the results".*

12 TRAFFIC AND TURBINE DELIVERY

The construction of six wind turbines at Coor Shanavogh will require construction vehicles, construction materials, plant and turbine parts to be delivered to the site. This chapter contains a description of the existing transport environment in the vicinity of the proposed Coor Shanavogh Wind Farm, the potential impacts of the proposed development on traffic and transport in the area and mitigation measures relating to roads and transport which will be put in place during the construction and operation of the proposed wind farm.

The Existing Transport Environment

The proposed wind farm is located in the townlands of Coor, Shanavogh and Kilernan, approximately 5.5km from Mullagh, Co. Clare. The elevation of the site ranges from approximately 90 m – 160 m OD (Malin Head), approximately 3km north of Doo Lough. Access to the proposed site is available from the M18 ring road around Ennis to the R474 running west to Coor and Shanavogh West. The site itself may be entered from either the northwest corner at Shanavogh West or the southeast corner at Coor via local roads. There are a number of existing forestry and farming tracks within the site. The proposed new access roads have coincided with these existing tracks as much as possible.

Coor Shanavogh wind farm is located in a remote area. The local roads and regional R474 may be considered relatively light traffic-wise in this area. The N85 and N86 are the main national routes leading from Ennis to West Clare. Thus temporary additional traffic on this route is unlikely to cause significant difficulties. It should be noted that these roads are already regarded as acceptable for removal of forestry during felling operations and consequently heavy vehicle movement would not therefore be an unexpected feature on these local and regional roads.

There is one bridge along the access route to the site, Inch Bridge (Gird Ref 530163, 675426). There is no restriction on this structure in terms of weight limit and it is of sufficient width for passage of up to 32m trailers. A small number of minor improvements have been highlighted along the route following a full route assessment by Exceptional Load Services Ltd (as outlined in Section 12.2.1). This survey assessed two possible routes to the site, the results of which are presented in Appendix 11 of Volume III of this EIS.

Assessment of Potential Routes

The assessment of delivery routes involves assessment for the delivery of turbine and substation equipment which require the use of exceptional load vehicles. For the turbines and substation equipment in principle it involves:

- elimination of non-suitable routes;
- elimination of routes which present excessive difficulties;
- assessment of suitable port facilities – principally the availability of off-loading equipment and sizeable laydown areas;
- assessment of the delivery route from port to site entrance in relation to road alignment (both vertical and horizontal);
- assessment of the delivery route from port to site entrance in relation to road (and bridge/ culvert) strength and running width.

Exceptional Load Services Ltd., a specialist company which provides route planning for delivery of oversized products such are wind turbine parts, were commissioned to conduct a full delivery route survey and assessment. The results of this survey are presented in Appendix 11 of Volume III of this EIS.

Proposed Turbine Delivery Route

It is proposed that all turbine parts will travel from the port at Foynes in Co. Limerick, follow the N69 to the M18 at Ennis and then onto the R474 to local access roads. The proposed turbine delivery route is presented in Appendix 11 of Volume III of this EIS. The completion of the new tunnel under the Shannon provides a convenient detour around Limerick city. The port at Foynes has been used successfully to transport turbine parts in the past, however Ringaskiddy and Dublin Port remain alternative options.

From Hand Cross on the R474 two potential routes were assessed by Exceptional Load Services (see Appendix 21.1 of Volume 4). One involved accessing the site from the local road to the north of the site in Shanavogh West, the other from the south in Coor. The latter route was deemed to be the preferable option as it required minimal land take and modifications apart from road widening in parts.

Other Construction Traffic

It is proposed that general construction traffic, such as personnel and material deliveries, will use the same access route as that for oversized loads, where appropriate. However, some vehicles and plant may come from different directions, depending on source locations.

There will be an increase in local traffic during the construction phase of the project. Construction personnel including plant operators, electricians,

engineers and trades-people will be commuting to and from the site. Intermittent deliveries of building material will also take place. Concrete, gravel and hardcore will be sourced locally where possible. It is expected that the suppliers will also use the same regional and country roads to access the site. HGV movements on public roads have been minimised by the proposed use of rock fill from a borrow pit within the site.

Vehicles requiring access to the site during the construction phase are outlined below. All access will be via the proposed entrance at the south eastern end of the site. Visibility splays and design details for this entrance are presented and outlined in the scaled application drawings Volume V of this EIS application. Internal operational traffic is also outlined in Chapter 12 of the EIS volume II.

Mitigation Measures for Traffic and Transport

To mitigate against the impacts of traffic associated with the project, the following mitigation measures will be implemented:

- The timing of turbine delivery along the N69 and R474 routes will be agreed with Limerick and Clare County Council's and the Gardaí to ensure that the affect on the public and emergency services is minimised.
- Parking facilities will be provided on site for construction traffic.
- A transport co-ordinator will be appointed to regulate all HGV movements to ensure easy access and egress to the site, as well as minimising the impact on local users.
- An experienced road repairs contractor will be appointed to carry out any necessary repairs to country roads upon completion of construction works, or earlier if deemed necessary by Clare County Council Roads Engineer; this is to ensure that access to the site is deemed passable at all times to minimise impact on local community.

- A condition survey of country roads will undertake pre-construction and the condition of the road agreed with the local Roads Engineer to provide a benchmark against which the condition of the road can be reviewed.
- A wheel wash, located inside the entrance to the proposed site, will mitigate the effects of mud or dust on the local road network.
- Water spraying will be used for dust suppression as required.
- A road sweeping vehicle will be provided as required to remove any mud that accumulates over time on the pubic road.
- Any road works will be carried out in accordance with the relevant environmental legislation.
- The application for on-site borrow pits significantly reduces the traffic impacts associated with the construction of the wind farm site, all rock aggregates will be sourced onsite.

Conclusions

Access to the site has been deemed by Exceptional Load Services as straightforward with minimal land take and modifications required. Although HGV movements to and from the site will increase during the construction phase of the development, this will be temporary. On a long term basis, once the site is in operation, it is anticipated that the development will not generate any adverse impacts on traffic in the vicinity of the site.

13 SHADOW FLICKER AND EMI

Shadow Flicker

Wind turbines will cast a shadow in their immediate vicinity when the sun is strong enough. Wind turbines differ from most other tall structures, as they have the potential ability to create a flickering effect on a stationary observer due to the rotation of the turbine rotor blades.

Shadow flicker is a rare problem and it is predominantly an indoor phenomena which may be experienced by a viewer sitting in an enclosed room by the flicker effect of the shadow passing the observers window or windows. It is rarely a problem outside when the light reaches the viewer from a much less focussed source and therefore the shadow flicker impact assessments are based on closest residences or indoor workplaces.

The latitude and geometry of all the turbine and the potential for shadow flicker can be calculated for any given residence. This work has been carried out and has been estimated for all the closest houses to the proposed Coor Shanavogh wind farm. Shadow flicker is generally only relevant within approximately 10 rotor diameters (around 830m) of a turbine since beyond this distance the shadows tend to be diffuse and no flicker effect can be discerned.

Predicted Impacts

There are no shadow-sensitive receptors within the locality of the proposed Coor Shanavogh wind farm that exceed 30 hours per year. The maximum shadow minutes per day is 12 minutes at receptor A and is caused by turbines number 4 and 5 (see Chapter 11, EIS volume II). Shadow flicker will only occur at this receptor in the months of January and February and October to December. However the guidance threshold

will not be exceeded and the effect will most probably not even reach 12 minutes. Appendix 10, EIS Volume III, includes the shadow calendar for the neighbouring premises.

The impact of the proposed wind farm is predicted to be negligible and overall no significant impacts are anticipated and no mitigation measures are required nor are any proposed. However, with modern sophisticated turbine control systems individual turbine operation can easily be restricted to prevent any effect during the brief periods where shadow flicker might be possible.

Electromagnetic Interference (EMI)

Wind farms, or individual wind turbines, like all large structures have the potential to interfere with television or radio signals via EMI. The towers are large steel obstacles and can provide a physical blockage to microwave links, and the alternating current electrical generating and transformer equipment, like all electrical equipment, generates its own electromagnetic fields. However, the most significant effect, at a domestic level, is straightforward involving a possible flicker effect caused by the moving rotor, particularly on television signals.

Depending on the topography surrounding a residence, a domestic receiver may receive broadcast signals from more than one location although the strength of those signals will vary with distance from the transmitter. It is normal for the receiver's antenna to be directed towards the most local, and usually strongest, broadcasting station. This is not, however, always the case particularly if the terrain is such that there is no direct line of sight between the receiver and that transmitter.

Radio and Telecommunications

No significant radio or television signal impacts have been experienced for the main wind farm since commissioning in September 2005 and none are anticipated for the extension.

Aviation

The Irish Aviation Authority (IAA) were contacted as part of the consultation process for the main wind farm and expressed no concerns regarding the wind farm. No requirements for aeronautical lighting were defined, solely that as built turbine co-ordinates be supplied following construction.
No impacts are anticipated on Civil Aircraft.

EMI Mitigation

The requirement for implementation of any miotgation measures will be addressed individually with RTENL (RTE Transmission Network Limited) and any other communications providers should the need arise. Currently no service providers have identified any concerns.

The RTENL protocol has already been entered into. This effectively requires the developer to accept responsibility for remedial measures which could be required as a result of potential negative impacts of wind farms on the RTE network.

14 INTERACTION OF THE FOREGOING

A matrix of all topics is presented in Table 14.1, which illustrates the overlap or interaction of topics. Please note that identification of interaction between environmental assessment themes/ topic does not necessary imply negative of positive cumulative impacts nor does Interaction in the matrix.

Table 14.1 Interaction matrix.

TOPIC	Human Beings & Material assets	Flora & Fauna	Soils & Geology	Hydrogeology & Water Quality	Air Quality & Climactic	Landscape & Visual	Cultural Heritage	Roads, Transportation and route selection
Human Beings		●	●	●	●		●	●
Flora & Fauna	●		●	●		●		
Soils & Geology	●	●		●		●		●
Water	●	●	●					
Air and Climate	●							
Landscape		●	●					
Cultural Heritage	●							
Material Assets	●		●					

As each diagonal half of the matrix is a mirror image of the other only the vertical side was described in descending order from the first interaction – Human Beings and Flora and Fauna in Chapter 14 of the EIS document (Volume 2).

Following the assessment of the interactions of the foregoing topics it can was concluded that no significant negative effects from the proposed Coor Shanavogh Wind Farm are expected. Evaluations of the potential impacts for each environmental topic are given in the relative assessment

chapters. Evaluations are given in some instances both before and after application of mitigation measures. Evaluation of impact is also given where necessary as an in-combination or cumulative impact. In short the necessary mitigation measures have been outlined for implementation in the relevant assessment topic chapters. Mitigation measures will also be applied as part of management protocols during the start up of the construction phase. Specific mitigation measures will be applied to the construction phase via construction management method statements.

Based on positive energy and climate impacts of the proposed development and the modest visual, peat, ecology and noise impacts, it is considered that Coor Shanavogh is a suitable site for the development of a six turbine wind farm.