FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.1

Scoping and Consultation Letters

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

Our Ref: P1306/Lt/SG/MG

TO WHOM IT MAY CONCERN

7th August 2018

Re: Coom Green Energy Park Environmental Impact Assessment Report - Scoping and Consultation

Dear Sir/ Madam,

Brookfield Renewable Ireland Limited (BRIL) Ltd in partnership with Coillte intends to apply for planning permission to construct a renewable energy development comprising of wind and solar PV near Bottlehill, Co. Cork. The proposed Coom Green Energy Park site includes lands in following townlands: Tooreen South, Knuttery, Coom (Fitzgeralds), Coom (Hudsons), Mullennaboree, Knockaunalour, Commons, Knoppoge, Carrig, Killeagh, Glannasack, Toorgarrif, Knockdorty, Lackendarragh North and Moneygorm.

A site location map showing the proposed outline development boundary areas is shown in Figure 1. The outline development boundary has been identified by detailed desk-based planning and environmental constraints studies and a preliminary visual impact assessment which included field surveys. The proposed windfarm site is located within two main land parcels;

- Site Area (1) Black Bog, Bottlehill & Badgers Hill areas.
- Site Area (2) Commons, Glannasack & Toorgarrif.

It is expected that the development will be connected to the existing Barrymore 110kV substation through the cable route shown in Figure 1. Also outlined in Figure 1 is the alternative option of connecting to an existing 220kV overhead line near Knockroura via a looped in connection. This is identified as "Potential Tie in Location" in Figure 1.

Cont'd…

CORE HOUSE, POULADUFF ROAD, CORK, IRELAND
T: +353 21 4964133 **F:** + 353 21 4964464 **E:** info@ftco.ie **W:** www.fehilytimoney.ie
Directors: Eamon Timoney David McHugh Bernadette Guinan Beren De Hora
Company Secretary: Sinead Timoney
Registered in Ireland, Fehily Timoney & Company Ltd. Number 180497
Registered Office: Core House, Pouladuff Road, Cork. VAT Registration Number: IE6580497D

The Applicants

The applicant for the proposed project will be Brookfield Renewable Ireland Limited (BRIL) and Coillte.

BRIL is a subsidiary of Brookfield Renewable Partners, a global renewable energy company that develops, acquires, builds and operates utility-scale wind and solar power projects. BRIL has constructed and operates a portfolio of approximately 250 renewable power facilities in North America, Latin America and Europe with a combined installed capacity exceeding 10,000 megawatts.

Coillte is a commercial forestry business in Ireland, owned by the state, and based in Newtownmountkennedy Co. Wicklow. Coillte manage approximately 7% of the country's land and operates three businesses with the core business being commercial forestry. Coillte have developed a number of large scale renewable energy projects in Ireland including Galway Wind Park, Sliabh Bawn Wind Farm, Co. Roscommon and Raheenleagh Wind Farm, Co. Wicklow and Catlepook, Co. Cork.

Existing Environment

The Bottlehill landfill development with associated infrastructure exists within the Site Area 1 and consists of approximately 10 ha currently and includes upgraded roads and infrastructure to accommodate the development. The Site Area 1 and Site Area 2 are occupied by coniferous forestry, green fields and an area of mineral extraction. Both land parcels contain an extensive network of recently upgraded forestry tracks running through the centre of the site which are in good condition with associated drainage along many tracks.

Proposed Development

The proposed development will comprise of up to 33 no. wind turbines with a tip height of up to 169m, turbine foundations and hardstanding areas, several solar arrays, new access tracks and upgrading of existing access tracks, substations including control buildings, underground electrical and communications cabling, borrow pits, drainage and sediment controls, temporary site compounds, tree felling and associated works. Several battery storage containers with associated hard standing compounds shall also form part of the development.

Structure and Scope of the EIAR

The planning application of this development will be accompanied by an Environmental Impact Assessment Report (EIAR). The contents of an EIAR will be prepared in accordance with Schedule 6 of the Planning and Development Regulations 2001 and the assessment of the effects will be carried out in accordance to EU 2014 EIA Directive. The EIAR will identify, describe and assess the direct and indirect significant effects of the project (including grid connection) on the following factors:

(a) population and human health
(b) biodiversity, with particular attention to protected species and habitats
(c) land, soil, water, air and climate

Cont'd

(d) material assets, cultural heritage and the landscape
(e) the interaction between the factors referred to in points (a) to (d).

This letter is being issued to you as part of the consultation process for the EIAR. As part of the consultation process, we would be interested in receiving any comments you may have on the proposed development, relevant to your area of expertise, before **8rd September 2018** in writing or email to silvia.garcia@ftco.ie

It is intended that a second round of statutory consultation will be carried out later in the year with a more developed site layout which will show internal infrastructure general arrangements etc. The general arrangement of the site will be developed using feedback from this round of statutory consultation and community engagement which is currently ongoing.

If you have no comments to make on this proposed development, I would be grateful if you would please acknowledge receipt of this letter and provide any queries to the undersigned.

Yours faithfully,

Silvia Garcia
for and on behalf of **Fehily Timoney & Company**

Encl.

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

Our Ref: P1306/Lt/MM/MG/CF

An Comhairle Ealaion (The Arts Council)

stephanie_connolly@corkcity.ie

25th June 2019

Re: Coom Green Energy Park (CGEP) Environmental Impact Assessment Report - Scoping and Consultation

Dear Sir or Madam,

Brookfield Renewable Ireland Limited (BRIL) Ltd in partnership with Coillte intends to apply for planning permission for a renewable energy development referred to as the Coom Green Energy Park (CGEP), located in North County Cork. The proposed CGEP site includes lands contained within the following townlands: Glashaboy North, Coom (Hudson), Tooreen South, Killeagh, Coom (Fitzgerald), Slievedotia, Mullenaboree, Knoppoge, Carrig, Knuttery, Lackendarragh North, Knockacullata, Knockdoorty, and Glannasack.

This letter and enclosed scoping report is being issued to you as part of the consultation process for the EIAR and follows an initial round of consultation which took place in Summer 2018. As part of the consultation process, we would be interested in receiving any comments you may have on the proposed development, relevant to your area of expertise, before 8th of August in writing or be email to cgep@ftco.ie

If you have no comments to make, I would be grateful if you would please acknowledge receipt of this letter.

If you have any queries regarding the project, please contact the undersigned.

Yours faithfully,

Trevor Byrne
for and on behalf of **Fehily Timoney & Company**

Encl.

CORE HOUSE, POULADUFF ROAD, CORK, IRELAND
T: +353 21 4964133 **F:** + 353 21 4964464 **E:** info@ftco.ie **W:** www.fehilytimoney.ie
Directors: Eamon Timoney David McHugh Bernadette Guinan
Company Secretary: Sinead Timoney
Registered in Ireland, Fehily Timoney & Company Ltd. Number 180497
Registered Office: Core House, Pouladuff Road, Cork. VAT Registration Number: IE6580497D

Appendix 1: EIAR Scoping Report

COOM GREEN ENERGY PARK (CGEP) ENVIRONMENTAL IMPACT ASSESSMENT - SCOPING REPORT

JUNE 2019

COILLTE

Brookfield

FEHILY TIMONEY & COMPANY

TABLE OF CONTENTS

LIST OF FIGURES

Page

1 INTRODUCTION

1.1 General

1.1.1 Introduction

Brookfield Renewable Ireland Limited (BRIL) Ltd in partnership with Coillte intends to apply for planning consent for a renewable energy development referred to as the Coom Green Energy Park (CGEP), located in North County Cork. The proposed CGEP site includes lands contained within the following townlands: Glashaboy North, Coom (Hudson), Tooreen South, Killeagh, Coom (Fitzgerald), Slievedotia, Mullenaboree, Knoppoge, Carrig, Knuttery, Lackendarragh North, Knockacullata, Knockdoorty, and Glannasack. The site is approximately 377 hectares in size.

A site location map is presented in Figure 1-1.

A number of grid connection options are currently being considered in order to supply power from the development to the Irish electricity network. One of which proposes to connect to the existing 110kV Barrymore substation near Rathcormac, Co. Cork via underground cable. The other option currently being considered is a 'looped in' connection to the existing Kilronan-Knockraha 220kV overhead line (OHL) using a 220kV underground cable to a purpose built substation located within the project site.

An initial round of statutory consultation took place in 2018 with consultees receiving a letter and supporting site boundary maps.

1.1.2 The Proposed Development

The proposed development is located approximately 12km to the south east of Mallow in County Cork.

The energy park will comprise of up to 22 no. wind turbines with a tip height of up to 169m, turbine foundations and hardstanding areas, new access tracks and upgrading of existing access tracks, 2 no. substation compounds including control buildings and battery storage units, underground electrical and communications cabling, borrow pits, drainage and sediment controls, temporary site compounds, tree felling and associated works. The applicant is also exploring the use of Solar Photovoltaics (PV) on substation building roof spaces as part of the energy park development.

It is proposed to supply power from CGEP to the Irish electricity network via underground cable to either the existing substation located at Barrymore 110kV substation near Rathcormac, Co. Cork, or via a 'looped-in' connection to the existing Killonan-Knockraha 220kV overhead line (OHL) using a 220kV underground cable (UGC) to a 220kV substation located at the CGEP Project site. The cables will traverse the following townlands primarily along the public road: Ballynahina, Coolmucky, Farran South, Farran North, Corrin, Glanakip, Chimneyfield, Toorgarriff, Killeagh, Moneygorm, Inchinanagh, Knoppoge, Carrig, Tooreen, Lackendarragh North, Knockacullata, Knockaunacorrin, Moanlahan, Knockdoorty, Mullenataura, Commons, Glannasack, Knockananig, Coolnakilla, Kill-Saint-Anne North, and Rathcormack-Mountain. It is expected that the proposed development will have a generation capacity of approximately 100MW

The current design site layout (Design Iteration 2) is presented in Figure 1-2.

The proposed grid connection options being considered are shown in Figure 2-1.

1.1.3 The Applicant

The applicants for the proposed project are Brookfield Renewable Ireland Limited (BRIL) and Coillte.

BRIL is a subsidiary of Brookfield Renewable Partners, a global renewable energy company that develops, acquires, builds and operates utility-scale wind and solar power projects. BRIL has constructed and operates a portfolio of approximately 250 renewable power facilities in North America, Latin America and Europe with a combined installed capacity exceeding 10,000 megawatts.

The Irish business today consists of more than 400 megawatts(MW)of operating wind capacity across 23 wind farms in nine counties and employs approximately 110 people at its Ireland and U.K business headquartered in Cork.

Coillte is a commercial forestry business in Ireland, owned by the state, and based in Newtownmountkennedy Co. Wicklow. Coillte manage approximately 7% of the country's land and operates three businesses, with the core business being commercial forestry. Coillte have developed a number of large scale renewable energy projects in Ireland including Galway Wind Park, Sliabh Bawn Wind Farm, Co. Roscommon, Raheenleagh Wind Farm, Co. Wicklow and Castlepook, Co. Cork.

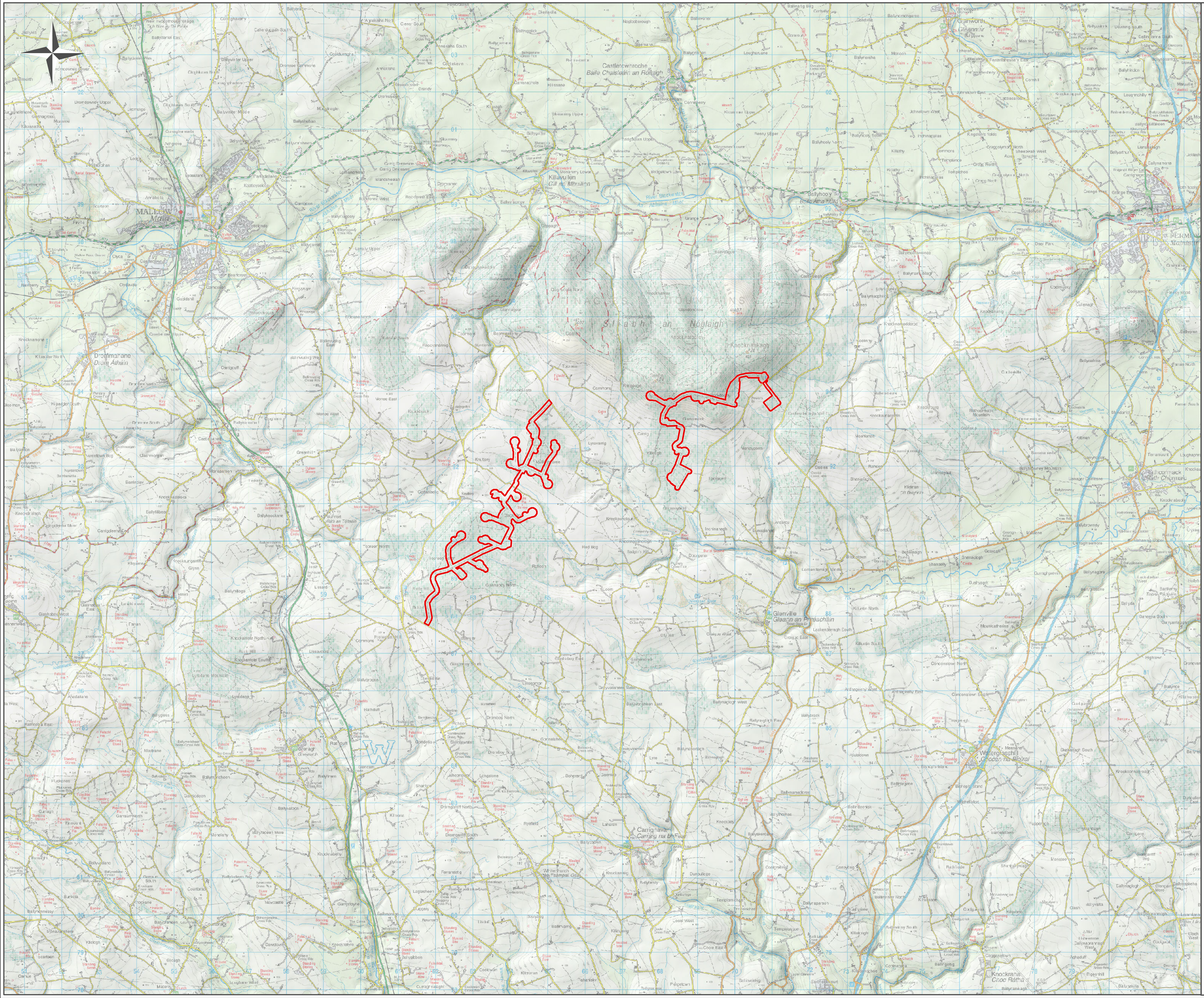
1.1.4 Purpose of the Report

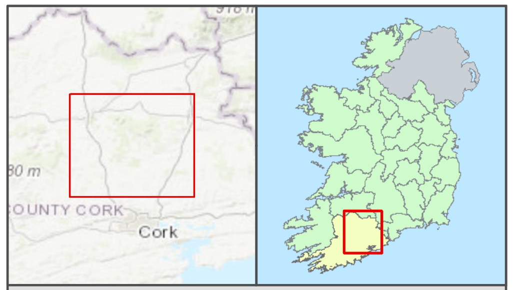
This is a scoping report prepared for the EIAR for the proposed CGEP comprising primarily of a wind farm and associated battery storage in north Co. Cork.

The purpose of the EIA scoping process is to identify the key points and issues which are likely to be important during the environmental impact assessment (EIA) and to eliminate those that are not. The scoping process identifies sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. In essence, the primary focus of scoping is to define the most appropriate assessment of significant effects related to the proposed development.

Map Path: R:\Map Production\2017\P1306\Workspace\EIA Scoping Report\P1306_Fig1-1_SiteLocation_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





Co. Cork

Legend

Proposed Development Boundary

Figure Title Site Location

Figure No. 1.1

Project Coom Green Energy Park

Client Brookfield Renewable Ireland Ltd. & Coillte

Scale 1:100,000 **Page Size** A3

Revision A **Date** 15/09/2018

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Kilometers
0 0.5 1 2

Map Path: R:\Map Production\2017\P1306\Workspace\EIA Scoping Report\P1306_Fig1-2_CurrentDesignLayout_A3.mxd

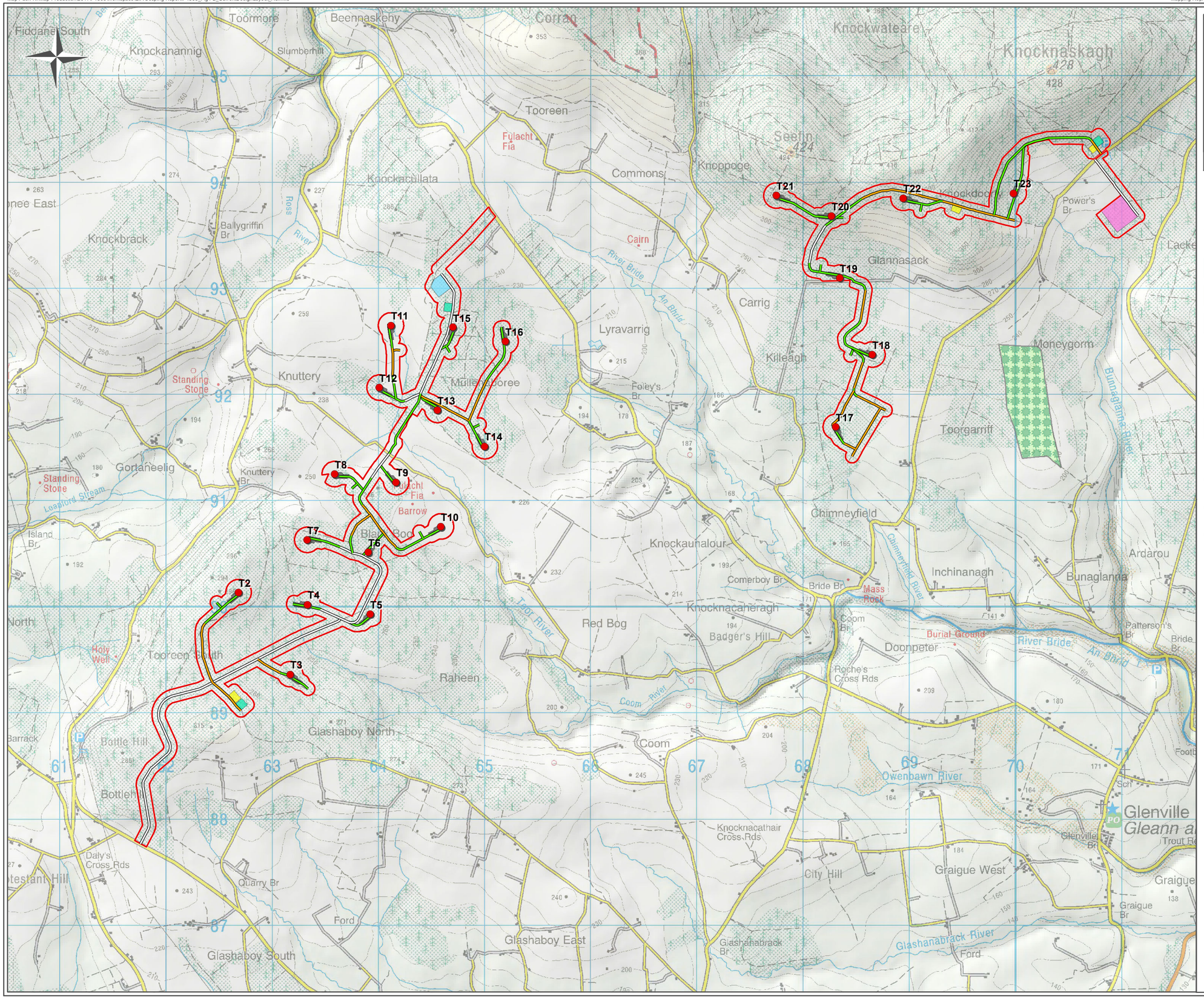


Figure Title
Current Design Layout

Figure No. 1.2

Project
Coom Green Energy Park

Client
Brookfield Renewable Ireland Ltd.
& Coillte

Scale 1:35,000 **Page Size** A3

Revision A **Date** 29/05/2019

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

1.2 Planning Process for the Proposed Development

It is intended that the proposed development will be submitted for planning directly to An Bord Pleanála pursuant to the Strategic Infrastructure Development Act 2006 (as amended), subject to a pre-application consultation process with An Bord Pleanála. Pre-application consultation with An Bord Pleanála under the Strategic Infrastructure Development was commenced in December 2018 under An Bord Pleanála case reference number PL04.303322.

1.3 Environmental Impact Assessment and the Function of the EIAR

Under Section 172 of the Planning and Development Act, as amended, a planning application for a development which comes within a class of development specified under Schedule 2 of Part 5 of the Planning and Development Regulations must be accompanied by an Environmental Impact Assessment Report (EIAR) in accordance with the 2014 Directive. Accordingly, as the proposed development will have more than 5 no. turbines and a generating capacity of greater than 5MW, an EIAR will be prepared for the project in accordance with the Planning and Development Regulations 2001 (as amended).

The purpose of an EIAR is to provide a detailed description of the proposed development and outline potential impacts associated with the construction and operation of the project. Where adverse impacts have been identified, mitigation measures are proposed and the residual impacts described.

1.4 Contributors to the EIAR

This Scoping Report has been prepared by Fehily Timoney & Company (FT) on behalf of BRIL and Coillte. FT is a planning, environmental and engineering consultancy based in Cork, Dublin and Carlow, specialising in civil and environmental engineering, environmental science and planning. FT is well established as a leading consultancy in wind farm development in Ireland.

FT will be designing and preparing the Environmental Impact Assessment Report for submission to An Bord Pleanála as described in Section 1.2 above.

Specialist contributors to the EIAR include:

- Macro Works who will prepare the landscape and visual impact assessment;
- John Cronin & Associates who will prepare the Cultural Heritage assessment;
- Inis Environmental Consultants who will be carrying out the ecological surveys and preparing the biodiversity section of the EIAR and the Natura Impact Statement.

1.5 Consultation

The stakeholder consultation process is being carried out in accordance with the Code of Practice for Wind Energy Development in Ireland-Guidelines for Community Engagement (available at: www.dccae.gov.ie). Comments on the scope of the EIAR can be submitted by email to cgep@ftco.ie by Friday the 8th of August 2019.

Project Website

A project website has been set up to inform the public of the project (https://coomgreenenergy.com). The website is being used to notify members of the public of upcoming public consultation events and any changes in the design and layout as a consequence of consultations. It is also being used to inform members of the public of research and development in the renewable energy sector.

Community Consultation

Since March 2018, the Project Team has been carrying out door to door consultation in the areas closest to the proposed development area to discuss the project with local residents. A Community Liaison Officer (CLO) has been appointed and is available for calls and meetings with members of the public.

As the design process progresses, one-to-one meetings will be ongoing with update leaflets/newsletters distributed in the local area to provide clear information on the main aspects of the project as it evolves. The Project Website will also display up to date information and will evolve with the project to provide a source of updated information as the project progresses.

The project team organised community information events in the area in November and December of 2018. Three community information events were held in total: in Glenville (28th November 2018), Mourneabbey (30th November 2018) and Whitechurch (5th December 2018). The objective of these events was to inform the local communities of the proposed development, to provide information pertaining to the proposed development and to seek feedback from the local community in terms of local knowledge and any issues that need to be addressed in the EIAR.

Feedback forms were available to attendees and over 50 no. feedback forms were completed from the first round of workshops. The main issues were recorded by the applicant and answers to the most prevalent questions were published on the project website.

A noise workshop presentation was held on the 9th of May 2019 in the Blarney Woollen Mills Hotel. An additional workshop presentation regarding engineering aspects of the project was held on the 14th May 2019 in the Blarney Woollen Mills Hotel. The purpose of the two workshop presentations followed feedback from community workshops held in November and December of 2018 where it was requested that more technical workshops be carried out.

These workshops were designed to provide attendees from the community with information on specific technical issues associated with the design and environmental impact assessment of the development from the experts who will be carrying out the work on behalf of the Applicant. The format of the events consisted of a presentation by the relevant expert followed by a Q&A session with members of the audience.

Feedback from the events were recorded and will inform the EIA process.

Statutory and Non-Statutory Scoping and Consultation

A scoping letter was issued to statutory and non-statutory consultees in August 2018. The scoping letter outlined details of the applicants, the proposed development description, the location of the development and the proposed structure of the EIAR. The scoping letter was accompanied by maps showing the proposed development site location, study area boundary and indicative grid connection route options. The responses from this consultation have informed the ongoing design process in addition to informing the scope of the environmental assessments.

The function of this Scoping Report for the EIAR, is to inform consultees of the development with detailed layout design and to seek further feedback to inform the final design.

2 PROJECT DESCRIPTION

2.1 Proposed Wind Farm

The proposed development will comprise of up to 22 no. wind turbines with a tip height of up to 169m, turbine foundations and hardstanding areas, new access tracks and upgrading of existing access tracks, 2 no. substations including control buildings and battery storage; and associated ancillary works. The current layout, Design Iteration 2 (DI2), is illustrated in Figure 1.2. The layout of the proposed wind farm has been designed to minimise the potential environmental effects of the wind farm while at the same time maximising the energy yield of the wind resource passing over the site.

The electricity generated by the proposed wind farm will be transmitted by a collector system of underground cables to the proposed onsite substation. The proposed development will also comprise underground cables from the development to the National Grid connection point as well as improvements to the public road network for the delivery of turbine components.

2.2 Proposed Substations and Battery Storage

It is proposed to construct 2 no. onsite electricity substation compounds within the proposed development site as shown in Figure 2.1. These will provide a connection point between the CGEP and the proposed grid connection point at the either the existing Barrymore substation or from a 'looped-in' connection to the existing Killonan-Knockraha 220kV overhead line.

It is also intended to include battery storage units within the substation compounds. One of battery storages basic roles is to act as a power reserve, for when electricity generation drops below demand. The reserve capacity within the battery storage unit can then be called on at a moment's notice. There are large variations in system demand on the electricity grid, varying over the course of a day and over monthly periods. Because of these changes in demand the power generation and grid must deal with large transitions between lows and highs, not only over the course of a day or week but also second-by-second. Battery storage is a means of storing and releasing electrical energy just like a rechargeable battery, mobile phone or electric car. The unit comprises a group of battery racks which are sealed within the container and are monitored and controlled for performance, temperature and other safety factors. The containers are sealed, fireproof and house all the necessary control and safety systems.

2.3 Grid Connection

It is proposed to supply power from CGEP to the Irish electricity network via underground cable to either the existing substation located at Barrymore 110kV substation near Rathcormac, Co. Cork, or via a 'looped-in' connection to the existing Killonan-Knockraha 220kV overhead line (OHL) using a 220kV underground cable (UGC) to a 220kV substation located at the CGEP Project site.

The proposed grid connection options being considered are shown in Figure 2-1.

The proposed grid connection route will follow the route of existing public and private roads between the proposed CGEP site and the point of connection with the existing grid network.

Connection will be sought under the Enduring Connection Process (ECP) grid access regime. The proposed grid connection route options are shown in Figure 2.1. The grid connection will be considered in the environmental impact assessment.

All grid connection cables will be underground. An element of overhead line works would be required for the 220kV loop-in option where the proposed underground cables from the development meet the existing overhead line (OHL) should this option be adopted.

A 220kV Loop-In from the existing overhead line would require a new 220kV line/cable interface mast to be installed on either side of an existing OHL tower. The OHL conductor will be terminated at the two new structures in order to facilitate the loop in to the new Coom Green Energy Substation. The existing OHL tower structure would then be dismantled and removed from the circuit.

Map Path: R:\Map Production\2017\P1306\Workspace\EIA Scoping Report\P1306_Fig2-1_GridConnectionRouteOptions_A3.mxd

Proposed IPP Substation at Knockacullata

Proposed Grid Connection Substation at Lackendarragh

Possible Tie-In Location

Existing Barrymore Substation

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17 T18 T19 T20 T21 T22 T23

Kilometers
0 0.5 1 2

Co. Cork

Legend

- Proposed Turbine Layout
- Existing 220KV Overhead Line
- Proposed Cable Route Option 1
- Proposed Cable Route Option 2
- Proposed Development Boundary

Substations

- Existing Barrymore
- Proposed IPP Substation at Knockacullata
- Proposed Grid Connection Substation at Lackendarragh

Figure Title
Grid Connection Route Options

Figure No. 2.1

Project
Coom Green Energy Park

Client
Brookfield Renewable Ireland Ltd.
& Coillte

Scale 1:70,000 **Page Size** A3

Revision A **Date** 29/05/2019

Consultants in Engineering and Environmental Sciences
www.fehilytimoney.ie
FEHILY TIMONEY & COMPANY

2.4 Turbine Delivery

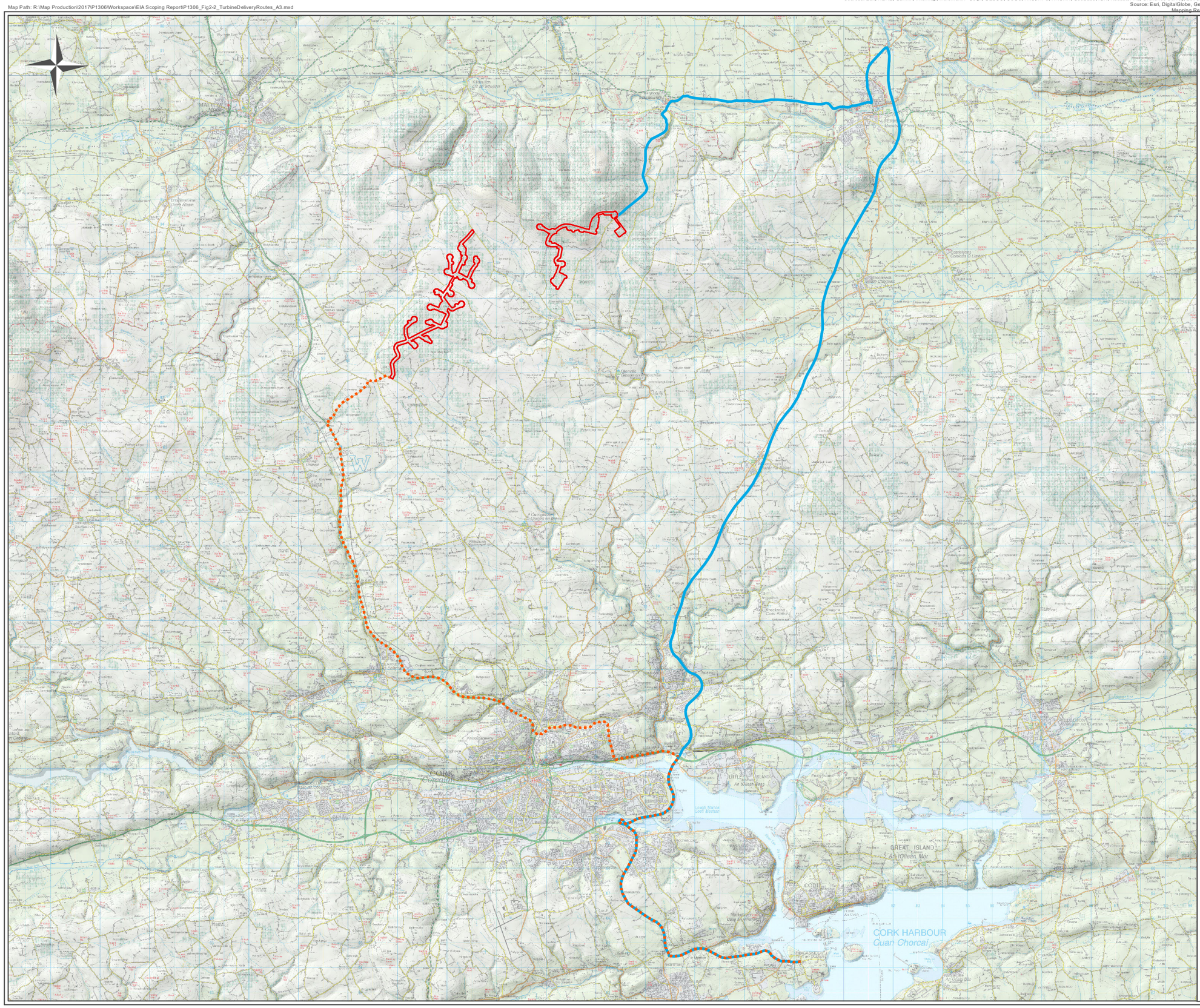
A number of components will enter the country through the ports including the blades, tower sections and the nacelles. The turbines will be assembled on site, which will be delivered to site by special transport vehicles. A number of routes to site have been surveyed to determine the most appropriate turbine delivery route. There are 2 no. routes identified to transport the wind turbine components to the site:

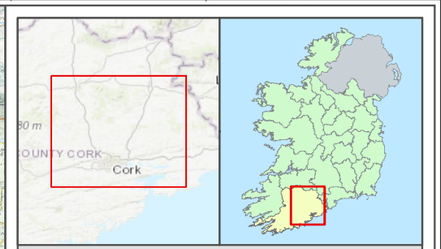
Route 1: The first route leaves the M8 Motorway at Junction 14, following the R639 Regional Road into Fermoy town and on to meet the N72 National Road. It continues on the N72 as far as a turn off just before Ballyhooly village. The TDR continues on this local road to the site entrance for the proposed Coom Energy Park.

Route 2: The second route leaves the N20 National Road at Lissavoura Cross Roads, following the Local Road to the top of Protestant Hill before going right, through Daly's Cross Roads as far as Bottlehill; the location of the site entrance.

The above routes are shown on Figure 2-2.

Map Path: R:\Map Production\2017\P1306\Workspace\EIA Scoping Report\P1306_Fig2-2_TurbineDeliveryRoutes_A3.mxd





Legend

- Proposed Development Boundary
- *Proposed Turbine Delivery Routes*
- Route 1
- Route 2

Kilometers
0 0.5 1 2

Figure Title
Turbine Delivery Routes

Figure No. 2.2

Project
Coom Green Energy Park

Client
Brookfield Renewable Ireland Ltd.
& Coillte

Scale 1:150,000 **Page Size** A3

Revision A **Date** 18/06/2019

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

3 STRUCTURE AND SCOPE OF THE EIAR

3.1 Contents of the EIAR - Statutory Requirements

The EIAR will be prepared in accordance with Schedule 6 of the Planning and Development Regulations 2001, as amended, which sets out the contents of an EIAR. In addition, the contents of Directive 2014/52/EU, which was adopted in the EU on 16 April 2014 will also be included in the preparation of this EIAR (the 2014 EIA Directive).

The purpose of the EIAR is to provide in particular:

a) a description of the project comprising information on the site, design, size and other relevant features of the project;

b) a description of the likely potential significant effects of the project on the environment;

c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;

e) a non-technical summary of the information referred to in points (a) to (d); and

f) any additional information relevant to the specific characteristics of the wind farm project proposed.

The EIAR will identify, describe and assess the direct and indirect significant effects of the project on the following factors:

(a) population and human health
(b) biodiversity, with particular attention to protected species and habitats
(c) land, soil, water, air and climate
(d) material assets, cultural heritage and the landscape
(e) the interaction between the factors referred to in points (a) to (d).

3.2 EIAR Methodology

3.2.1 General

The EPA and the European Commission (EC) have published guidelines on the preparation of environmental impact assessment reports, namely:

- Draft Advice Notes on Preparing Environmental Impact Statements (EPA, 2015);
- Draft Guidance on the information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency (EPA), 2017);
- Environmental Impact Assessment of Projects - Guidance on Scoping (European Commission (EC), 2018);
- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government, 2018).

The EIAR team will have regard to these guidelines in the preparation of the EIAR.

The team will also have regard to best practice guidance for individual environmental topics. Regard will also be paid to the 'Best Practice Guidelines for the Irish Wind Energy Industry' published by the Irish Wind Energy Association and the 'Wind Energy Development Guidelines' published by the Department of Environment, Heritage and Local Government (2006) or the latest adopted revision at the time of application.

There are two different EIAR structures which are commonly used and which the EPA guidelines accept as equally valid. The structure, which the EIAR team proposes to use for the EIAR for the proposed CGEP, is the grouped format structure.

Using this structure there is a separate chapter for each topic, e.g. air quality, biodiversity, hydrology. The description of the existing environment, the proposed development and the potential impacts, mitigation measures and residual impacts are grouped in the chapter. The grouped format makes it easy to investigate topics of interest and facilitates cross-reference to specialist studies.

Given the need to ensure that the EIAR is readily accessible to the general public, as well as to the statutory authorities, the EIAR team has proposed to structure the EIAR as described below:

- Non-technical Summary
- Introduction
- Site Selection & Consideration of Alternatives
- Description of the Proposed Development
- Policy and Legislation
- EIA Scoping, Consultation and Key Issues
- Air Quality and Climate Change
- Noise and Vibration
- Biodiversity
- Land, Soils and Geology (including hydrogeology)
- Hydrology & Water Quality
- Population, Human Health & Material Assets
- Shadow Flicker
- Traffic and Transportation
- Archaeology, Architecture and Cultural Heritage
- Landscape & Visual
- Telecommunications & Aviation
- Interactions of the Foregoing

3.2.2 EIAR Chapter Structure

The broad methodology framework used in each chapter will include the following:

- Introduction
- Methodology
- Existing Environment
- Potential Impacts
- Mitigation Measures
- Residual Impacts

Introduction
This section introduces the environmental topic to be assessed and the areas to be examined within the assessment.

Methodology
Specific topic related methodologies are outlined in this section. This will include the methodology used in describing the existing environment and undertaking the impact assessment. It is important that the methodology is documented so that the reader understands how the assessment was undertaken. This can also be used as a reference if future studies are required.

Existing Environment
An accurate description of the existing environment is necessary to predict the likely significant impacts of a new development. Existing baseline environmental monitoring data can also be used as a valuable reference for the assessment of actual impacts from a development once it is in operation.

To describe the existing environment, desktop reviews of existing data sources will be undertaken for each specialist area relying on published reference reports and datasets to ensure the objectivity of the assessment. Desktop studies are also supplemented by specialised field walkovers or studies in order to confirm the accuracy of the desktop study or to gather more baseline environmental information for incorporation into the EIAR.

The existing environment will be evaluated to highlight the character of the existing environment that is distinctive and what the significance of this is. The significance of a specific environment can be derived from legislation, national policies, local plans and policies, guidelines or professional judgements. The sensitivity of the environment will also be described.

Potential Impacts
In this section, individual specialists predict how the receiving environment will interact with the proposed development. The full extent of the proposed development's effects and emissions before the proposed mitigation measures are introduced is outlined. Impacts from both the construction and operation phases of the proposed development are outlined. Interactions and cumulative impacts with other environmental topics are also included in this evaluation.

The evaluation of the significance of the impact is also undertaken. Where possible, pre-existing standardised criteria for the significance of impacts will be used in accordance with the guidelines set out in the EPA (2015) Draft Guidelines on the Information to be contained in Environmental Impact Statements. Such criteria can include Irish legislation, international standards, European Commission and EPA guidelines or good practice guidelines. Where appropriate criteria do not exist the assessment methodology section states the criteria used to evaluate the significance.

Mitigation Measures
If significant impacts are anticipated mitigation measures will be devised to minimise impacts on the environment. Mitigation measures by avoidance, by reduction and by remedy can be outlined.

Residual Impacts
The assessment identifies the likely impact that will occur after the proposed mitigation measures have been put in place. These impacts are described in detail and assessment of their significance undertaken.

3.2.3 EIAR Report Structure

The structure proposed for the EIAR is as follows:

Volume 1 - Non Technical summary

Volume 2 - Main EIAR

Volume 3 - Appendices for the EIAR

Volume 4 – Photomontages and Visual Maps

4 ENVIRONMENTAL ISSUES TO BE ADDRESSED IN THE EIAR

4.1 Introduction

The EPA Advice Notes provide guidance on the topics which would usually be addressed when preparing an EIAR for different classes of development. The Advice Notes highlight typical issues, which would arise for each development class. Project Type 33 is 'installations for harnessing wind power for energy production (wind farms)'. The scope of the EIAR will have regard to the guidance provided on the issues to be addressed for a Project Type 33.

The EIAR will summaries International, European, National and Local Energy and Planning Policy, the challenges associated with Climate Change and the related need for the proposed development.

4.2 Alternatives Considered

The alternatives, which were considered, when developing the overall configuration of the proposed CGEP, will be described and the technology options for the project will be outlined in Chapter 2 Introduction and Project Rationale.

The principle alternatives studied with respect to the CGEP will be outlined under the following headings:

- *Locations* – This will include a discussion of the overall site selection process for the CGEP on a national, regional and local scale. It will include a site selection report which will be included in the EIAR outlining details of the criteria used to determine site suitability for wind energy development including:
    - Wind resource;
    - Proximity to residential dwellings;
    - Land Zoning in County Development Plans;
    - Established and Future Land-Use;
    - Ecological Conservation Designations;
    - Landscape Designations; and
    - Ease of Access etc.
- *Access* – Details of the criteria used to select the network of access tracks that will provide access from the public road network to the site (and to each turbine within the site) in addition to those that will provide internal connections (as an alternative to using public roads) between turbines will be outlined. This will include information on the availability of existing track, suitable ground conditions, terrain, local road infrastructure etc.
- *Connection to the National Grid* – Details of the criteria used to select the proposed grid connection route will be provided. This will include an assessment of alternative grid connection route options.

The reasons, including environmental and plan-led considerations will be explained.

4.3 Scheme Description

The EIAR will describe each element of the project including the following:

- Community Benefit Package
- Existing Environment
- Landownership
- On Site Wind Resource
- Turbine Layout

- Power Output
- Turbine typical components
- Access Tracks and Hardstandings
- Watercourse crossings
- Grid Connection
- Onsite substations
- Battery storage
- Electrical cabling
- Traffic Management
- Tree felling
- Replant lands
- Wind farms in proximity
- Construction overview
- Operation and lifespan
- Decommissioning

In a judgement in 2014, O'Grianna v. An Bord Pleanála, Cork County Council and Framore Limited, it was ruled that all planning permission should not be granted for a wind farm project requiring a grid connection unless the grid connection details are provided in the Environmental Impact Assessment (EIA) process.

Arising from this it is essential that the details of this project and its proposed grid connection should be provided in the EIA process, this will be set out in the Description of Development in detail in Chapter 3, while Chapter 2 will provide a detailed assessment of alternatives considered in relation to the preferred grid connection route.

The operating procedures and hours, staffing, monitoring, maintenance requirements, and the provision for decommissioning of the proposed CGEP will also be outlined.

If planning consent is secured for the proposed development, tree felling, site preparation works, upgrading of existing access tracks and the provision of new access tracks will precede all other activities. Drainage infrastructure will be constructed in parallel with the track construction. This will be followed by the construction of the turbine foundations and the provision of the hardstanding areas. In parallel with these works the on-site electrical works; sub-station and internal cable network; will be completed. The cable from the wind farm site to the proposed grid connection point will then be laid underground, primarily along public roads. Any works required to the public road network to facilitate turbine delivery will also be carried out.

4.4 Construction Activities

CGEP will have a defined planning boundary to include not only the turbines themselves but all ancillary infrastructure such as transformers and crane hardstanding areas at each turbine, borrow pits, new and upgraded site tracks, on-site underground cabling and an on-site substation with toilet facilities. Details on all of these elements will be provided within the EIAR.

Information will be provided on the following aspects of the construction of the CGEP:

- Construction programme
- Construction sequence and methodology
- Drainage control measures
- Temporary site facilities
- Site preparation works
- Access road construction and upgrade
- Borrow pits and reinstatement works
- Cable installation on site

- Turbine foundation and associated hardstanding area construction
- Turbine delivery and installation
- Commissioning

The control measures that will be implemented to manage the risk of soil and water pollution, emissions of dust and noise, construction waste management and traffic impacts will be explained.

4.5 Consultation Programme

Outlined in Section 1.5 of this report are the primary consultation methods and events that have been conducted to date. Over the course of the final design and preparation of the EIAR, consultation will continue with the community, stakeholders and consultees. As part of the EIAR, full details of all consultation will be documented and assessed.

4.6 Environmental Aspect: Population, Human Health and Material Assets

4.6.1 Aspects to be Addressed

The Population, Human Health and Material Assets Chapter of the EIAR will assess the likely significant effects of the proposed development on Population, Human Health and Material Assets with a particular reference to the topics of population, human health, socio-economic activity, land-use, recreation, amenity and tourism, and material assets.

Population
The potential impacts of the proposed CGEP on population trends and statistics on population (density, age) will be addressed in this chapter.

Human health
The potential impacts on human health from the proposed CGEP will be assessed.

Health and Safety
Details relating to health and safety arising from the proposed construction, operation and decommissioning of the green energy park will be assessed.

Socio-economic activity
The potential impacts of the proposed CGEP on employment and the main economic activities of the region as well as property values will be addressed in this chapter.

Land-use
The assessment will address the potential impacts of the proposed CGEP on land use.

Recreation, amenity and tourism
The assessment will address the potential impacts of the proposed CGEP on residential amenity, recreational facilities and tourism of the region.

Material assets
The potential impact of the proposed development on physical infrastructure including renewable and non-renewable resources as well as utility infrastructure will be assessed.

4.6.2 Assessment Methodology

Population
With the purpose of analysing population trends and statistics on the proposed area, population data from the Central Statistics Office will be obtained for the study area defined by electoral division. The statistics of this data is compared against county and state trends, density and age.

Human health
The assessment will contain a desk study review of the impacts of the operation of renewable energy developments on human health using published and verified sources of information.

Health and Safety
The assessment will contain a desk study review of the impacts of the operation of renewable energy developments on health and safety using published and verified sources of information.

Socio-economic activity
Data from the Central Statistics Office will be used to define the socio-economic baseline. The potential positive and negative impacts of the proposed CGEP on population, employment and economic activity both directly and indirectly, will be assessed.

Land-use
The main land uses in the area, which could potentially be affected by the proposed development, will be described using Corine 2018 land cover data and this data will be verified by subsequent walkovers and drive-by surveys.

Recreation, amenity and tourism
All areas of scenic beauty in addition to heritage, culture and leisure facilities in the areas will be identified. A review of the main recreational activities in the area likely to be affected will be conducted. Residential amenities and recreational facilities, such as forestry in public ownership, walking paths, sports facilities, will be recorded and potential impacts assessed.

An assessment will then be conducted for each element of the proposed CGEP to ascertain any potential impacts that may arise which could directly or indirectly affect recreational activity or an amenity. This assessment will be prepared giving cognisance to other disciplines such as cultural heritage and archaeology, hydrology and ecology.

A review will be conducted of a number of published studies and surveys which have been conducted both in Ireland by Fáilte Ireland and in the UK on the attitude of tourists to wind farms. A study of the potential impacts that the proposed development may have on the tourism of the region will be carried out by reviewing Fáilte Ireland surveys, appraising the existing patterns of the tourism within the county and appraising the impacts that wind farms have on tourism in other counties and countries

Material assets
Information on the existing material assets within the receiving environment will be obtained and assessed in the context of the proposed development. The CGEP will also be considered under the material assets section in its own right as it will be classed as a renewable resource.

4.6.3 Receiving Environment

The proposed development is located c. 9.1km from the Mallow, c. 1.5km from Fermoy, and c. 16km from Cork City. Other settlements within the vicinity of the proposed development include Glenville, c. 4km from the site boundary, Grenagh which is c. 5.5 km from the site boundary and Rathcormac which is located c. 10.5km from the proposed development.

A survey of existing dwellings was carried out by FTC in April 2018. According to the house survey, there are 70 no. houses located within the initial 1.36km study area of which 30 comprise a mix of residential and commercial, and a further 2 receptors characterised as commercial only.

4.6.4 Potential Impacts

Population
The potential impacts arising from the proposed development on population during construction are likely to be slight positive, given the opportunities for enhanced employment opportunities associated with the proposed development. During operational phase these impacts would likely be reduced to imperceptible. The assessment will consider the potential impacts during all phases of the proposed development.

Human health
The potential affects arising from the proposed development can impact human health during construction, operational and decommissioning will be considered in this chapter. Once operational, turbines contribute to the production of renewable energy and for this reason, it is thought that the operational phase will deliver positive impacts to human health.

Health and Safety
If not properly designed and constructed, there is the potential for construction and operational activities associated with the proposed development to impact on the health and safety of employees associated with the development as well as the public. Best practice construction and environmental management measures will be employed to prevent the potential for accidents. The EIAR will be accompanied by a comprehensive Outline Construction and Environmental Management Plan which will include detailed health and safety requirements during the construction, operation and decommissioning of the green energy park. With the implementation of measures outlined in the EIAR and oCEMP, it is anticipated that the proposed development is not likely to have a potential significant impact on human health and safety.

Socio-Economics
The proposed development will have significant long and short term benefits for the local economy including job creation, landowner payments, local authority commercial rate payments and a Community Benefit Scheme. These will be developed in full and considered in the EIAR.

Land Use
The proposed development will require land take for the access tracks, wind turbines bases and adjacent hard-standings and sub-station footprints. The current land uses will continue other than within this land take. Full details will be contained in this chapter of the EIAR.

Recreation, Amenity and Tourism
Potential construction impacts from the grid connection cables include full or partial closure of roads used within the area, while the cables are being installed. There may be disruption to access routes and walking paths, however any disruption will be mitigated where possible by maintaining access for people throughout, and where this is not possible, in minimising the impact, clearly communicating the timing and scope of works to the local community.

Material Assets
Utilities such as overhead power lines or telephone lines or underground services may require diversion or be temporarily disrupted during the construction of the wind farm or cable trench. This has the potential to impact on nearby dwellings and commercial / industrial activities. All potential impacts will be considered in full in this chapter.

4.7 Environmental Aspect: Shadow Flicker

4.7.1 Aspects to be addressed

This chapter will address the potential effects on human beings of shadow flicker, i.e. the moving shadows cast by the turbine blades in times of direct sunlight.

4.7.2 Assessment Methodology

A shadow flicker assessment will be carried out using ReSoft Windfarm software (version 4.2.2.1) to predict the time and duration of shadow flicker on windows of habitable or permitted houses within 10 rotor diameter from a proposed turbine, as informed by the house and planning surveys.

The methodology used for the shadow flicker assessment will be performed in consideration of the "Wind Energy Development Planning Guidelines" DoEHLG (2006) and the Irish Wind Energy Association (2012) "Best Practice Guidelines for the Irish Wind Energy Industry". This methodology includes:

- Calculation of sunshine factor based in the historical measurements from the closes Met Éireann meteorology station.
- Calculation of shadow flicker levels for the final turbine layout.
- Where exceedances are predicted, detailed mitigation measures, including an outline potential turbine shut-down will be proposed.

Cumulative impacts of the proposed CGEP and other schemes will be assessed. IWEA Best Practice Guidelines (2012, Section 6.3.4) states that *"any such wind farm developments within 2 km of the proposed development should be considered in a separate cumulative shadow flicker assessment.* There are no other known proposed, consented or existing wind farms within this distance of the proposed CGEP.

Based on latest draft guidelines, a demonstration of the potential for the development to comply with zero shadow flicker and a curtailment analysis to demonstrate potential downtime will also be provided.

4.7.3 Receiving Environment

The general receiving environment is rural. The majority of buildings in the vicinity of the proposed development are residential or agricultural buildings. A survey of existing dwellings was carried out by FT in April 2018 up to a distance of 1.36km from the proposed development boundary.

4.7.4 Potential Impacts

Shadow flicker occurs at certain times of the year when the sun is shining and low in the sky, and where the movement of turbine blades cast moving shadows over areas in the vicinity of the turbines. These moving shadows can periodically reduce light coming from, for example, the window of a room, causing the light to appear to flicker.

For shadow flicker to occur, a number of conditions must be reached:

- That there is a sufficient level of sunlight shining at a low angle in the sky;
- That the turbine is directly between the sun and the dwelling, and;
- That the blades are turning and no screening is obscuring views.

CGEP will operate a zero shadow flicker policy for all dwellings in the area. In order to achieve this, a dedicated shadow flicker system will be installed at the green energy park to prevent shadow flicker impact from occurring at any house. The shadow flicker system will comprise of a programmed module that will monitor intensity of sunlight, position of the sun, and potential for flicker based on the location and height of houses.

The monitoring system will send a signal to the turbine that is anticipated to cause shadow flicker effect, instructing it to shut down temporarily for the duration of the impact. This system is highly effective in preventing shadow flicker and takes advantages of emerging technologies relating to wind farm technology.

4.8 Environmental Aspect: Noise and Vibration

4.8.1 Aspects to be addressed

The chapter will address noise and vibration impacts from the construction, operation and decommissioning of the proposed CGEP.

4.8.2 Assessment Methodology

The noise and vibration impact assessment will address impacts from the construction and operation of the CGEP as well as carrying out noise monitoring to quantify the baseline noise levels in the vicinity of the proposed development.

Noise Monitoring

The survey methodology will be based on the Institute of Acoustics Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (May 2013) and the associated supplementary notes relevant to the baseline measurements and analysis.

The guidance states that at least two weeks monitoring is typically required to collect all necessary data. If insufficient wind data is collected after two weeks, the monitoring periods will be extended until such time as sufficient wind speed and direction data has been measured.

The noise monitoring will be carried out in accordance with ISO 1996 Parts 1 and 2, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, The Institute of Acoustics, May 2013 and the Supplementary Guidance Note 1: Data Collection, September 2014.

The data analysis and reporting will be carried out applying relevant sections from the IOA Good Practice Guide and the following supplementary notes:

- Supplementary Guidance Note 2: Data Processing and Derivation of ETSU-R-97 Background Curves, September 2014
- Supplementary Guidance Note 4: Wind Shear, July 2014

Three rounds of noise monitoring at 18 noise monitoring locations has taken place to characterise the noise environment in the vicinity of the proposed development.

Wind speed data was obtained from a permanent mast and a Lidar unit (the lidar unit was positioned at two locations, the location was dependent on where on site the noise meters were installed).

Data was measured for a minimum of two weeks and up to five weeks in some cases until such time as sufficient data had been deemed to be collected. The predicted noise levels will be assessed against the noise limits in the "preferred draft approach".

Following detailed engagement between the Department of Housing, Planning, Community and Local Government (DHPCLG) and the Department of Communications, Climate Action and Environment (DCCAE), an emerging "preferred draft approach" to the Review of the 2006 Wind Energy Development Guidelines was jointly announced on 13 June 2017.

The emerging "preferred draft approach" was outlined to update the general public, stakeholders and planning authorities on the progress made and timetable for conclusion of the Review of the 2006 Guidelines, in the light of the elapse of time since the review commenced in 2013.

The "preferred draft approach" proposes noise restriction limits consistent with World Health Organisation standards, proposing a relative rated noise limit of 5dB(A) above existing background noise within the range of 35 to 43dB(A), with 43dB(A) being the maximum noise limit permitted, day or night. The noise limits will apply to outdoor locations at any residential or noise sensitive properties.

Data Analysis and Limit Derivation

The baseline noise measurements will be correlated with the standardised 10m height wind speed and rainfall data and then plotted to provide wind speed versus averaged background noise levels at each monitoring location. The averaged prevailing background noise level as a function of wind speed will be used to derive the daytime and night-time noise limits for increasing wind speeds and allow derivation of daytime and night-time noise limits based on the DoEHLG Wind Energy Development Guidelines (2006) and/or noise limits in accordance with the Review of the Wind Energy Development Guidelines 2006, draft issued in June 2017.

Operational Impact Analysis and Mitigation Design

Operational noise predictions will be carried out to determine the noise levels at the nearest noise sensitive locations. Noise predictions will be carried out using International Standard ISO 9613, Acoustics – Attenuation of Sound during Propagation Outdoors. The noise modelling parameters and assumptions used will be in accordance with the recommended parameters in 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', The Institute of Acoustics, May 2013.

It is proposed that the methodology in the Wyle Report is used to calculate the directivity. Calculating the directivity is not a trivial exercise and requires extensive work. The method requires octave band information from each turbine at each receptor.

The predicted operational noise levels from the proposed development as well as the cumulative predicted operational levels from all nearby operational and consented developments will be compared against noise limits derived using the Wind Energy Development Guidelines 2006 and the Review of the Wind Energy Development Guidelines 2006, draft issued in June 2017.

The noise predictions will also be assessed against the World Health Organisations Night noise guidelines for Europe (2009) which identifies a target of 40 dB Lnight outside night noise guideline. The Lnight, outside is the night-time noise indicator (Lnight) of Directive 2002/49/EC. It is the long-term average sound level determined over all the night periods (23:00 – 07:00) of a year. This requires long term wind speed data to be analysed during night-time periods. The data will be binned into various wind speeds and directions. This data in combination with the predicted noise levels for wind directions and wind speeds will be used to calculate a predicted Lnight, outside at each of the monitoring locations.

Cumulative Impact

The predicted noise the proposed development and the other operational and consented dwellings will also be considered. It is proposed to depart from the above and apply the methodology outlined in the IOA guidelines. The potential cumulative impacts and the need to determine whether it is necessary to model the potential cumulative impacts will be appraised in accordance with the IOA guidelines. The IOA guidelines state… "*If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary*." The IOA guidelines also state... "*Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary*."

In addition to the cumulative impact from nearby operational and consented wind farms, part of the proposed development will be on Bottlehill landfill which is a licenced facility. Therefore, the noise impact from the proposed development within the licensed area in combination with the noise emissions from landfill activities will be considered as part of the cumulative assessment for the development.

Construction Impact Analysis and Mitigation Design

Construction noise predictions will be carried out to determine the noise levels at the nearest noise sensitive locations. Noise prediction will be carried out using British Standard BS 5228-1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.

Predicted construction noise levels will be compared against noise levels in BS 5228:2009+A1:2014 Part 1. Where the impact significance identifies a requirement for mitigation, mitigation measures will be outlined.

4.8.3 Receiving Environment

A survey of existing dwellings was carried out by FTC in April 2018 to a distance of up to 1.36km from the proposed development boundary. No turbine will be located within 750m of a dwelling.

4.8.4 Potential Impacts

Potential impacts of potential noise nuisance will be addressed at the design stage by locating turbines at sufficient separation distances or by employing reduced turbine noise modes to comply with the noise limits in force at the time of application.

4.9 Environmental Aspect: Traffic and Transportation

4.9.1 Aspects to be addressed

The traffic impact assessment will address the traffic impacts on the road network from the construction and operation of the proposed CGEP. The assessment will include the supply of materials, plant and equipment, the turbine elements and the components of the sub-station. Traffic arising from the construction and operations workforce will also be addressed.

4.9.2 Assessment Methodology

A traffic impact assessment will be conducted in accordance with the Transport Infrastructure Ireland (TII) Traffic and Transport Assessment (TTA) Guidelines, May 2014. Data collected from road traffic surveys along the delivery route will be used in the assessment.

A route survey will be carried out by a specialist transport consultant between the port of entry options and proposed site entrance locations. This survey will identify potential pinch points and locations that may require off site temporary upgrades to facilitate the safe transport of the turbines to the development site.

Auto Track vehicle swept path analysis (SPA) will be conducted for all internal tracks to ensure that they are adequate to allow delivery of turbine components while also minimising the required land take where feasible. SPA will also be carried out on pinch points identified in the transport route survey report.

The methodology for the traffic impact assessment will include a review of the traffic volumes and impacts which will be generated by the construction and operation of the wind farm. The traffic generated by the construction workforce, by the transport of materials and equipment as well as future maintenance-related activities will be predicted.

The traffic distribution pattern on the local road network during construction will be examined and impacts determined.
The potential disruption to the road network during the installation of the cables and the availability of alternative routes will be assessed, where required. Recommendations will be made to mitigate any potential traffic impacts on the road network.

4.9.3 Receiving Environment

A number of routes to site have been surveyed to determine the most appropriate turbine delivery route. There are 2 no. routes identified to transport the wind turbine components to the site:

Route 1: The first route leaves the M8 Motorway at Junction 14, following the R639 Regional Road into Fermoy town and on to meet the N72 National Road. It continues on the N72 as far as a turn off just before Ballyhooly village. The TDR continues on this local road to the site entrance for the proposed Coom Energy Park.

Route 2: The second route leaves the N20 National Road at Lissavoura Cross Roads, following the Local Road to the top of Protestant Hill before going right, through Daly's Cross Roads as far as Bottlehill; the location of the site entrance.

The proposed development is located in the vicinity of the Bottlehill Landfill and access to the site will primarily use the access for this facility from the N20 National Road. Coillte forest tracks will be used where possible and upgraded as necessary to serve internal access.

4.9.4 Potential Impacts

The greatest potential for traffic impact from the proposed development is during the construction phase which will give rise to additional HGV traffic on the road network.

The turbines will be delivered to the site in components, typically comprising of loads for each of the towers: the rotor blades; the nacelle; the rotor hub; the turbine base; and the electrical components. The delivery route from the port into which the components are shipped, to the proposed wind farm site will use the national primary route network as much as possible. Modifications may be required to the existing local road network to cater for the delivery of the oversized loads.

Stone aggregate will be required for the upgrading of existing tracks and construction of new site road as well as the construction of turbine bases and hardstands. All of these activities have the potential to generate significant local traffic numbers. Borrow pits are currently proposed as part of the proposed development.

The nature of the local road network in the vicinity of the proposed wind farm site is such that widening/improvement works may be required to accommodate construction traffic. There will be an increase in local traffic during the construction of the wind farm; staff, including plant operators, electricians, engineers and trades people, will be commuting to and from the site each morning and evening. In addition, there is likely to be an increase in local traffic due to onlookers as the turbines are erected.

There will also be temporary traffic impacts from cable laying works on the public roads. These impacts will be managed through the implementation of suitable mitigation measures to reduce the nuisance being caused to local road users.

The cumulative impact of construction traffic will also be considered in terms of other developments in the area.

4.10 Environmental Aspect: Air Quality and Climate

4.10.1 Aspects to be addressed

The assessment will address the potential impacts on air quality due to construction equipment and activities and to emissions from traffic associated with the construction process. The potential impacts on air quality in the operational phase will also be addressed.

The climate in the immediate local area of a proposed development is known as the micro-climate whereas the climate of a large geographical area (global) is the macro-climate. The potential impacts of the CGEP on micro-climate and macro-climate will be addressed.

4.10.2 Assessment Methodology

Air quality monitoring conducted by the EPA at a number of locations in the vicinity of the site will be reviewed and levels compared with the air quality standards. To assess the impacts of construction dust emissions, the approach and assessment criteria outline in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (NRA, 2008) will be used.

For the purposes of assessing the impact on air quality of emissions generated by construction traffic, the methodology described in the Design Manual for Roads and Bridges 2007a (UK Highways Agency, May 2007) will be used. Parameters to be assessed will include oxides of nitrogen, particulates PM10 and PM2.5, carbon monoxide and benzene.

The potential micro-climatic impacts of CGEP will be assessed in relation to the micro-climatic baseline, the scale of the elements of the project and the nature of use of the surrounding environment. For the assessment of macro-climatic effects, the emissions of carbon dioxide (CO2) and other greenhouse gases from fossil fuel power generation, which will not be required should the CGEP become operational, will be quantified and assessed in terms of Ireland's commitments under EU and international climate change treaties and protocols.

In terms of carbon losses and savings, the Scottish Windfarm Carbon Assessment Tool. will be used to estimate carbon savings as a result of the proposed construction and operation of the wind farm.

4.10.3 Receiving Environment

In terms of micro-climate, CGEP is located in a mainly rural area, corresponding to air quality zone D, Rural Ireland, in the Air Quality Regulations SI 180 of 2011, as amended. The air quality is expected to be good.

The macro-climatic baseline is the future emission of CO_2 and other greenhouse gases, which would be produced by fossil fuel power generation in the country, in the absence of the proposed CGEP.

4.10.4 Potential Impacts

The assessment will address the potential impacts on air quality due to construction equipment and activities and to emissions from traffic associated with the construction process. The potential impacts on air quality in the operational phase will also be addressed.

The construction phase of the proposed CGEP has the potential to generate dust emissions, which could give rise to nuisance for local residents.

To assess the impacts of construction dust emissions, the approach and assessment criteria outlined in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2008) will be used.

Construction plant and equipment, and the traffic generated by the construction process, have the potential to give rise to emissions of oxides of nitrogen, benzene and particulates, which could impact on local air quality. The operation of the proposed CGEP is not expected to have a negative impact on air quality.

The proposed CGEP is expected to have a positive impact in terms of the nett reduction in emissions of CO_2 and other greenhouse gases as a result of the proposed wind farm. For the assessment of macro-climatic effects, the reduction in emissions of CO_2 and other greenhouse gases from fossil fuel power generation when CGEP is operational, will be quantified and assessed in terms of Ireland's commitments under EU and international climate change treaties and protocols.

4.11 Environmental Aspect: (Biodiversity)

4.11.1 Aspects to be addressed

This chapter of the EIAR will address the terrestrial and freshwater aquatic habitats and species, including those of conservation concern within and in close proximity to the wind farm; including along and in close proximity to the on-site cable routes; on and in close proximity to the sub-station, tree felling and any required replanting. It will also address the potential impacts on Biodiversity from the proposed underground cable between the wind farm and the grid connection as well as any proposed alterations to the public road network required for the delivery of turbine components.

In particular, the assessment will focus on:

- Natura 2000 sites i.e. Special Areas of Conservation designated under the EU Habitats Directive (Council Directive 92/43/EEC) and Special Protection Areas designated under the EU Birds Directive (Directive 2009/147 EC), within the zone of influence of the proposed development
- Other designated sites such as Natural Heritage Areas, proposed Natural Heritage Areas, Nature Reserves and Refuges for Fauna or Flora (where applicable)
- Habitats listed in Annex I of the Habitats Directive
- Species listed in Annex II and Annex IV of the Habitats Directive
- Birds listed in Annex I of the Birds Directive
- The impact on any flight paths of bird and bat species
- Species protected under the Wildlife Acts
- Protected flora under the Flora Protection Order (2015)
- Red data book species
- And biodiversity in general.

4.11.2 Assessment Methodology

Desk studies will be undertaken in which ecological databases, such as those of the National Parks and Wildlife Service (NPWS), EPA and NBDC will be consulted. The NPWS, Inland Fisheries Ireland and the main environmental non-governmental organisations have been or will be consulted.

Bird survey methods have been selected following a review of best practice guidelines, including guidance available from Scottish Natural Heritage (SNH), and following consultation with NPWS and other bodies such as BirdWatch Ireland. The ecological surveys commenced in 2016 and are ongoing at the site.

The works being conducted include the following elements:

- Ecological monitoring of terrestrial and aquatic ecosystems according to current best practice, e.g. Irish Environmental Protection Agency (IRE), the Irish National Parks and Wildlife Service of Ireland (NPWS), the Irish National Roads Authority of Ireland (NRA), Chartered Institute of Ecological and Environmental Management (CIEEM), The Heritage Council of Ireland, Bat Conservation Ireland (BCI) and Scottish Natural Heritage (SNH)
- Appropriate Assessment Screening Reports and Natura Impact Statements (Article 6, E.U. Habitats Directive)
- Desktop studies including ecological data review and analysis
- Ecological Constraints Studies
- Ecology Surveys, including but not limited to:
    - Birds e.g. Vantage Point surveys targeting Hen Harrier and other receptors, Hen Harrier winter roost surveys, wintering wildfowl distribution surveys, General breeding bird transect surveys etc.
    - Mammals e.g. Badger, Otter, other von-volant mammals;
    - Bat surveys
    - Habitat and Botanical surveys
    - Aquatic Ecology including macro-invertebrates, fisheries, freshwater pearl mussel (where applicable), etc.
    - Other taxa. e.g. Butterflies such as Marsh Fritillary
- Ecological Impact Assessment (EcIA)
- Statutory Compliance and Consultation, advice on conservation and legislation
- Biodiversity Action Plans and/or Species and Habitat Management Plans as applicable

For each mitigation measure the following will be provided:

- Details of how the mitigation will be secured and implemented
- Evidence of the degree of confidence in their likely success
- A timescale of when they will be implemented
- Details of how the mitigation measures will be monitored and how any mitigation failure will be addressed.

4.11.3 Receiving Environment

The Blackwater River (Cork/Waterford) SAC (side code: 002170) is located to the southeast of the development site. Other environmental designated sites include the Boggeragh Mountains NHA, Cork Harbour SPA, Ballyhoura Mountains SAC and Kilcolam Bog SPA.

4.11.4 Potential Impacts

This chapter of the EIAR will address the nationally designated sites, terrestrial and freshwater (aquatic) habitats and species, including those of conservation concern on and in close proximity to the wind farm and including along and in close proximity to the proposed cable route and proposed transport routes.

The ecological evaluation of the site and its' flora and fauna will be assessed according to NRA (2009). Once the value of the identified ecological receptors (features and resources) is determined, the next step will be to assess the potential impact and resulting effect of the proposed development on the identified key ecological receptors.

This will be carried out with regard to the criteria outlined in various impact assessment guidelines (NRA, 2009; CIEEM, 2018). The impacts will be assessed under a number of parameters such as magnitude, extent, timing, frequency, duration and reversibility. The impact significance criteria detailed in the EPA guidelines (EPA, Draft 2017) will be used where applicable.

Potential impacts of the wind farm on flora and fauna include:

- Direct loss of habitat due to the footprint of the area;
- Secondary Damage to adjacent habitats during construction which could potentially be affected by construction activity;
- Impacts during construction on the ecology of water dependant habitats
- Impacts on water quality and thus secondary effects on Biodiversity both at a local level and regional level due to pollution run-off whether during or post construction;
- Impacts on aquatic species during construction or due to pollution events etc.;
- Effects on local wildlife, including loss of habitat, disturbance and displacement;
- The potential collision risk to birds and bats;
- The introduction of alien invasive species during construction;
- Displacement of bird species from limited breeding areas;
- Displacement or disturbance to breeding waders from areas within the proposed wind turbine envelope;
- Barrier effect on migrating birds, where applicable, whereby individual species' dispersal or migration routes are affected by the placement of turbines which effectively cause a barrier;
- Impacts on the conservation status or constituent parts of designated sites.
- Potential impacts associated with tree felling and any required replanting on designated sites, habitats, flora and fauna.

The potential for likely significant effects on European (Natura 2000) sites as a result of the proposed development will be appraised though the appropriate assessment process.

4.11.5 Appropriate Assessment

An Appropriate Assessment Screening Report and if required a Natura Impact Statement will be prepared in respect of the proposed development, so as to enable the competent authorities to carry out an Appropriate Assessment as required by Article 6(3) of Council Directive 92/43/EEC ("the Habitats Directive") and section 177U and 177V of the Planning and Development Act 2000, as amended ("the 2000 Act"). The potential impact to European sites due to tree felling and any proposed replanting shall also be considered.

In compliance with the aforementioned provisions of Article 6(3) of the Habitats Directive and section 177U of the 2000 Act, a Screening Appropriate Assessment of an application for consent for proposed development shall be carried out by the competent authority or authorities to assess, in view of best scientific knowledge, if that proposed development, individually or in combination with another plan or project is likely to have a significant effect on a European site, in view of the site's conservation objectives.

Where significant effects on a Natura 2000 site cannot be discounted during Stage 1 Screening for Appropriate Assessment, the Assessment must proceed to Stage 2 and a Natura Impact Statement prepared at which point a detailed, targeted assessment of the nature and potential significance of direct and indirect impacts arising from the proposed project must be completed and an appraisal as to whether the integrity of the Natura 2000 site would be adversely affected.

European sites, as defined in the 2000 Act, comprise both Special Protection Areas (SPAs) for birds and Special Areas of Conservation (SACs) for habitats and other species, and are designated by Member States pursuant to the requirements of Council Directive 79/409/EEC, now Directive 2009/147/EU, on the conservation of wild birds ("the Birds Directive") and the Habitats Directive, respectively.

Article 6(3) of the Habitats Directive envisages a two-stage assessment process, which is implemented into Irish law (with some additional requirements) by the provisions of sections 177U and 177V of the 2000 Act. Screening for AA in accordance with section 177U is the first stage of the AA process ("Stage One"), in which the possibility of there being a significant effect on a European site is considered. Plans or projects that have no appreciable effect on a European site are thereby excluded, or "screened out", at this stage of the process.

The first step in the screening process is to develop a list of European sites which may have the potential to be affected by the proposed development. Each relevant European site is reviewed to examine whether or not the proposed development is likely to have a significant effect on the European site.

The proposed development is located within the surface water catchment of the River Bride, a tributary of the River Blackwater (Cork/Waterford). The River Blackwater main channel and the River Bride are both designated within the River Blackwater (Cork/Waterford) SAC (site code: 2170). This is the primary European Site located close to the proposed development. Further to the east, the Blackwater Callows SPA (site code: 004094) is located east of Fermoy town. All European Sites within 15km of the proposed development will undergo consideration as to the potential for likely significant effects thereon.

For each European Site under consideration, the qualifying interests or special conservation interests of each European site will be identified and any potential for effects summarised under various headings for the purposes of the screening process:

- Direct effects refer to habitat loss or fragmentation arising from land-take requirements for development. Direct impacts can arise as a result of a change in land use or management, such as the clear-felling of forestry, creation of access roads and hardstanding's etc.
- Indirect and secondary effects may arise, for example, when a development alters the hydrology of a catchment area, which in turn affects the movement of groundwater to a site, and the qualifying interests that rely on the maintenance of water levels. Deterioration in water quality could occur as both an indirect and direct consequence of a particular development, which in turn changes the aquatic environment and reduces its capacity to support certain plants and animals.
- The introduction of invasive species can also be defined as an indirect (cross-factor) effect, which results in increased movement of vectors (humans, fauna, surface water), and consequently the transfer of alien species from one area to another.
- Disturbance to fauna can arise directly through the loss of habitat (e.g. otter holts) or indirectly through noise, vibration and increased activity associated with construction and operation.
- *Ex-situ* effects on supporting habitats or species for European Sites may occur and dependant on pathways may result in the likelihood of significant effects on European Sites.

During Stage 2 AA, the effect of the project on the integrity of the European site(s), as defined by its structure and function, and its conservation objectives is appraised. Potential impacts on species or habitats will be evaluated with respect to the scale, extent and nature of the impact, for example the area of habitat affected, changes in hydrodynamics, the percentage reduction in species density, potential changes in species distribution. The duration of the impact will be determined in terms of the duration of the works and also the amount of time required for the species and / or habitat to be replaced or to recover from the impacts. During Stage 2 of the AA process, mitigation measures can be developed to minimise effects on European Sites.

Mitigation measures will follow the mitigation hierarchy:

- Avoidance
- Reduction
- Remedy

For each mitigation measure the following will be provided:

- Details of how the mitigation will be secured and implemented
- Evidence of the degree of confidence in their likely success
- A timescale of when they will be implemented
- Details of how the mitigation measures will be monitored and how any mitigation failure will be addressed.

4.12 Environmental Aspect: Soils, Geology, Hydrogeology

4.12.1 Aspects to be addressed

The assessment will address soils, bedrock and groundwater underlying the wind farm.

4.12.2 Assessment methodology

The methodology for the soils and geology assessment will be in accordance with the guidelines published by the Institute of Geologists of Ireland in 2013, 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements'.

At this stage, it is envisaged that the Preliminary Site Investigation (Phase 1) will consist of geophysics at turbine locations in order to provide a preliminary assessment of rockhead levels at each site, peat probing along access road routes to identify whether roads are likely to be floated or founded and trial pits at borrow pit locations to confirm the depth of overburden at borrow pit locations and potentially log the upper weathered rock deposits.

It is proposed to carry out exploratory rotary boreholes at selected locations along the proposed grid connection cable route where horizontal directional drilling (HDD) techniques being considered as a method of traversing existing watercourses and the M8 motorway, which cross the existing public road route between the development site and Barrymore substation.

Geophysics will be undertaken at the turbine locations and trial pits will be carried out at the proposed borrow pit locations.

The data gathered will be used to inform the final location of all turbines and associated infrastructure.

An earthworks balance calculation will be prepared for the overall development to assess where excavated material can be beneficially re-used. In addition, an assessment of the volumes of raw material will be made which will in turn be used to determine the number and size of borrow pits required.

4.12.3 Receiving Environment

The Geological Survey of Ireland (GSI) 1:100,000 scale bedrock geology map shows that the wind farm site is underlain by the Ballytrasna Formation which is described as a purple mudstone and sandstone.

The subsoils present at the proposed wind farm site are taken from the GSI online mapping and comprise:

- Glacial till derived from Devonian sandstones,
- Blanket peat; and
- Alluvium (A). Undifferentiated alluvial deposits occur along river channels.

The majority of the site is underlain by Glacial Till.

There is a karstic feature noted north of the site at Killavullen caves and an active sand and gravel quarry (Lyrevarrig) approximately 1km from the site. No geological heritage areas were identified in the vicinity of the site.

The underlying bedrock is noted as a Locally Important Aquifer, with vulnerabilities noted from High to Extreme.

4.12.4 Potential Impacts & Mitigations

The potential impacts of the development of the wind farm on the geology, hydrogeology and slope stability are:

- The excavation and removal of soil and rock and interference with any existing site drainage is a potential direct permanent effect that, without mitigation, could alter the existing hydrogeological balance of the site;
- The construction of the turbines, hardstanding areas, access tracks, borrow pits and cable trenches has the potential to cause hydrogeological impacts by modifying the natural groundwater levels adjacent to the excavation. This in turn may deprive ditches and streams of their natural supply of water which may lead to reduced base flow and recharge to the bedrock aquifer;
- Areas which are underlain by peat deposits are susceptible to slope stability issues, including peat slides and bursts, when changes are made to topography, hydrogeology and hydrology of the site;
- The use of granular fill and other materials for the construction of the access tracks has the potential to have a permanent impact on the source quarries or borrow pits;
- Excavations have the potential to increase erosion and sediment release that could also have additional impacts on water quality due to sedimentation of water courses;
- Soil compaction may occur due to movement of construction and maintenance traffic;
- Removal of sub soils may result in the exposure of the underlying rock to sources of contamination and may increase the vulnerability of the aquifer, whether or not the rock is exposed;
- Chemical pollution may occur as a result of an accidental spillage or leakage of chemicals, runoff from vehicle washing facilities, unset concrete, storage of fuels or refuelling activities, etc. Chemical pollutants may enter the groundwater and have implications for ecology and any wells in the area, particularly those located down-gradient of the site.
- Sanitary waste arising from temporary construction compounds could lead to contamination of groundwater

At the substation, the potential impacts are the pollution of groundwater from an oil or fuel spillage during construction. The sub-station and the construction compound will have staff welfare facilities.

4.13 Environmental Aspect: Water Quality and Hydrology

4.13.1 Aspects to be Addressed

The assessment will address impacts on hydrology and water quality. The aspects of the hydrological environment that could be affected by the activities associated with the proposed CGEP will also be addressed.

4.13.2 Assessment Methodology

The emerging design layout will consider the sensitivities of the environmentally designated areas in the proximity of the site. A preliminary site visit will be undertaken to establish the constraints relating to hydrology and noting any hydrological features. The desk study will involve setting out the principles for surface water management, attenuation and treatment for the site specific land use at the site. Once the design layout is fixed, a further site visit will be scheduled in to undertake a walkover of the site, to identify all the streams crossed by the proposed layout and examine how overland flow will be accommodated and to identify suitable locations for the treatment of discharges.

Cumulative impacts will be addressed to assess the hydrological impact of neighbouring sites. Taking account of the sensitivity of the receiving environment, the treatment of the surface water run-off will concentrate on Silt Protection Controls (SPCs). Measures will also be considered to avoid any increase in flooding downstream.

A Flood Risk Assessment (FRA) will be undertaken to assess the impact of the proposed development on downstream flooding. Liaison will be ongoing with the Geology department in-house to incorporate any relevant results emerging from the hydrogeological and geotechnical findings and in particular the peat stability assessment. This FRA will examine the requirements for the conveyance of flood flows at stream crossings. The FRA will include an assessment of flood history, hydrometric data (water levels and flows) for adjacent water body, surveyed site levels and rainfall data for extreme events. The FRA will take cognisance of climate change and extreme flood events as deemed appropriate. The capacity of downstream structures will be examined for the pre and post development scenarios. Siltation and pollution control will be examined along with attenuation, which will be incorporated into the proposed drainage system where required to mitigate any risk of an increase in flooding and to protect the downstream environmentally protected areas.

The methodology will include the following:

- Study of existing surface water/drainage features in the vicinity;
- Delineation of catchment boundaries;
- Catchment mapping;
- Establish constraints;
- Study of the proposed layout of the development;
- Examine grid connection route options;
- Assessment of the turbine delivery route (TDR);
- Liaison with in-house Geotechnical department for details on soil conditions on the site;
- Study of planning documents for adjacent developments;
- History of flooding and status of drainage in the neighbourhood;
- Existing Water Quality assessment;
- Study of the sections of forestry, examining details of planting and existing forestry drainage systems;
- Forestry felling assessment relevant to hydrology and water quality;
- Preparation of the overall hydrological, water quality and drainage impact assessment:
    a. Potential impacts of the proposed development on hydrology (hydrodynamics and flooding)
    b. Potential cumulative hydrological impacts of the proposed development with any neighbouring wind farms
    c. Potential drainage into sensitive catchments
    d. Potential impacts of the proposed development on water quality
- Consult with interested bodies, Inland Fisheries Ireland and relevant Local Authorities;

- Study of development plans;
- Site drainage investigation will involve identification of drainage sub-catchments, studying the requirement(s) of cross-drainage works, if any, exploring the infiltration potential of the soils in the area, etc.;
- Outline of mitigation measures for flooding and pollution of receiving waters;
- Design of site appropriate erosion and sediment control measures, development of erosion and sediment control procedures for implementation on site;
- Preparation of Flood Risk Assessment in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, DoEHLG and OPW, November 2009, including a cumulative assessment with adjacent developments and Surface Water Management Plan in accordance with Greater Dublin Strategic Drainage Study (GDSDS) and the CIRIA SuDS Manual (C753) including the design of stream crossings;
- Design of site specific surface water drainage system and drainage infrastructure – to control flow of surface water on site during construction, Sustainable Drainage Systems (SuDs);
- Preparation of Designer's Risk Assessment – Drainage Element;
- Contribution to the Appropriate Assessment;
- Outline of residual impacts.

The Hydrology element of the EIAR and the FRA will inform the civil design of the site. A Surface Water Management Plan (SWMP) will be prepared as part of the Outline Construction and Environmental Management Plan (oCEMP). A hydrological impact assessment and flood study will be incorporated into the SWMP, culminating in a Drainage/ Surface Water Management Plan for Erosion Control, Protection of Water Quality and mitigation of flood risk.

4.13.3 Receiving Environment

The site lies within the Hydrometric Area 18_Blackwater Munster and within the River Blackwater Catchment.

The Blackwater catchment includes the area drained by the River Blackwater and all streams entering tidal water between East Point and Knockaverry, Youghal, Co. Cork, draining a total area of 3,310km². The largest urban centre in the catchment is Mallow. The other main urban centres in this catchment are Fermoy, Mitchelstown, Youghal, Kanturk and Millstreet. The total population of the catchment is approximately 109,030 with a population density of 33 people per km².

Sub catchments associated with the proposed development areas include the following:

- Bride [Waterford]_SC_010
- Blackwater [Munster]_SC_080
- Blackwater [Munster]_SC_110

The majority of the site development area lies within the Bride [Waterford]_SC_010 sub catchment. Small portions of the western and north-western parts of the development area lie within the Blackwater [Munster]_SC_080 and Blackwater [Munster]_SC_110 respectively.

The following Water Framework Directive river sub basins are associated with the proposed development area:

- COOM_010
- CLYDA_030
- ROSS (KILLAVULLEN)_010
- BRIDE (BLACKWATER)_010
- BRIDE (BLACKWATER)_020

In addition to the above, the proposed grid connection route passes through the following river sub-basins:

- BLACKWATER (MUNSTER)_180
- BRIDE (BLACKWATER)_030

The main waterbodies within the study area are the Toor and Coom rivers along with their associated tributary streams which flow east into the River Bride which is a main tributary of the Blackwater. The River Bride flows south between the two main development study areas. The Bunnaglanna and North Lackendarragh Streams have their headwaters in the Knocknaskagh Hill area near the eastern boundary of the development study area.

According to the Water Framework Directive Website, http://watermaps.wfdireland.ie, the River Bride (IE_SW_18_1605), which is the major waterbody flowing through the western development area, is of good overall status but classified as "at risk".

In terms of flood risk, PFRA/CFRAMS: 1% AEP Fluvial Flood Extent mapping shows potential for flooding within a very small percentage of the SW area of the development study area. The proposed grid connection route crosses a fluvial flood zone in three locations. Pluvial flood zones are identified by PFRA/CFRAMS in 4no. locations within the energy park development study area but these are small and relatively isolated. There are 2no. pluvial flood zones in close proximity to the proposed grid connection route.

4.13.4 Potential Impacts

The main potential impact from the construction of the energy park is the sedimentation of watercourses. Rainfall run-off containing silt could potentially lead to siltation and consequent physical effects on flora and fauna in aquatic habitats.

Sediment has the potential to arise from:

- Temporary spoil heaps from the excavations for the turbine bases; if left exposed, the spoil heaps could lead to an increase in silt-laden run-off draining off site.
- Haulage roads passing close to watercourses could allow the migration of silt-laden run-off into watercourses (crushable stone in site access roads could lead to heavy vehicles creating fines in the stone with a subsequent loss of sediment in the surface water run-off).
- Silt carried on the wheels of vehicles leaving the site could be carried onto the public road.
- Tree felling could lead to an increase in sediment in the surface water run-off.
- While the cable trench is open adjacent to a watercourse and at stream crossings, this could lead to an increase in the concentration of suspended solids in the watercourse.

In addition, possible impacts on water quality during construction activity include:

- Concrete operations could contaminate receiving waters.
- Runoff from vehicle washing facilities could lead to contamination of receiving waters.
- Refuelling activities could result in fuel spillages.

The potential impacts on hydrology and drainage that may arise from the proposed development of the CGEP include impacts on localised flooding patterns and downstream structures as well as cumulative hydrological impacts with neighbouring developments.

At the temporary compound, the potential impacts are the pollution of surface water from an oil or fuel spillage during construction.

During the operational phase of the CGEP, potential impacts on water quality will primarily arise from the use of lubricants, coolants and hydrocarbons in the operations of the turbine transformers as well as routine maintenance of all plant and equipment.

4.14 Environmental Aspect: Archaeological, Architectural and Cultural Heritage

4.14.1 Aspects to be Addressed

The assessment will address features and sites of archaeological, architectural and cultural heritage significance. The purpose of the study will be to assess the significance of the receiving cultural heritage environment and to identify and evaluate the magnitude of the impact of the proposed CGEP on the sensitivity of each cultural heritage feature within this environment and on the broader historic character of the landscape. Measures will be proposed to mitigate effects (where possible) so as to allow a fully informed decision to be made by the adjudicating authority.

4.14.2 Assessment Methodology

The content of the cultural heritage assessment will be based on current EPA guidelines and relevant national and international best practice guidelines. The assessment will identify the recorded and potential elements of the cultural heritage resource (including archaeology, built heritage, history and folklore) within a study area encompassing the proposed development areas, grid connection, borrow pits and site access routes.

A preliminary review of the recorded cultural heritage resource within the wider environs of the development area, including known archaeological sites and designated architectural heritage structure, was compiled at the outset of the design process by John Cronin and Associates (JCA). This identifies the nature, location and legal status of all recorded archaeological sites within the environs of the proposed development. There are no designated architectural heritage structures located within the close environs of the proposed development area. The archaeological consultants have continued to liaise with the project team as the development design has progressed and this included a review of grid connection options. The EIAR will expand on this preliminary review and will include a review of relevant publications, archaeological excavations in the region, cartographic sources, archival records, aerial and LiDAR imagery and other sources. A preliminary inspection of the proposed development area, including grid connection options, has been undertaken and further inspections will be carried out during the EIAR assessment.

4.14.3 Receiving Environment

There are no recorded archaeological sites located within the footprint of the proposed development while there are three recorded archaeological sites within distances of 100m-350m of proposed development areas. Surface traces of two of these sites (Barrow CO043-001---- and Fulacht Fiadh CO043-005----) have been removed by the modern forestry plantation but the potential exists for the survival of sub-surface archaeological features and/or artefacts at their locations. The third recorded monument (Ring Barrow CO043-004----) remains extant within an area of pasture adjacent to a forestry plantation. While no development works are proposed at the recorded locations of any of these sites, it is envisioned that their locations maintained within clearly signed exclusion areas for the duration of the construction phase.

There surrounding landscape contains a range of archaeological monuments and these will be reviewed and assessed in the EIAR. Island wedge tomb (National Monument 502) is approx. 2.3km to the west of the nearest proposed turbine location. The location of this monument will also be assessed during the Visual Impact Assessment carried out as part of the EIAR. A number of hilltop cairns and a recorded section of the Claidh Dubh routeway are located within forestry in lands to the north of the proposed development area. These sites will also be assessed as part of the EIAR.

There are no designated architectural heritage structures located within the close environs of the proposed development area. A review of historic maps indicates that prior to the creation of the extensive modern forestry plantations that now cover much of the development area, it comprised vacant upland heathland in recent centuries. The EIAR will include an assessment of any surviving vernacular structures and bridges within the environs of the proposed development, including the grid connection, as such structures are often of local cultural heritage interest and worthy of preservation by record or preservation in situ.

4.14.4 Potential Impacts

The predicted impacts of the proposed scheme on both the recorded and potential elements of the cultural heritage resource within proposed development areas will be identified and clearly defined based on EPA criteria. The assessment will also address cumulative impacts and potential inter-visibility and sensitivity analyses of cultural heritage sites within the surrounding landscape.

Appropriate mitigation measures to minimise impacts on the cultural heritage resource will be formulated following consultation with both the client and the relevant local and national authorities. These may involve (1) the preservation *in situ* of identified sites within protected buffer zones and (2) undertaking pre-development site investigations and/or the supervision of ground works during the construction phase. It is noted that the forested nature of much of the development area will form a constraint for pre-development site investigations. While details on any required mitigation measures will await assessment, it is envisioned that potential impacts will be subject to constant assessment as the design and consultation process progresses.

As statutory consultees the NMS (via the Development Applications Unit) and Cork County Council (CCC) will be consulted in relation to required mitigation measures as part of the formal EIAR consultation process.

4.15 Environmental Aspect: Aviation and Telecommunications

4.15.1 Aspects to be Addressed

The rotating blades of a wind turbine can occasionally cause interference to electro-magnetically-propagated signals. Such interference could, in theory, affect all forms of electromagnetic communications including:

- Satellite communications
- RADAR
- Cellular radio communications
- Aircraft instrument landing systems
- Air traffic control
- Terrestrial microwave links
- Television broadcasts

In addition, it is possible that houses in the immediate vicinity of the turbines could require some remedial measures in relation to television reception.

The EIAR will include an assessment of any such potential impacts.

4.15.2 Assessment Methodology

An evaluation of the possible effects that the proposed development could have on aviation and existing telecommunications networks will be conducted. A study will be undertaken to analyse the impact of the turbines on telecommunications operator's point-to-point microwave radio links.

This evaluation will include the generation of GIS based telecommunications constraints mapping for the areas affected. The purpose of this mapping is to identify potential negative impacts on the telecommunications network and facilitate the selection of optimum sites and turbine locations by avoiding telecommunication links where possible, and thereby limiting any potential negative impacts on service providers in the area.

The proposed assessment methodology will include:

- Consultation with Irish Aviation Authority, Commission for the Regulation of Utilities, emergency services
- Consultation with telecommunications operators to gather the necessary data
- Preparation of constraint mapping

- Analyses of the impact of the turbines on telecommunications operators' point-to-point microwave radio links and apply appropriate buffer distances around links and masts where required
- Discussions with telecommunications operators identifying potential clashes. Operators to provide feedback on initial assessment and to provide information on the importance of the links identified.
- Further specialist investigations will be carried out if the telecommunications operators identify potential impacts.
- Where necessary, mitigation measures to be agreed with operators including:
    - Turbine relocation
    - Telecommunications link relocation
    - Underground fibre optic cables to replace microwave link
    - Submission of final detailed layout to telecoms operators.
    - Agree any layout alterations following final detailed assessment by telecoms operators, or agree suitable mitigation measures if necessary.

Impacts on aviation will be addressed following detailed discussions with the Irish Aviation Authority.

In relation to the cables, mapping of telecommunications cables, which could potentially be affected by the installation of the CGEP cables, will be obtained and potential impacts assessed.

4.15.3 Receiving Environment

In terms of the receiving environment, links will be identified within a suitable buffer distance of the turbines, following consultation with network providers.

4.15.4 Potential Impacts

An evaluation of the possible effects that the proposed development could have on aviation and existing telecommunications networks will be conducted. A study will be undertaken to analyse the impact of the turbines on telecommunications operator's point-to-point microwave radio links.

This evaluation will include the generation of GIS based telecommunications constraints mapping for the areas affected. The purpose of this mapping is to identify potential negative impacts on the telecommunications network, and facilitate the selection of optimum sites and turbine locations by avoiding telecommunication links where possible, and thereby limiting any potential negative impacts on service providers in the area.

The Irish Wind Energy Association 2012 guidelines, "*Best Practice Guidelines for the Irish Wind Energy Industry*", indicate that wind turbines within 20 km of a radio navigation aid have the potential to cause electro-magnetic interference with these signals. It is possible that houses in the immediate vicinity of the turbines could require some remedial measures in relation to television reception. In practice, such measures are not difficult to implement, are relatively inexpensive and if necessary will be undertaken by the developer in conjunction with RTÉ.

4.16 Environmental Aspect: Landscape and Visual Impact

4.16.1 Aspects to be addressed

The Landscape chapter describes the landscape context of the proposed CGEP and assesses the likely landscape and visual impacts of the scheme on the receiving environment. Although closely linked, landscape and visual impacts are assessed separately. **Landscape Impact Assessment (LIA)** relates to changes in the physical landscape brought about by the proposed development, which may alter its character. **Visual Impact Assessment (VIA)** relates to assessing effects on specific views and on the general visual amenity experienced by people. **Cumulative landscape and visual impact assessment** is concerned with additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.

Aspects to be addressed in the report are:

- Receiving environment, covering details on:
  - wider landscape context
  - localised site context.
  - Landform, landcover, land use patterns and trends
  - key/unique landscape elements and features
  - defining attributes of the wider landscape

- Landscape character, covering details on:
  - Character as outlined in CDP
  - Associated landscape values
  - Sensitivity levels within the landscape
  - Statutory designations
  - Landscape designations
  - Scenic/amenity routes
  - Views and prospects
  - Features of natural and built heritage

- Landscape Policy Context:
  - Relevant policy objectives within Cork CDP and LAPs
  - Relevant policy objectives within neighbouring counties within the 30km Study Area (Objectives appendicised).

- Visual context:
  - Zone of Theoretical Visibility
  - Viewshed Reference Points (Detailed findings appendicised).
  - Route Screening Assessment (Detailed findings appendicised).

Residential Amenity Assessment will be assessed with detailed findings in an Appendix as part of the Population and Human Health Chapter of the EIAR.

Assessment of these aspects will ultimately inform potential landscape, visual and amenity aspects, residual impacts, and in turn appropriate mitigation measures to ensure impacts are not significant.

4.16.2 Assessment Methodology

The Landscape and Visual Assessment of the CGEP will be undertaken in accordance with the Landscape Institute and the Institute of Environmental Management and Assessment publication entitled 'Guidelines for Landscape and Visual Impact Assessment' – Third Edition (2013). This is recognised as the principal best practice guidance for landscape and visual assessment of all forms of development in Ireland and the UK.

Regard will also be given to the overarching Environmental Impact Assessments guidelines and advice notes set out by the EPA:

- Environmental Protection Agency (EPA) Guidelines on the Information to be contained in the Environmental Impact Assessment Reports (EPA, Draft 2017)
- EPA Advice notes on current practice in the preparation of Environmental Assessment Reports (EPA, Draft 2015)

Other relevant LVIA and wind energy specific guidance that will be considered includes;

- Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines (2006).
- Scottish Natural Heritage (SNH) Siting and Designing Wind Farms in the Landscape (version 3a – 2017)
- Scottish Natural Heritage (SNH) Assessing the Cumulative Impact of Onshore Wind Energy Developments (2012).
- Scottish Natural Heritage (SNH) Visual representation of wind farms: Best Practice Guidelines (version 2.2 - 2017).

Production of the Landscape and Visual Impact Assessment involved baseline work in the form of desktop studies and fieldwork comprising professional evaluation by qualified and experienced Landscape Architects. This entailed the following:

Desktop Study

- Establishing an appropriate Study Area from which to study the landscape and visual impacts of the proposed CGEP – 20km in this instance, in accordance with the Wind Energy Development Guidelines 2006;
- Review of a Zone of Theoretical Visibility (ZTV) maps, which indicates areas from which the development is potentially visible in relation to terrain within the Study Area;
- Review of relevant County Development Plans, particularly with regard to sensitive landscape and scenic view/route designations;
- Selection of potential Viewshed Reference Points (VRPs) from key visual receptors to be investigated during fieldwork for actual visibility and sensitivity;
- Consultation with the local community and the Local Authority in respect of sensitive VRP locations to be included in the assessment.

Fieldwork

- Recording of a description of the landscape elements and characteristics within the Study Area.
- Selection of a refined set of VRP's for assessment. This includes the capture of reference images and grid reference coordinates for each VRP location for the visualisation specialist to prepare photomontages.

Appraisal

- Consideration of the receiving landscape with regard to overall landscape character as well as the salient features of the study area including landform, drainage, vegetation, land use and landscape designations.
- Consideration of the visual environment including receptor locations such as centres of population and houses; transport routes; public amenities and facilities and; designated and recognised views of scenic value.
- Consideration of design guidance and planning policies.
- Consideration of potentially significant effects and the mitigation measures that could be employed to reduce such effects.
- Estimation of the significance of residual landscape impacts.
- Estimation of the significance of residual visual impacts aided by photomontages prepared at all of the selected VRP locations.
- Estimation of cumulative landscape and visual effects in combination with other surrounding developments that are either existing or permitted.

4.16.3 Receiving Environment

The site of the proposed CGEP is contained in productive rural landscape of rolling farmland and forestry between the settlements of Mallow to the northwest and Cork City to the south. The site is contained on the southern slopes and foothills of the Nagles Mountains with the Blackwater River Valley contained on the northern side of this range. There are a number of small settlements within the study area as well as a dispersed rural population. The N20 national primary route runs between Cork and Mallow to the west of the site and the N73 national secondary road runs along the Blackwater Valley in an east-west direction.

4.16.4 Planning and Policy Context

The Department of Environment, Heritage and Local Government Wind Energy Development Guidelines (2006)

The Wind Energy Development Guidelines (2006) provide guidance on wind farm siting and design criteria for a number of different landscapes types. The proposed CGEP is considered to principally contained within an area that identifies with the 'Hilly and Flat Farmland' landscape type.

Cork County Development Plan 2014-2020

A landscape character assessment is incorporated within the Cork County Development Plan and divides the county into 16 No. Landscape Character Types (LCTs). The site in question is situated between two Landscape Character Types; LCT 10b – 'Fissured Fertile Middleground' and LCT 13b – 'Valleyed Marginal Middleground' (**Figure 1.4-1.6** refers). LCT 10b – Fissured Fertile Middleground is recognised as having; Medium landscape sensitivity; Low Landscape Value; and County Landscape Importance while LCT 13b is recognised as having; Medium landscape sensitivity; Medium Landscape Value; and Local Landscape Importance. It should also be noted that LCT 5 'Fertile Plain with Moorland' borders LCT 13b immediately to the north and is identified as having a '*Very High*' landscape value, a '*Very High*' landscape sensitivity, and a '*County*' landscape importance.

In terms of Wind Energy development, the site is contained in an area that is **'Open to Consideration'**, whereas, immediately to the north of the Nagles ridgeline within the Blackwater Valley context, wind energy is 'Normally Discouraged'.

In terms of scenic designations, Scenic Routes are indicated in the Cork County Development Plan 2014 online map browser. Designated Scenic Routes that occurs within the study area include:

- **S2:** Local Roads adjoining Kilworth Mountains Views of the Araglin River Valley, distant views of the Galtee, Kilworth, Knockmealdown Mountain Ranges & Cairn Hill.
- **S3:** N8 National Primary Route between Moorepark and Mitchelstown. Views of the Galtee, Nagle, Kilworth & Knockmealdown Mountain Ranges.
- **S4:** R667 Regional Road, section of local road & R666 Regional Road between Kilworth & Fermoy. Views of the Blackwater, Funchion & Argalin River Valleys
- **S5:** R666, Regional Road from Coolalisheen Bridge to Ballyalacken. Views of the Blackwater River Valley.
- **S6:** Local Road to Coolbaun. Views of pastoral landscape & the Bride River Valley.
- **S7:** N72 National Secondary Route between Bellvue Cross and Kilbarry overlooking Blackwater valley. Views of the Blackwater River Valley & distant Mountain Views
- **S8:** Local Road between Glenabo Bridge & Ballynahina. Distant views of the Blackwater and Bride River Valleys & local views of wooded valley.
- **S9:** N72 National Secondary Route between Cregg Castle, Castlehyde & Fermoy. Views of the settlement of Fermoy, the Blackwater Valley, the eastern slopes of the Nagle Mountains & demesne walls, characteristic of the area.
- **S10:** N72, National Secondary Route from Renny Lower through village of Ballyhooly. Views of the Blackwater Valley & the northern slopes of the Nagle Mountains.
- **S11:** Local Road at Carrigacunna through Nagle Mountains to Ross River Valley to Fiddane Bridge. Views of the Nagle Mountains.

- **S12:** Local Road between Knuttery and Bottlehill. Views of rolling landscape.
- **S13:** Local Road from Craig Cross Roads to County Boundary. Views of the Ballyhoura Mountains & the Awbeg Valley.
- **S14:** N72 National Secondary Route between Mallow and Roskeen Bridge. Views of the Blackwater valley.
- **S19:** R579 Regional Road from Glenaknockane towards Donoughmore. Views of Boggeragh Mountains & rural uplands.
- **S37:** Local Road & R618 Regional Road between Leemount and Macroom via Coachford. Views of the Lee Valley & reservoir, rural landscape & the Sullane River.
- **S39:** Local Road & R617 Regional Road between Clogheen, Tower and Blarney and the road to Blarney Lake. Views of the settlements of Ballincollig, Tower & Blarney, Blarney Castle & the Lee Valley.
- **S40:** Section of Local Road between Blarney and Grenagh. Views of wooded banks of the River Martin & Putland Bridge.
- **S41:** R639 Regional Road & Local Road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthane. Views of the Estuary & Harbour, wooded landscape, open countryside & hillsides.
- **S42:** Local Road at Forest-town, N.W. Carrigtwohill and Westwards to Caherlag. Views of the Harbour, open countryside & tree lined hillsides.
- **S43:** R626 Regional Road between Lisgould and Carrigogna. Views of wooded landscape & intermittent views of open countryside.
- **S44:** Local Road between Monaleen Bridge, Ardlass & Gurteen Cross Roads. Views of hills & rural landscape.

All of these designated scenic routes were investigated during the desk study stage (using ZTV maps) and those not precluded due to terrain screening were further investigated for actual visibility during fieldwork. Each of the remaining relevant scenic views will be represented by viewpoint/s for the purpose of the visual impact assessment.

4.16.5 Completed Baseline Work

In terms of 'mitigation by avoidance' design work completed to date, Macro Works has prepared Zone of Theoretical Visibility (ZTV) maps, which indicate from where in the surrounding landscape turbines may be visible. 'Reverse ZTV maps', which highlight turbines that may be potentially visibility from important key receptors have also been prepared from scenic designations within the Blackwater Valley and from the top of Blarney Castle. These maps along with preliminary 'wireframe' photomontages from many of the same key receptors have influenced the design iterations to date. The ZTV maps also informed the preliminary selection of viewpoint to inform the LVIA from throughout the study area.

Fieldwork has been undertaken and photography has been captured at a broad selection of potential viewpoints. The final assessment set of viewpoints is likely to be a slightly refined subset of this and subject to any scoping comments from the Planning Authority.

4.16.6 Potential Impacts

The proposed wind turbines will be large moving structures with the potential to have significant landscape and visual impacts. The development of wind farms, including associated infrastructure such as tracks and ancillary buildings also has the potential for significant physical impact on the landscape within the site.

The significance of both landscape impacts and visual impacts is assessed on the basis of weighing visual/landscape receptor sensitivity (i.e. value and vulnerability) against landscape / visual impact magnitude (i.e. scale and nature of change). Consequently, the greatest potential for significant impacts to occur is in respect of highly sensitive receptors, especially where such receptors are in close enough proximity to the proposed development that they may experience a high magnitude of change.

In this instance the key sensitive receptors are considered to be the high sensitivity landscape of the Blackwater Valley and viewers contained within its designated scenic setting. Blarney Castle is also an internationally renowned and heavily visited tourist/heritage asset, albeit a considerable distance from the site. Contrastingly, local residents are relatively sensitive receptors that are in close enough proximity to the proposed CGEP that the magnitude of visual change could result in significant visual impacts. There are also two scenic route designations in close proximity to the site that are of relatively high sensitivity and from which viewers could experience a high magnitude of visual change resulting in significant impacts.

Aside from the potentially significant impacts outlined above, there is a considerable number visual receptors within the wider context of the study area (roads, residents, settlements, heritage and amenity areas) where non-significant visual impacts will occur.

5 CUMULATIVE IMPACTS, INDIRECT IMPACTS AND INTERACTION OF EFFECTS

5.1 Aspects to be Addressed

The cumulative impact of the proposed CGEP with other projects which are either existing, permitted or pending planning permission, or for which there is information in the public domain, at a sufficient level of detail to allow assessment, will be addressed. Indirect effects and effects in different environmental media will be addressed.

The cumulative effects from the construction of the wind turbines, cabling and haul route alterations will also be assessed. Cumulative assessment will be assessed under each individual chapter heading.

5.2 Cumulative Assessment Methodology

The assessment methodology will be based on the EPA guidance and the EU guidelines, 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions', published by the Office for Official Publications of the European Communities in May 1999. Cumulative impacts will also be assessed in accordance with the Scottish Natural Heritage (SNH) guidance on Assessing the Cumulative Impact of Onshore Wind Energy Development (March, 2012). Other key guideline documents used for carrying out the cumulative impact assessment include the following:

- Draft Advice Notes on Preparing Environmental Impact Statements (EPA, 2015);
- Draft Guidance on the information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency (EPA), 2017);
- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government, 2018).

As part of scoping the studies required to assess the impacts of the proposed CGEP in the different environmental media, the potential for significant cumulative and indirect impacts and interactions will be examined and any such potential impacts will be identified. Where the potential for significant cumulative and indirect impacts and interactions is identified, such impacts and interaction of impacts will be included in the scope and addressed in the baseline and impact assessment studies for each of the relevant environmental media and aspects of the project. The cumulative and indirect impacts and interaction of impacts will be presented in the chapters of the EIAR which address the most relevant environmental media.

The matrix and expert opinion approaches, as outlined in the EU Guidelines, will be used in the identification of the potential for significant cumulative and indirect impacts and interactions. A matrix of potential interactions will be prepared.

5.2.1 Receiving Environment

Cumulative impacts will be assessed for other projects which are either existing, permitted or pending planning permission, or for which there is information in the public domain, at a sufficient level of detail to allow assessment.

5.2.2 Potential Impacts

If other projects of a similar scale and type are under construction at the same time as proposed CGEP, there would be a cumulative increased demand for construction materials and skills, and there would be potential for increased construction traffic, dust and noise. The proposed CGEP has the potential to reduce Ireland's reliance on fossil fuel power generation and assist in it meeting its EU targets for renewable energy generation. Once operational, the cumulative effects with other wind farms and solar farms in area will be a positive one due to the replacement of fossil fuel energy production with clean, green energy.

FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.2

2rn Protocol Agreement

Block B, Cookstown Court,
Old Belgard Road, Tallaght,
Dublin 24, Ireland
Tel: +353 (0)1 208 2259
E-mail: 2rn@2rn.ie

Protocol Agreement

between

Coom Green Energy Park Ltd

and

2rn

concerning the wind farm at:

Coom Green Energy Park,

Near Glenville, Co. Cork

"Developer":	Coom Green Energy Park Limited Floor 5, City Quarter, Lapps Quay, Cork Registered No. 614275
"2RN":	RTÉ Transmission Network DAC trading as "2RN", Montrose, Donnybrook, Dublin 4. Registered No. 364909
"Development":	Proposed development by way of initial construction or intensification of use of a wind farm at Coom Green Energy Park, Near Glenville, Co. Cork
"Viewer(s)":	Proprietor (or agent of proprietor) of a private residence or business premises where a television set, for which a current television licence is held, is used and/or a broadcast radio receiver.
"Local Dealer":	Local dealer being a television engineer / dealer carrying on business in the vicinity of the development and may be nominated by the wind farm developer.

Interference on Viewers' Television Sets and/or Broadcast Radio Receivers

1. When 2RN is put on notice, whether by telephone or written communication, that a viewer is having problems with their reception, 2RN will undertake a preliminary assessment, over the telephone or by other means of communication, and ascertain whether or not the wind farm is a likely cause of the interference complained of.

2. If 2RN believes the interference is wind farm related, the viewer will be asked to contact the wind farm developer. Then the developer will arrange for a local dealer to visit the viewer.

3. Both parties to this protocol note that the type of interference caused by electromagnetic disturbance emanating from wind farms manifests itself in very specific ways on television sets and broadcast radio receivers.

4. The local dealer will arrange directly with the viewer to make a visit to the viewer's house and assess the cause of the interference. The local dealer will take whatever steps are necessary to remedy the interference.

5. The local dealer will prepare a brief report in writing which will be sent to the developer. If the local dealer is of the view that the interference is due to interference from the development, the dealer will send an invoice in respect of the site visit and remedial work to the developer. The developer is the party primarily liable for the discharge of any amounts due in respect of any such site visit and remedial work. If the local dealer identifies that the problem is due to some other cause, the local dealer will invoice the viewer in the usual way.

6. Where the reception interference problem affects a number of viewers in the same vicinity, and this is identified by the local dealer and/or 2RN, it may be that it will be necessary for 2RN to develop an existing alternative or additional transposer site within that locality.

7. The developer in this instance will be responsible for all the costs associated with the development of the new transposer site, where this transposer site is necessitated by the presence of the development.

8. The maximum expenditure incurred by 2RN in the provision of the new transposer site (arising from section 6) will be €150,000, (such figure to be index linked upwards only – by reference to the Consumer Price Index published by the Central Statistics Office, calculated on the basis of the average increase over the 12-month period preceding demand for reimbursement by 2RN). A detailed estimate is to be submitted to the Developer in advance for comment, within a reasonable timeframe.

9. If the cost of acquiring and developing a new transposer site exceeds the sum of €150,000 the developer and 2RN will enter into negotiations to ascertain how the cost of remedying the problem being experienced by viewers in the locality might most equitably be met. The developer, however, shall be the party primarily liable for the discharge of any amounts due in respect of the acquisition and development of a new transposer site to the extent that such an acquisition and development is attributable to the presence of the development.

10. Where the acquisition and development of a transposer site is additional to the transposer(s) serving the locality prior to the commencement of operation of the development, the developer shall be liable to reimburse to 2RN the ongoing operational costs of the said additional transposer for so long as same shall be necessary to counteract the interference with viewers' reception caused by the development, up to a maximum of €15,000 per annum (such figure to be index linked – upwards only – by reference to the Consumer Price Index published by the Central Statistics Office, calculated on the basis of the average increase over the 12 month period preceding demand for reimbursement by 2RN).

11. The developer will be entitled to see copies of operational costs to the extent that company confidentially is not breached. All the 2RN costs involved in investigation and reports associated with the proposed development shall be covered by the developer if it is found that the said development is the cause of the interference.

12. The developer shall be entitled to retain its own engineer to inspect and report on the source of interference and if a transposer site is built, 2RN undertakes to facilitate access to the installation in question for the purposes of carrying out any such inspection and/or tests necessary.

13. The developer will indemnify 2RN fully in respect of damage to the person or property of any such engineer or inspector as retained by the developer, or any other agent or licensee of the developer involved in or associated with such inspection and/or tests. The developer will ensure that competent personnel only are deployed onto 2RN property under the terms of this clause and hereby indemnify 2RN in respect of any damage to 2RN's property or personnel caused by the negligence of such engineer, inspector or other agent or licensee.

Interference with 2RN installations (to include transmitter stations, transposers and, if applicable, links stations

14. Where 2RN detects interference with the reception of a receive and/or transmission signal at a transposer site, 2RN will investigate the cause of the interference and report in writing to the developer if 2RN determines that the interference is attributable in whole or in part to the development.

15. The developer shall be entitled to retain its own engineer to inspect and report on the source of interference and 2RN undertakes to facilitate access to the installation in question for the purposes of carrying out any such inspection and/or tests necessary.

16. The developer will indemnify 2RN fully in respect of damage to the person or property of any such engineer or inspector as retained by the developer, or any other agent or licensee of the developer involved in or associated with such inspection and/or tests. The developer will ensure that competent personnel only are deployed onto 2RN's property under the terms of this clause and hereby indemnify 2RN in respect of any damage to 2RN's property or personnel caused by the negligence or such engineer, inspector or other agent or licensee.

17. Engineers representing both 2RN and (if applicable) the developer, will agree on remedial works (e.g. reorientation of reception antennas) and the cost of same. 2RN shall carry out the necessary remedial works and the cost of same shall be discharged/reimbursed to 2RN by the developer (subject to the provisions below).

    In the following paragraph, the term "installation" shall mean one or more installation sites if applicable.

18. In the event that an additional or alternative installation is required in order to overcome reception or transmission problems caused exclusively by the development, 2RN shall identify a new location for such installation, within a reasonable timeframe.

19. The developer shall be responsible for all costs associated with the development of the new installation (e.g. repeat broadcasting station), where the new installation is necessitated exclusively because of interference caused by the development. The developer shall be liable for such costs up to a maximum of €150,000 (such figure to be index linked – upwards only – by reference to the Consumer Price Index published by the Central Statistics Office, calculated on the basis of the average increase over the 12-month period preceding demand for reimbursement by 2RN). Where the likely costs of such additional or alternative installation exceed €150,000 (as adjusted), 2RN and the Developer shall negotiate and determine between them how the costs of this new development might most equitably be met. The projected costs are to be submitted to and agreed with the developer prior to development of the new installation, within a reasonable timeframe.

20. Where the acquisition and development of a transposer site is additional to the transposer(s) serving the locality prior to the operation of the development, the

developer shall be liable to reimburse to 2RN the ongoing operational costs of the said additional transposer for so long as same shall be necessary to counteract the interference with viewers' reception caused by the development, up to a maximum of €15,000 per annum (such figure to be index linked – upwards only – by reference to the Consumer Price Index published by the Central Statistics Office, calculated on the basis of the average increase over the 12-month period preceding demand for reimbursement by 2RN.

21. The developer will be entitled to see copies of operational costs to the extent that company confidentially is not breached. All the 2RN costs involved in investigation and reports associated with the proposed development shall be covered by the Developer if it is found that the said development is the cause of the interference.

22. The parties agree that any dispute which arises concerning the interpretation of this Agreement shall first be referred to: -

    (a) in the case of 2RN, the Executive Director for the time being; and
    (b) in the case of the Developer, the Executive Director for the time being;

    and such persons shall use all reasonable commercial efforts to resolve any such dispute within ten (10) Business Days.

23. If the dispute is not resolved by the relevant parties within the time period referred to above then save in respect for a dispute referable to the Expert, the parties may by agreement in writing attempt to settle all other disputes by mediation in accordance with the rules of the International Centre for Dispute Resolution (ICDR). To initiate the mediation a party must give notice in writing to the other party to the dispute requesting mediation and a copy of the request must be sent to ICDR. The mediation will start not later than 20 days after the date of such notice. The commencement of mediation will not prevent the parties commencing or continuing court proceedings. Unless otherwise agreed between the parties

    (a) the mediator will be nominated by ICDR;

    (b) the costs of the mediator shall be borne and discharged as to 50% by the Company and as to the remaining 50% by the Developer, and

    (c) the mediation shall be conducted in Dublin, Ireland, at a venue agreed upon by the parties and the mediator or, failing such agreement, at a venue selected by the mediator in his/her discretion.

24. If a dispute or difference arises between the parties that is technical in nature the parties may refer such dispute, by agreement in writing between the parties, for final determination to the Expert (as hereinafter defined).

25. The expert for the purposes of this Clause shall be an independent party who has expertise in the area giving rise to the dispute (the "Expert") appointed by the agreement by the parties, or in default of agreement on such appointment, on the application of either party, by the President for the time being of the Institute of Engineers of Ireland or his duly appointed deputy, who shall carry out his functions in accordance with the following:

    (a) in making a determination, the Expert shall act as an expert and not as an arbitrator and his decision shall (in the absence of manifest error (and the Expert shall give reasons for his determination)) be final and binding on the parties;
    (b) the Expert shall afford both parties a reasonable opportunity to be heard and to state their respective cases and to advance arguments or evidence in support of their respective positions;
    (c) each party shall bear the costs and expenses of all counsel and other advisers, witnesses and employees retained by it and the costs and expenses of the Expert shall be borne by the parties in the proportions the Expert may direct, or in the absence of direction, equally.

26. This Agreement shall be governed by and construed in accordance with the laws of Ireland. Subject always to clauses 20, 21 and 22 above, each of the parties agrees that the courts of Ireland are to have exclusive jurisdiction to settle any dispute arising out of or in connection with this Agreement.

Dated this 20th day of ~~February~~ October, 2020

Signed for and on behalf of 2RN

Matthew Craig

(Authorised signatory)

Signed for and on behalf of the Developer

Emma Hamilton

(Authorised signatory)

FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 16.3

Pager Power Aviation Assessments

PAGERPOWER
Urban & Renewables

Risk Assessment (Aviation)

Brookfield Renewable Ireland Limited

Coom Green Energy Park

December, 2019





PLANNING SOLUTIONS FOR:

- Solar
- Telecoms
- Railways
- Defence
- Buildings
- Wind
- Airports
- Radar
- Mitigation

www.pagerpower.com

ADMINISTRATION PAGE

Job Reference:	9296A
Date:	September, 2018
Prepared for:	Brookfield Renewable Ireland Limited
Author:	Mike Watson
Telephone:	+44 (0)1787 319001
Email:	mike@pagerpower.com

Reviewer	Kai Frolic
Date:	September, 2018
Telephone:	+44 (0)1787 319001
Email:	kai@pagerpower.com

Issue	Date	Detail of Changes
1	20 September, 2018	Initial issue
2	21 September, 2018	Minor amendments
3	16 December, 2019	Wind Farm Layout change
4	19 December, 2019	Additional Met Mast Added

Pager Power Limited, Stour Valley Business Centre, Sudbury, CO10 7GB, United Kingdom

T: +44 (0)1787 319001 E: info@pagerpower.com W: www.pagerpower.com

EXECUTIVE SUMMARY

Background

The developer provided an indicative layout of 22 wind turbines for this assessment. Each turbine will have a maximum height of 169 metres above ground level with tip altitudes rising to nearly 1800 feet above mean sea level. The proposal lies north of the city of Cork and its centre is 27.4 kilometres (14.8 nautical miles) from Cork Airport.

Aviation Impacts

Wind turbines can impact aviation including aeronautical radio and radar systems. This report identifies aviation infrastructure that could be affected by the turbines and also provides an indication of the level of corresponding risk to the wind farm project.

Identified Receptors

The nearest significant airport is Cork to the south whilst there is a minor airfield 18km to the east called Fermoy (Knock).

The nearest aeronautical radar station is at Tullig More about 3 kilometres south west of Cork Airport. Tullig More is understood to consist of both Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) operated by the Irish Aviation Authority (IAA). The nearest En-Route radar station is at Woodcock Hill, County Clare, about 70 kilometres north of the proposed development.

The nearest aeronautical radio navigation beacons are at Cork Airport and include a category II Instrument Landing System (ILS) for Runway 16. Test flights are regularly flown to confirm navigation beacons are working correctly.

IAA Consultation

The Irish Aviation Authority (IAA) has been consulted regarding the proposed development and has raised concerns that the proposed turbines could impede some ILS test flights.

Initial Risk Assessment

Physical Obstruction Risks

It is unlikely that there will be any significant physical obstruction risk to aircraft using Cork Airport and there will be no significant risk to aircraft using Fermoy (Knock) airfield.

Radar and Navigation Beacons

There will be no significant impact on the Tullig More Secondary Surveillance Radar (SSR). However there is likely to be a technical impact on the Tullig More Primary Surveillance Radar (PSR) which may well be operationally acceptable because:

- Any effects will be limited to the wind farm area which is just 0.04% of the radar's coverage area;
- Commercial aircraft flying in this area will be flying in Controlled Airspace where any wind farm effects on PSR may be disregarded;

and

- Air traffic controllers see flights from SSR radar which will not be affected by the proposal.

There will be no significant impact on the IAA Woodcock Hill radar station and there will be no significant impacts on aeronautical navigation beacons at Cork Airport.

ILS Test Flights

There is unlikely to be any significant impact on ILS test flights and in the event that test flights were impacted it is likely that these impacts could be mitigated. Overall impacts on ILS test flights are unlikely to be significant because:

- ILS coverage is already limited below 3000 feet meaning that requirements for test flights below this altitude will be limited;
- The exact paths of test flights are not defined with international (ICAO) flying regulations and can be amended to suit any limitations arising from terrain or structures;

and

- The majority of testing occurs within 5 degrees of the flight path and the proposed development lies beyond 5 degrees.

Wind Turbine Lighting

It is likely that there will be a requirement for the wind turbine nacelles to be fitted with red aeronautical ground lights which should be illuminated at night.

Recommendation

It is recommended that engagement and consultation with the Irish Aviation Authority (IAA) continues. Further analysis of ILS check flights could be undertaken.

Other Assessments

Other Assessments

There are three assessments that have been undertaken – two as a result of consultation with the Irish Aviation Authority.

These reports are:

- Aviation Risk Assessment
- ILS Calibration Flight Impact Assessment
- Radar Vectoring Area Assessment

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company specializes in assessing the impact of wind turbines on aviation and radar - having undertaken projects in 46 countries within Europe, Africa, America, Asia and Australia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

The developer provided an indicative layout of 22 wind turbines for this assessment. Each turbine will have a maximum height of 169 metres above ground level with tip altitudes rising to nearly 1800 feet above mean sea level. The proposal lies north of the city of Cork and its centre is 27.4 kilometres (14.8 nautical miles) from Cork Airport.

Wind turbines can impact aviation including aeronautical radio and radar systems. This report identifies aviation infrastructure that could be affected by the turbines and also provides an indication of the level of corresponding risk to the wind farm project.

1.1 Units of Measurement and Coordinate Systems

Units of measurement and coordinate systems normally used by the aviation and wind farm development industries differ. These differences are set out in the table below:

Parameter	Aviation	Onshore wind – Ireland	Conversion
Distance	Nautical Mile (nm)	Kilometre (km)	1nm = 1.852km
Height	Feet (ft)	Metres (m)	1ft = 0.3048m
Location	WGS84 Lat/Long	ITM Eastings and Northings	Specialist tool required

Table 1 Units of measurement and coordinate systems

2 WIND FARM INFORMATION

The Nagle Mountain wind farm consists of 22 wind turbines having a tip height of 169 metres above ground level. This layout is shown on the map below:

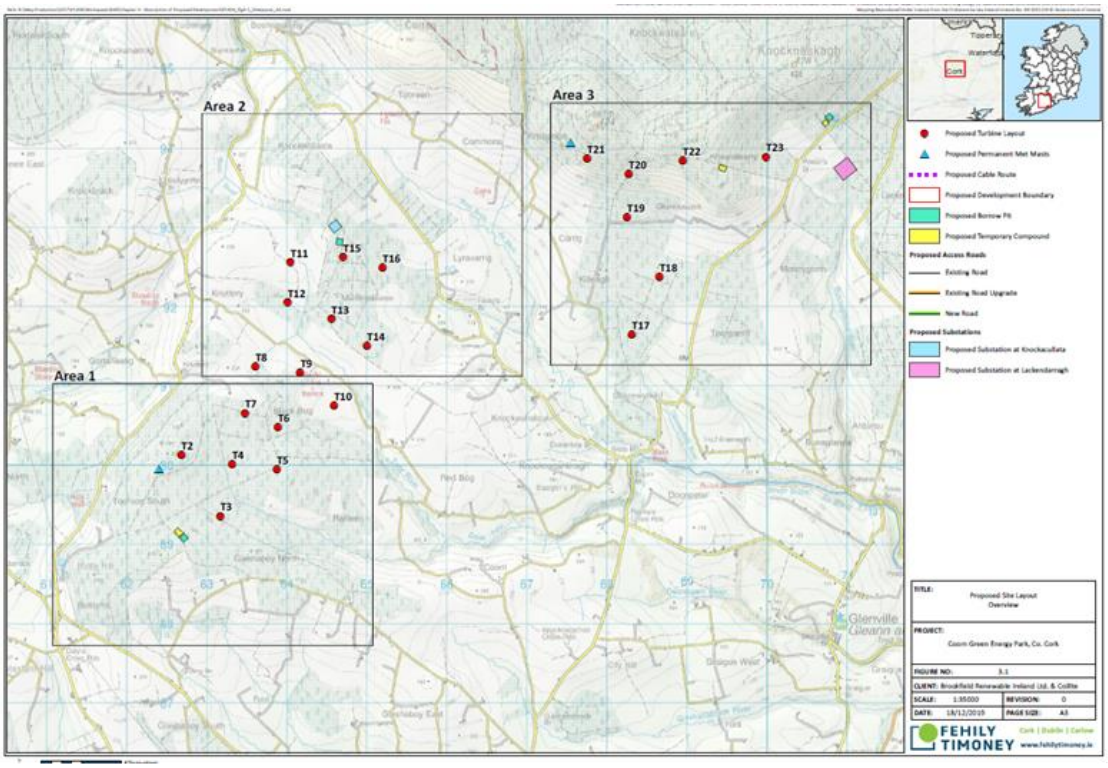


Figure 1 Wind Turbine Layout

There are two groups of wind turbines with turbine T22 being the highest in the north-east corner. Elevation, heights and altitudes are shown in the table below:

Quantity	Metres (m)	Feet (ft)
Ground Elevation (approximate)	374	1,227
Turbine Tip Height above ground level	169	555
Turbine Tip Altitude (approximate)	543	1,780

Table 2 Turbine 22 height and altitude data

2.1 Wind Turbine Coordinates

ID	X (ITM)	Y (ITM)	E (TM65)	N (TM65)
T2	562641	590193	162683.05	90134.74
T3	563128	589420	163170.16	89361.57
T4	563273	590075	163315.19	90016.71
T5	563833	590014	163875.32	89955.7
T6	563848	590542	163890.32	90483.82
T7	563433	590717	163475.23	90658.86
T8	563566	591305	163608.26	91246.99
T9	564126	591229	164168.38	91170.97
T10	564548	590812	164590.48	90753.88
T11	564002	592625	164044.36	92567.28
T12	563969	592119	164011.35	92061.17
T13	564515	591909	164557.47	91851.12
T14	564961	591567	165003.57	91509.05
T15	564661	592686	164703.5	92628.3
T16	565156	592556	165198.61	92498.27
T17	568267	591705	168310.31	91647.08
T18	568612	592430	168655.39	92372.24
T19	568206	593193	168249.29	93135.41
T20	568229	593738	168272.3	93680.53
T21	567708	593928	167751.18	93870.57

ID	X (ITM)	Y (ITM)	E (TM65)	N (TM65)
T22	568905	593906	168948.45	93848.57
T23	569943	593950	169986.68	93892.58

Table 3 Wind Turbine Coordinates

2.2 Permanent Meteorological Masts

A permanent meteorological mast is planned at ITM coordinates 567452.1 594170.5. The mast will have a maximum height of 100 metres on ground that has an elevation of approximately 350 metres making the maximum mast altitude approximately 450 metres which is 1,476 feet. This is approximately 300 feet lower than the tip of turbine T22.

A further permanent mast is planned at ITM coordinates 562316 590061. This 100 metre mast will have a maximum altitude of approximately 395 metres which is 1,295 feet. This is almost 500 feet lower than the tip of turbine T22.

The chart below shows the proposed turbine and permanent meteorological mast locations.

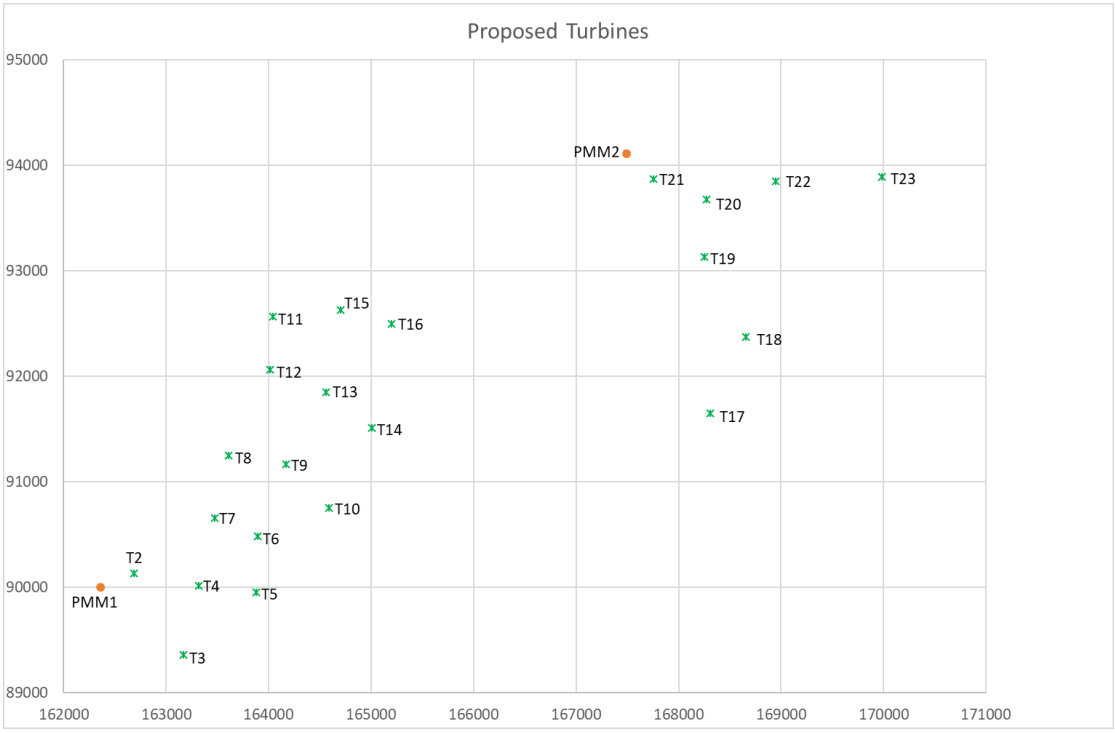


Figure 2 Chart showing Proposed Turbine and Meteorological Mast Locations

3 CORK AIRPORT

Cork Airport is located approximately 7km south of Cork. It is operated by Dublin Airport Authority plc. The airport handles around 1.6 million passengers a year. The diagram below[1] shows the airport's runways.

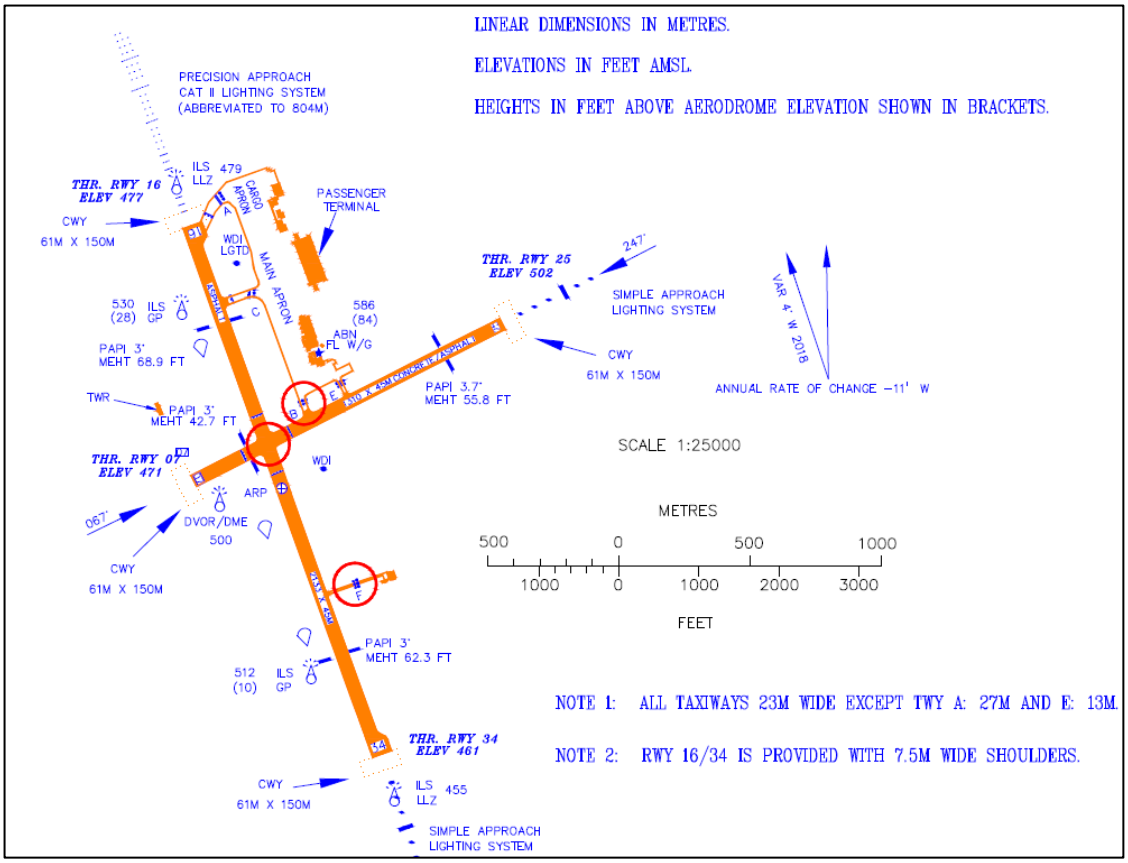


Figure 3 Cork Runways

The airport has two substantial paved runways which are 2133m and 1310m long.
The airport has a variety of navigation equipment including visual markings and approach aids, radio navigation beacons, instrument landing system and radar.

[1] Sourced from the IAA Aeronautical Information Publication (AIP)

3.1 Cork Radar – Tullig More

Cork Airport has a radar to the south west of the airport at Tullig More. The radar is operated by the Irish Aviation Authority and is operated by air traffic controllers working in Dublin, but providing a service to aircraft arriving and departing Cork Airport.

Parameter	Value
Structure	Radome on Building
Location Description	Tullig More Hill
Coordinates (Latitude/Longitude)	51 49 17N 8 31 20W
Coordinates (ING)	164047E 63287N
Terrain Elevation	160 metres
Antenna Height agl	7.5 metres
Antenna Height amsl	167.5 metres

Table 4 Cork Radar Parameters (indicative)

3.2 Instrument Landing Systems

Cork Airport has Instrument Landing Systems (ILS) installed for aircraft approaching either end of the airport's longer runway (Runway 16/34). The proposed wind development lies within the radio beam of the Runway 16 Localizer (LLZ). Coverage of the Runway 16 Localizer is limited - the Airport's Aeronautical Information Publication (AIP) states:

> *Coverage is restricted to 35° either side of course line. Signals received outside the coverage sector including back beam radiation should be ignored. Use at 3000 feet AMSL restricted to 18NM, due low signal coverage. LLZ Flags may be observed below 3000ft AMSL outside 10NM range from threshold.*

4 OTHER AVIATION AND RADAR RECEPTORS

4.1 Fermoy (Knock) Airfield

Fermoy (Knock) is a privately owned unlicensed landing strip which lies approximately 18 kilometres east of the proposed development. The runway is 300 metres long and the coordinates are 52°07'N 08°13'W. The runway is grass and is orientated east/west with runway numbers 10/28.

4.2 Woodcock Hill Radar, County Clare

This is a national En-Route radar operated by the Irish Aviation Authority (IAA) as part of the national radar network. This is a Secondary Surveillance Radar (SSR) having coordinates 52°43'N 8°42'W.

5 IAA CONSULTATION

The wind farm developer consulted the Irish Aviation Authority (IAA) regarding the proposed wind development in July and August 2018. The following IAA comments have been made:

- Instrument Flight Procedures (IFPs) are unlikely to be affected
- There are concerns relating to the potential impact on aircraft flying VFR (in accordance with Visual Flight Rules) beneath controlled airspace
- There are potential concerns relating to Instrument Landing System (ILS) test flights

6 ASSESSMENT

6.1 Physical Obstruction Risks

6.1.1 Cork Airport – Physical Safeguarding

The proposed development is 27 kilometres from Cork Airport and beyond its physical safeguarding Obstacle Limitation Surfaces (OLS) which extend 15 kilometres from the airport. The development does not therefore present a physical safeguarding risk.

6.1.2 Cork Airport – Instrument Flight Procedures (IFPs)

The Irish Aviation Authority (IAA) appears to have indicated that the proposed development will not affect IFPs. At this range from the airport IFPs have a minimum altitude of 3000 feet which is more than 1200 feet vertically clear of the highest turbine tip which has an altitude of approximately 1780 feet.

6.1.3 Fermoy Knock Airfield

Minor airfields such as Fermoy are typically assessed when proposed wind farms lie within 5 kilometres. At a range of 18 kilometres the proposed wind farm will have no impact.

6.1.4 VFR Flights beneath Controlled Airspace

The southern part of the proposed wind farm lies entirely within Controlled Airspace. The northern part of the wind farm lies in Uncontrolled Airspace – with Controlled Airspace above it. The base of this Controlled Airspace has an altitude of 2,500 feet which is more than 600 feet above the tip of the highest turbine which has an estimated maximum tip height of 1,890 feet.

The wind turbines may cause a minor restriction to VFR flights flying around the Cork Airport Control Zone in certain conditions however no significant overall impact is predicted because the airspace is Controlled to the south and is less restricted to the north.

6.2 Tullig More Secondary Surveillance Radar (SSR)

Under Eurocontrol guidelines SSR are safeguarded against wind turbines to a range of 16 kilometres. The distance from the centre of the wind farm to the radar is 30 kilometres which is significantly more than this 16km safeguarding distance. Because of this no impacts are likely and no further assessment is recommended.

6.3 Tullig More Primary Surveillance Radar (PSR)

The majority of the wind turbines will be at least partially visible to the PSR. This means that the turbines will generate false returns on air traffic control displays in the vicinity of the wind farm. Whilst the wind farm is likely to cause a local technical effect the resulting operational effect may well be acceptable.

The schematic diagram below shows how data from multiple radar is combined before it is displayed to air traffic controllers directing aircraft to and from Cork Airport.

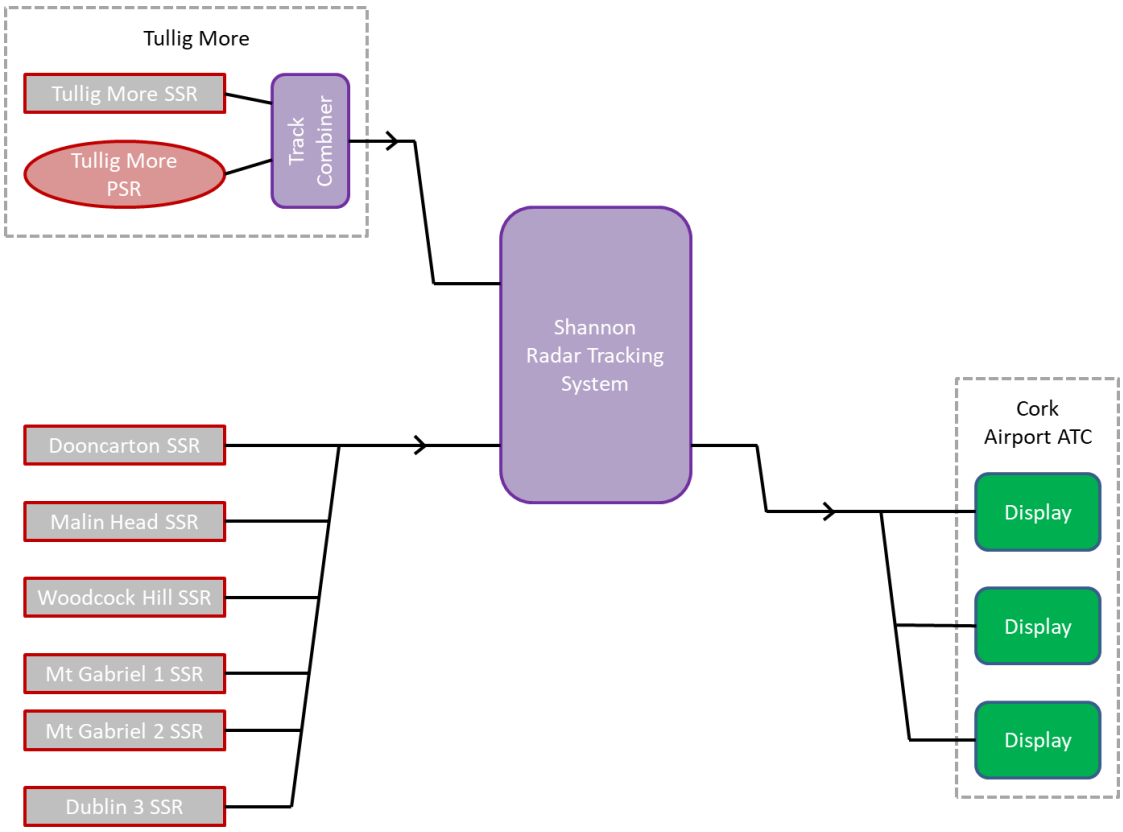


Figure 4 Schematic diagram showing Cork Airport radar data flow

This data combination process means that the wind farm's effects may be operationally acceptable because:

- Any effects will be limited to the wind farm area which is just 0.04% of the radar's coverage area[2];
- Commercial aircraft flying in this area will be flying in Controlled Airspace where any wind farm effects on PSR may be disregarded;

  and

- Air traffic controllers see flights from SSR radar which will not be affected by the proposal.

6.4 IAA Woodcock Hill Radar Station (SSR)

Under Eurocontrol guidelines SSR are safeguarded against wind turbines to a range of 16 kilometres. The distance from the centre of the wind farm to the radar is 70 kilometres which is significantly more than this 16km safeguarding distance. Because of this no significant impacts are predicted.

6.5 Cork Airport Radio Navigation Beacons including ILS

Safeguarding requirements for radio navigation beacons are defined by the International Civil Aviation Organisation (ICAO) in publication EUR DOC 015 *European Guidance Material on Managing Building Restricted Areas*.

All proposed wind turbines lie beyond the safeguarding distances specified for the radio navigation beacons at Cork Airport. Because of this no significant impacts are predicted.

6.6 ILS Test Flights

The International Civil Aviation Organisation (ICAO) publishes its *Manual on Testing of Radio Navigation Aids* which defines how flight tests for ILS localizers should be undertaken. ILS coverage requirements are defined in ICAO *Annex 10 to the Convention on International Civil Aviation – Aeronautical Telecommunications – Volume 1 – Radio Navigation Aids*.

A review of the above documents, the Cork Airport AIP, the IAA's comments and the relative geometry of the proposed wind farm led to the assessment below:

There is unlikely to be any significant impact on ILS test flights and in the event that test flights were impacted it is likely that these impacts could be mitigated.

[2] Calculated using a radar range of 60 nautical miles

Overall impacts on ILS test flights are unlikely to be significant because:

- ILS coverage is already limited below 3000 feet meaning that requirements for test flights below this altitude will be limited;
- The exact paths of test flights are not defined with international (ICAO) flying regulations and can be amended to suit any limitations arising from terrain or structures;

and

- The majority of testing occurs within 5 degrees of the flight path and the proposed development lies beyond 5 degrees.

6.7 Obstruction Lighting

All structures that are higher than 150 metres above ground level require aeronautical lighting in accordance with national and international legislation. It is therefore highly likely that the turbines' nacelles will have to be fitted with red aeronautical ground lighting.

7 CONCLUSIONS

7.1 Identified Receptors

The nearest significant airport is Cork to the south whilst there is a minor airfield 18km to the east called Fermoy (Knock).

The nearest aeronautical radar station is at Tullig More about 3 kilometres south west of Cork Airport. Tullig More is understood to consist of both Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) operated by the IAA. The nearest En-Route radar station is at Woodcock Hill, County Clare, about 70 kilometres north of the proposed development.

The nearest aeronautical radio navigation beacons are at Cork Airport and include a category II Instrument Landing System (ILS) for Runway 16. Test flights are regularly flown to confirm navigation beacons are working correctly.

7.2 IAA Consultation

The Irish Aviation Authority (IAA) has been consulted regarding the proposed development and has raised concerns that the proposed turbines could impede some ILS test flights.

7.3 Initial Risk Assessment

7.3.1 Physical Obstruction Risks

Initial findings are that there will be no significant physical obstruction risk to aircraft using Cork Airport and there will be no significant risk to aircraft using Fermoy (Knock) airfield.

7.3.2 Radar and Navigation Beacons

There will be no significant impact on the Tullig More Secondary Surveillance Radar (SSR). However there is likely to be a technical impact on the Tullig More Primary Surveillance Radar (PSR) which may well be operationally acceptable because:

- Any effects will be limited to the wind farm area which is just 0.04% of the radar's coverage area;
- Commercial aircraft flying in this area will be flying in Controlled Airspace where any wind farm effects on PSR may be disregarded;

and

- Air traffic controllers see flights from SSR radar which will not be affected by the proposal.

There will be no significant impact on the IAA Woodcock Hill radar station and there will be no significant impacts on aeronautical navigation beacons at Cork Airport.

7.3.3 ILS Test Flights

There is unlikely to be any significant impact on ILS test flights and in the event that test flights were impacted it is likely that these impacts could be mitigated. Overall impacts on ILS test flights are unlikely to be significant because:

- ILS coverage is already limited below 3000 feet meaning that requirements for test flights below this altitude will be limited;
- The exact paths of test flights are not defined with international (ICAO) flying regulations and can be amended to suit any limitations arising from terrain or structures;

  and

- The majority of testing occurs within 5 degrees of the flight path and the proposed development lies beyond 5 degrees.

7.4 Wind Turbine Lighting

It is likely that there will be a requirement for the wind turbine nacelles to be fitted with red aeronautical ground lights which should be illuminated at night.

7.5 Recommendation

It is recommended that engagement and consultation with the IAA continues. Further analysis of ILS check flights could be undertaken.

Pager Power Limited
South Suffolk Business Centre
Alexandra Road
Sudbury
Suffolk
CO10 2ZX

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com

PAGERPOWER
Urban & Renewables

ILS Calibration Flight Impact Assessment

Brookfield Renewable Ireland Limited

Coom Green Energy Park

December, 2019





ADMINISTRATION PAGE

Job Reference:	9296B
Date:	April, 2019
Prepared for:	Brookfield Renewable Ireland Limited
Author:	Mike Watson
Telephone:	+44 (0)1787 319001
Email:	mike@pagerpower.com

1st Reviewer	Andrea Mariano
2nd Reviewer	Danny Scrivener
Date:	April, 2019
Telephone:	+44 (0)1787 319001
Email:	andrea@pagerpower.com; danny@pagerpower.com

Issue	Date	Detail of Changes
1	23 April, 2019	Initial issue
2	23 May, 2019	Minor amendments
3	19 December, 2019	Revised turbine layout
3.1	27 December, 2019	Reference to 22 turbine layout added

Pager Power Limited, South Suffolk Business Centre, Alexandra Road, Sudbury, CO10 2ZX, United Kingdom

T: +44 (0)1787 319001 E: info@pagerpower.com W: www.pagerpower.com

1 KEY FINDINGS

1.1 Background

Brookfield Renewable Energy is developing a proposed wind farm named Coom Green Energy Park which lies north of Cork and approximately 27 kilometres from Cork Airport in southern Ireland. The wind development is also referred to as Nagle Mountain.

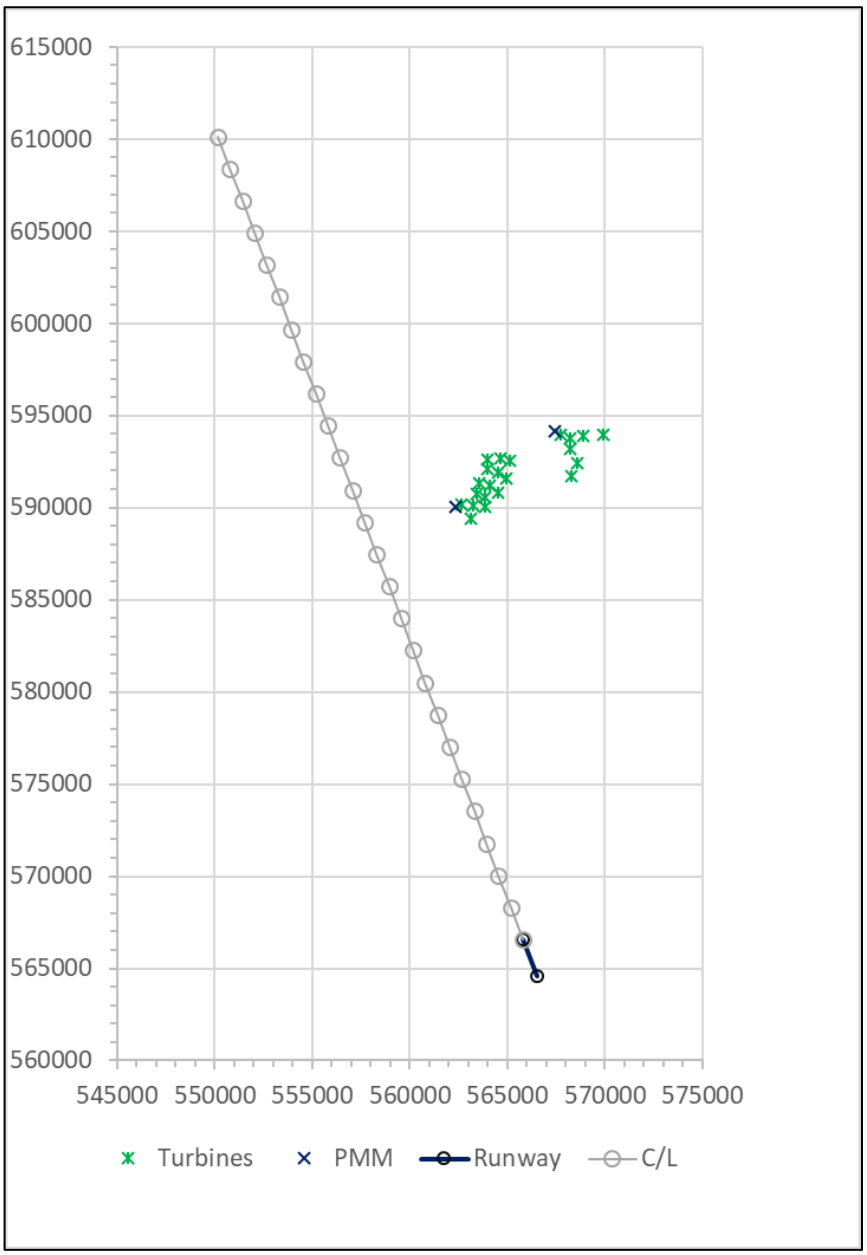


Figure 1 Chart showing extended centre line, turbines and met masts

1.2 Cork Airport

The diagram on the preceding page shows the relative locations of the turbines; the permanent meteorological masts; the runway and its extended centre line. The marks on the extended centre line have a spacing of 1 nautical mile.

Cork Airport has a range of radio transmitters which pilots use to navigate - one of these systems being an Instrument Landing System (ILS). The Irish Aviation Authority (IAA) has raised concerns that the wind farm could affect periodic test flights that are used to calibrate and check the ILS.

1.3 Test Flights

These test flights fly a range of trajectories which either fly towards the airport or in an arc, or orbit, centred on the runway threshold[1]. The IAA has provided a schedule of ILS checks and their associated flight trajectories.

1.4 Assessment

The aircraft altitude (or height) has no impact on the horizontal separation between wind turbine and aircraft. Similarly the wind turbine altitude (or height) has no impact on horizontal separation.

In this analysis only the horizontal clearance between aircraft and the turbines has been considered. This means that the results of this analysis apply for aircraft flying at any altitude profile on the specified horizontal trajectory. Similarly the results apply for any turbine height.

A software tool has been used to calculate the minimum horizontal separation between each specific (horizontally defined) trajectory and the nearest wind turbine or permanent meteorological masts.

1.5 Trajectories beyond 2 Nautical Miles[2]

Most trajectories will not be affected by the proposed wind farm and are more than 2 nautical miles away.

Aircraft flying Centre Line approaches will be at least 2.5 nautical miles from the proposed wind farm with permanent meteorological mast 1 being closest.

Aircraft flying approaches 8 degrees right of the runway extended centre line will be at least 4.4 nautical miles from the proposed wind farm with permanent meteorological mast 1 being closest.

Aircraft flying approaches 8 degrees left of the runway extended centre line, commencing at 10 nautical miles or less, will be at least 2.5 nautical miles from the proposed wind farm with turbine 3 being closest.

Aircraft flying orbits of 6 nautical miles will be at least 6.4 nautical miles from the proposed wind farm with turbine 3 being closest.

---

[1] In practice the arcs are centred on the Runway 16 threshold which is the zero reference point for the DME (Distance Measuring Equipment) associated with the Instrument Landing System

[2] 2 nautical miles = 3.7 kilometres

Aircraft flying orbits of 17 nautical miles will be at least 2.04 nautical miles from the proposed wind farm with turbine 23 being closest.

Aircraft flying orbits of 25 nautical miles will be at least 10.0 nautical miles from the proposed wind farm with turbine 23 being closest.

1.6 Trajectories within 2 Nautical Miles

One trajectory, however, pass less than 2 nautical miles[3] from the proposed wind farm.

1.7 Eight Degree Left Slice Approach

Aircraft flying an eight (8) degree left slice approach pass 0.579 nautical miles west of the proposed wind farm with permanent meteorological mast 1 being closest. The mast is highlighted on the diagram below:

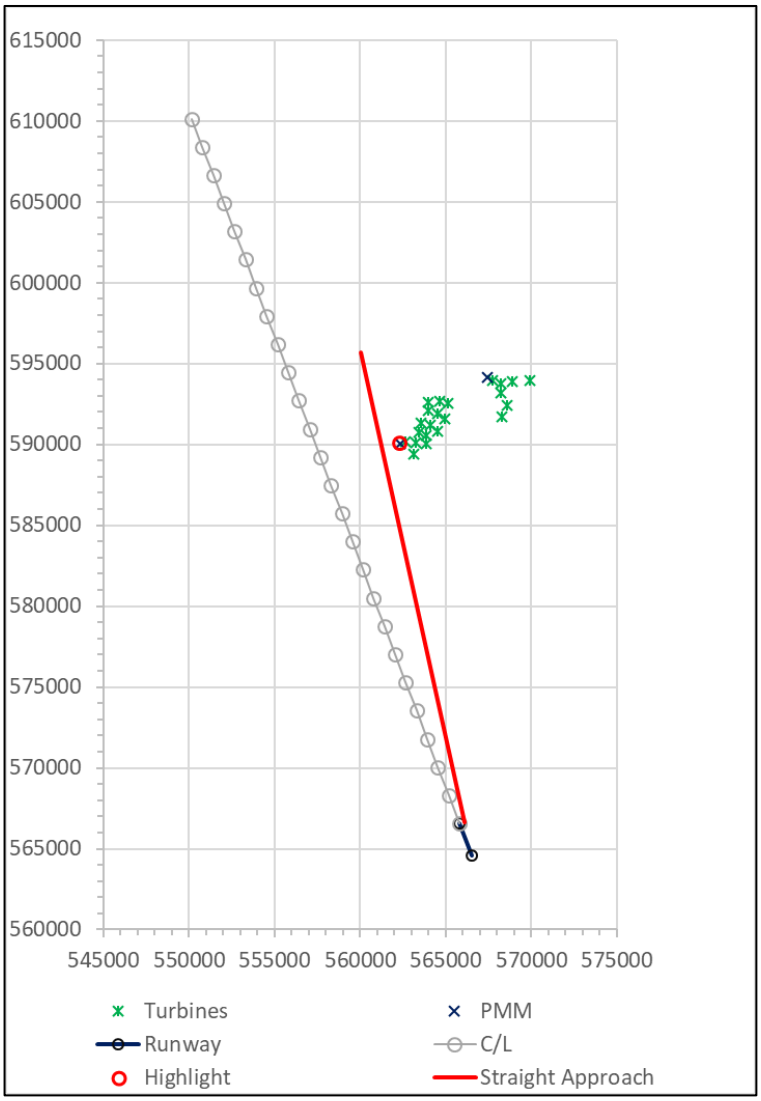


Figure 2 Chart showing proximity of turbines to 8 degree left slice approach

Note that this trajectory is flown in commissioning checks but not during routine calibration checks.

[3] The 2 nautical mile distance has been selected arbitrarily as a cut-off distance for assessment purposes. It significantly exceeds the 150 metre obstacle separation distance required for VFR flights.

1.8 Visual Flight Rules

Test flights are conducted under Visual Flight Rules (VFR) whereby pilots fly visually rather than with instruments. When flying VFR pilots must ensure that they do not fly within 150 metres of any structure[4].

Wind turbines are complex structures with large moving rotors. The clearance distances in the analysis above relate to the wind turbine bases rather than the entire wind turbine structure. It is necessary to consider the rotor radius of 70 metres when evaluating the calculated clearances.

All trajectories are 0.579 nautical miles or more from the proposed wind turbine towers and permanent meteorological masts. One nautical mile is 1852 metres which means that all trajectories are 1,072[5] metres from the proposed towers.

1.9 Overall Impact

The horizontal clearance between aircraft flying the test trajectories and the turbines is more than seven times the minimum horizontal clearance distance of 150 metres applicable for VFR flights in Ireland. The proposed turbines will therefore not affect aircraft flying ILS test trajectories and will therefore not have a significant impact on ILS test flights.

1.10 Mitigation

Whilst the proposed development will not impede aircraft flying the test trajectories it would nevertheless be prudent to ensure that pilots of test aircraft are fully aware of the presence of wind turbines, and any associated anemometry masts, before undertaking any test flights. The following mitigation measures are therefore recommended:

- All turbines and meteorological masts having a height of 100m or more are promulgated in the Irish Air Navigation Obstacle database
- The extremities of the wind farm are lit
- Meteorological masts are lit
- Locations of meteorological masts having a height of less than 100m are promulgated to the pilots of test aircraft[6]
- Test aircraft are fitted with Terrain Awareness and Warning System (TAWS)
- Test aircraft TAWS obstacle databases are regularly updated

1.11 Conclusions and Recommendations

It is recommended that this report is shared with the Irish Aviation Authority.

[4] Irish Aviation Authority (Rules of the Air) Order, 2004 – Rule 3
[5] 0.579 x 1852 = 1,072
[6] This could be via the Aeronautical Information Publication or directly to pilots

1.12 Other Reports

There are three assessments that have been undertaken – two as a result of consultation with the Irish Aviation Authority.

These reports are:

- Aviation Risk Assessment
- ILS Calibration Flight Impact Assessment
- Radar Vectoring Area Assessment

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company specializes in assessing the impact of wind turbines on aviation and radar - having undertaken projects in 46 countries within Europe, Africa, America, Asia and Australia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

2 INTRODUCTION

2.1 Overview

The developer provided a proposed layout of 22 wind turbines for this assessment. Each turbine will have a maximum height of 169 metres above ground level with tip altitudes rising to approximately 1,890 feet above mean sea level. The proposal lies north of Cork and its centre is 27 kilometres (14.5 nautical miles) from Cork Airport.

Wind turbines can impact aviation. This report identifies potential impacts on flights checking the airport's Instrument Landing System (ILS).

2.2 Units of Measurement and Coordinate Systems

Units of measurement and coordinate systems normally used by the aviation and wind farm development industries differ. These differences are set out in the table below:

Parameter	Aviation	Onshore wind – Ireland	Conversion
Distance	Nautical Mile (nm)	Kilometre (km)	1nm = 1.852km
Height	Feet (ft)	Metres (m)	1ft = 0.3048m
Location	WGS84 Lat/Long	ITM Eastings and Northings	Specialist tool required

Table 1 Units of measurement and coordinate systems

3 WIND FARM INFORMATION

3.1 Wind Farm Map

A 22 turbine wind farm layout has been assessed. This is shown on the map[7] below.

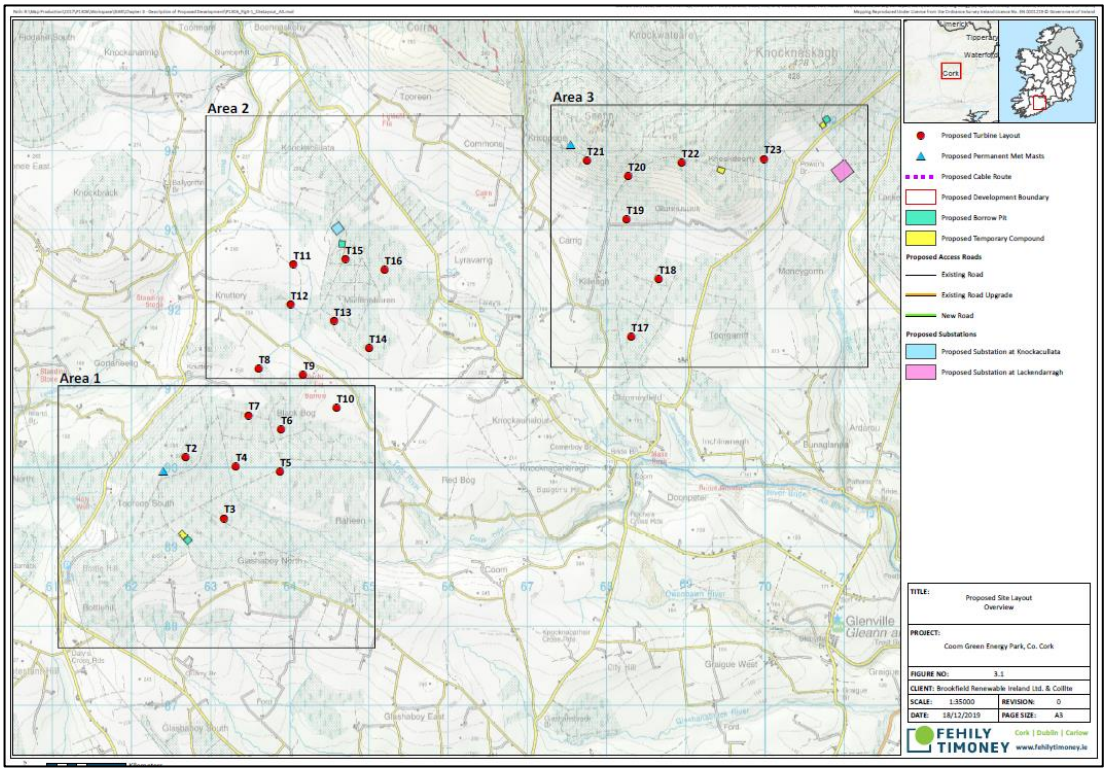


Figure 3 Map showing individual turbine locations and numbers

3.2 Wind Turbine Coordinates

ID	X (ITM)	Y (ITM)	E (TM65)	N (TM65)
T2	562641	590193	162683.05	90134.74
T3	563128	589420	163170.16	89361.57
T4	563273	590075	163315.19	90016.71
T5	563833	590014	163875.32	89955.7

[7] Provided by the developer

ID	X (ITM)	Y (ITM)	E (TM65)	N (TM65)
T6	563848	590542	163890.32	90483.82
T7	563433	590717	163475.23	90658.86
T8	563566	591305	163608.26	91246.99
T9	564126	591229	164168.38	91170.97
T10	564548	590812	164590.48	90753.88
T11	564002	592625	164044.36	92567.28
T12	563969	592119	164011.35	92061.17
T13	564515	591909	164557.47	91851.12
T14	564961	591567	165003.57	91509.05
T15	564661	592686	164703.5	92628.3
T16	565156	592556	165198.61	92498.27
T17	568267	591705	168310.31	91647.08
T18	568612	592430	168655.39	92372.24
T19	568206	593193	168249.29	93135.41
T20	568229	593738	168272.3	93680.53
T21	567708	593928	167751.18	93870.57
T22	568905	593906	168948.45	93848.57
T23	569943	593950	169986.68	93892.58

Table 2 Wind Turbine Coordinates

3.3 Permanent Meteorological Masts

A permanent meteorological mast is planned at ITM coordinates 567452.1 594170.5. The mast will have a maximum height of 100 metres on ground that has an elevation of approximately 350 metres making the maximum mast altitude approximately 450 metres which is 1,476 feet. This is approximately 300 feet lower than the tip of turbine T22.

A further permanent mast is planned at ITM coordinates 562316 590061. This 100 metre mast will have a maximum altitude of approximately 395 metres which is 1,295 feet. This is almost 500 feet lower than the tip of turbine T22.

The chart below shows the proposed turbine and permanent meteorological mast locations.

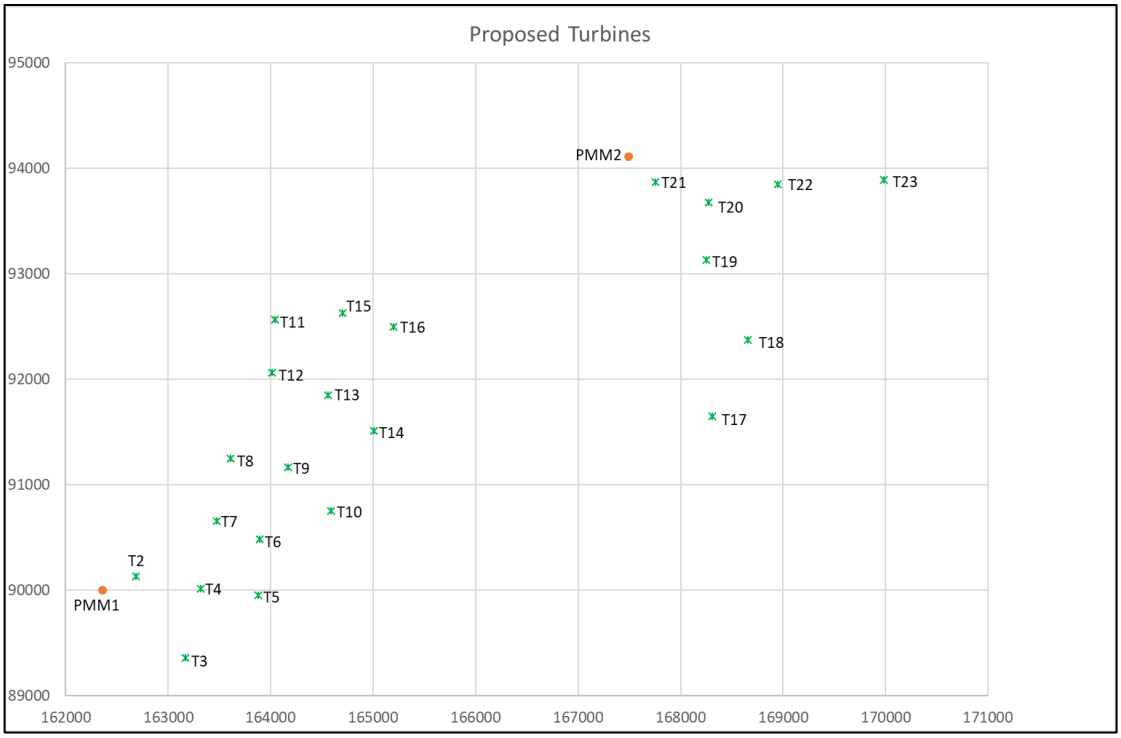


Figure 4 Chart showing Proposed Turbine and Meteorological Mast Locations

4 CORK AIRPORT

4.1 Airport Information

Cork Airport is an Irish Aviation Authority (IAA) licensed aerodrome used predominately by private and commercial jet and fixed wing propeller aircraft. An ATC Tower is present on the airport.

4.2 Runway Details

Cork Airport has two physical runways. The main runway 16/34 measures 2,133m by 45m. The runway is shown on the aerodrome chart in Figure 5[8] below.

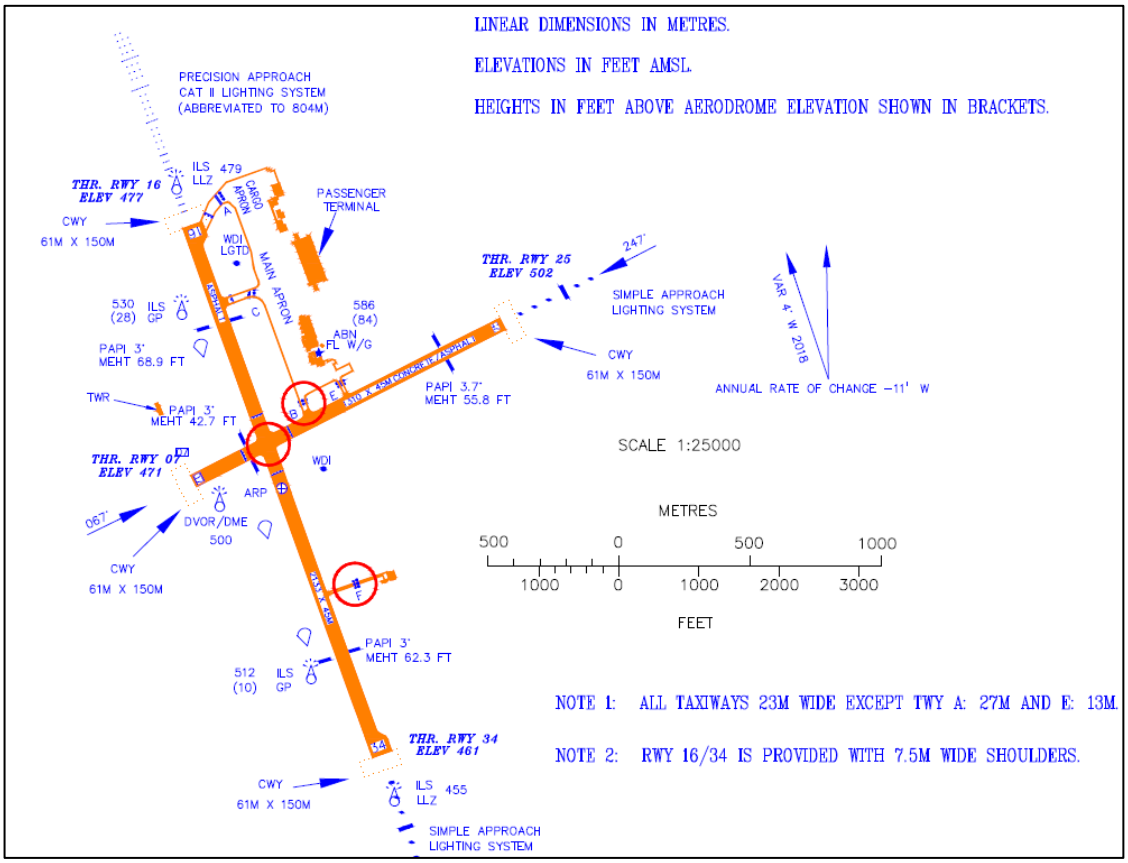


Figure 5 Cork Airport aerodrome chart

[8] Source: Irish Aviation Authority IAP.

4.3 Instrument Landing System

Specific parameters pertaining to the Runway 16 Instrument Landing System are shown in the Irish Aviation Authority Aeronautical Information Publication (AIP).

Parameter	Units	Value
ILS Category	n/a	Cat II
Slope	Degrees	3
Threshold Elevation	Feet	461
Distance to ILS Point A	Nautical Miles	4
Distance to ILS Point B	Nautical Miles	0.57

Table 3 Instrument Landing System Parameters

5 IAA FLIGHT CHECK SCHEDULE

ILS flight check profiles

4.2 Routine ILS Inspection Profile Requirements

Note: Where only 1 transmitter is checked on a routine, subsequently the other transmitter will be checked on the next routine.

Section	Profile	Description	Procedure	Notes	TX
9.1.1	01	Centreline Approach	10NM-Threshold 3000'	Course Structure, Alignment, GP Angle & RF measurement	1or2
9.1.3	04	Loc Orbit	6NM 1500' +35-35°	Clearance	1or2
9.1.1	05	Centreline Approach Cat III only	2NM to Point E level 50ft down runway Centreline	Loc Course Structure, Alignment	1or2
9.1.1	12	Top Edge	1 NM required between 4NM-Point B 1800'	(75μA) 90Hz width	1or2
9.1.1	13	Bottom Edge	1 NM Required between 4NM-Point B 1500'	(75μA) 150Hz width	1or2
9.1.2	14	Slice for 3° GP	0.3θ ≈12NM-Threshold 1000'	Clearance	1or2
9.1.2	15	Left Slice for 3° GP	10NM-0.45θ 1000'	Coverage 8° of Centreline Both transmitters if M Array	Alt 1or2
9.1.2	16	Right Slice for 3° GP	10NM-0.45θ 1000'	Coverage 8° of Centreline Both transmitters if M Array	Alt 1or2
	All	Ident Loc/DME	Co-Pilot listens/Fl	Check ident and synchronization	1or2
9.1.1	01	DME	4NM-1NM 1500'	DME Range Error	1or2

4.3 Annual ILS Inspection Profile Requirements

Section	Profile	Description	Procedure	Notes	TX
9.1.1	01	Centreline Approach	10NM-Threshold 3000'	RF, Course Structure, Alignment Angle GP & Loc	1&2
9.1.1	01	Centreline Approach	DOC or 10NM-Threshold on GP	Course Structure, Alignment Angle GP & Loc	1or2
9.1.1	01	Centreline Approach	10-4NM on GP & Loc	Power Ratio check (Two Freq Only) Course Line TX OFF	1or2

			C/L		
9.1.3	04	Loc Orbit	6NM 1500' +35-35°	Clearance	1&2
9.1.3	04	Loc Orbit	17NM 1500' +35-35°	Clearance & Coverage	1or2
9.1.3	04	Loc Orbit	25NM 2000' +10-10°	Clearance & Coverage	1or2
9.1.2	14	Loc Range Run	DOC or 25NM 2000'	Clearance	Alt 1or2
9.1.2	14	Slice for 3° GP	0.3θ DOC or 12NM-Threshold 1000'	Course Only (Two Freq Only)	1or2
9.1.1	05	Centreline Approach Cat III only	10NM to Point E level 50ft down runway Centreline	Course Structure, Alignment, GP Angle & RF measurement	1&2
9.1.1	12	Top Edge	4NM-Point B 1800'	(75μA) 90Hz width	1or2
9.1.1	13	Bottom Edge	4NM-Point B 1500'	(75μA) 150Hz width. See Note	1or2
9.1.2	14	Slice for 3° GP	0.3θ DOC or 12NM-Threshold 1000'	Course, Clearance & Coverage	1&2
9.1.2	14	Slice for 3° GP	0.3θ DOC or 12NM-Threshold 1000'	Course Only (Two Freq Only)	1or2
9.1.2	15	Left Slice for 3° GP	10NM-0.45θ 1000'	Coverage 8° of Centreline	Alt 1or2
9.1.2	16	Right Slice for 3° GP	10NM-0.45θ 1000'	Coverage 8° of Centreline	Alt 1or2
9.1.1	11	Centreline Approach	4NM-Threshold 1500'	Low & Wide, then Low & High Angle Alarm	1or2
9.1.1	12	Top Edge	4NM-Point B 1800'	Low & Wide then Wide & Narrow Alarm	1or2
9.1.1	13	Bottom Edge	4NM-Point B 1500'	Low & Wide, then Wide & Narrow Alarm	1or2
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Low & Wide Alarm for Clearance	1or2
9.1.2	14	Slice	DOC or 10NM-THD @ 1000'	Normal	1or2

9.1.1	01 *	Centreline Approach	4NM-Threshold 1500'	Fly Left & Right Alarms	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Wide Alarm	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Narrow Alarm	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Normal Check	1or2
	All	Ident LOC/DME	Co-Pilot/FI listens	Check ident and synchronisation	1&2
9.1.1	01	DME	4NM-1NM 1500'	DME Range Error	1or2
9.1.4		Promulgated procedure	Procedure-Threshold	Pilot comments	1 or2
9.1.5		Promulgated procedure & DME IFPs	Procedure-Threshold	Pilot comments	1or2

4.4 Commissioning ILS Inspection Profile Requirements

Section	Profile	Description	Procedure	Notes	TX
9.1.1	01	Centreline Approach	DOC or 10NM-Threshold on GP	RF, Course Structure, Alignment Angle GP & Loc	1&2
9.1.1	01	Centreline Approach	2000' 25NM-Threshold	Course Structure, Alignment Angle GP & Loc	1or2
9.1.1	01	Centreline Approach	10-4NM on GP & Loc C/L	Power Ratio check (Two Freq Only) Course Line TX OFF	1or2
9.1.1	01*	Centreline Approach	4NM-Theshold on GP & Loc C/L	Polarisation Check Roll 20° Left & Right	1or2
9.1.1	02	Left Edge	4NM-Point B 1500'	(150µA) 90Hz course width	1&2
9.1.1	03	Right Edge	4NM-Point B 1500'	(150µA) 150Hz course width	1&2
9.1.3	04	Loc Orbit	6NM 1500' +35-35°	Clearance & Coverage	1&2
9.1.3	04	Loc Orbit	17NM 1500'	Clearance & Coverage	1or2

			+35-35°		
9.1.3	04	Loc Orbit	25NM 2000' +10-10°	Clearance & Coverage	1or2
9.1.2	14	Loc Range Run	DOC or 25NM 2000'	Clearance	Alt 1or2
9.1.1	05	Centreline Approach Cat III only	2NM to Point E level 50ft down runway Centreline	Loc Course Structure, Alignment	1&2
9.1.1	12	Top Edge	4NM-Point B 1800'	(75µA) 90Hz width	1&2
9.1.1	13	Bottom Edge	4NM-Point B 1500'	(75µA) 150Hz width	1&2
9.1.2	14	Slice for 3° GP	0.3θ DOC or 12NM-Threshold 1000'	Course, Clearance & Coverage	1&2
9.1.2	14	Slice for 3° GP	0.3θ DOC or 12NM-Threshold 1000'	Course Only (Two Freq Only)	1or2
9.1.2	15	Left Slice for 3° GP	16NM-0.45θ 1000'	Coverage 8° of Centreline	1&2
9.1.2	16	Right Slice for 3° GP	16NM-0.45θ 1000'	Coverage 8° of Centreline	1&2
9.1.1	11	Centreline Approach	4NM-Threshold 1500'	Low & Wide, then Low & High Angle Alarm	1or2
9.1.1	12	Top Edge	4NM-Point B 1800'	Low & Wide then Wide & Narrow Alarm	1or2
9.1.1	13	Bottom Edge	4NM-Point B 1500'	Low & Wide, then Wide & Narrow Alarm	1or2
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Low & Wide Alarm for Clearance	1or2
9.1.2	14	Slice	DOC or 10NM-THD @ 1000'	Normal	1or2
9.1.1	01 *	Centreline Approach	4NM-Threshold 1500'	Fly Left & Right Alarms	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Wide Alarm	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Narrow Alarm	1or2
9.1.3	04 *	Loc Orbit	6NM 1500' +35-35°	Normal Check	1or2
9.1.3	20	Orbit	5NM @1500' 360°	DME Coverage check 20° only on 2nd TX	1&2
9.1.4		Promulgated procedure	Procedure-Threshold	Pilot comments	1or2
9.1.5		Promulgated procedure	Procedure distance spot checks for:-	IFP's, Missed Approach, Direct arrivals, Hold, En-Route	1or2

4.5 Additional Commissioning ILS Inspection Profile Requirements

For Side Band Reference & M Array Glide Paths

	Profile	Description	Procedure	Notes	TX
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Dephase Upper Antenna with monitor in Alarm	1or2
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Dephase Lower Antenna with Monitor in Alarm	1or2
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Advance Middle Antenna	1or2
9.1.2	14	Slice	DOC or 10-2NM @ 1000'	Retard Middle Antenna	1or2

Pager Power Limited
South Suffolk Business Centre
Alexandra Road
Sudbury
Suffolk
CO10 2ZX

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com

PAGERPOWER
Urban & Renewables

Radar Vectoring Area (Cork) Assessment

Brookfield Renewable Ireland Limited

Coom Green Energy Park

December, 2019





ADMINISTRATION PAGE

Job Reference:	9296D
Date:	August, 2019
Prepared for:	Brookfield Renewable Ireland Limited
Author:	Mike Watson
Telephone:	+44 (0)1787 319001
Email:	mike@pagerpower.com

Reviewer	Danny Scrivener
Date:	August, 2019
Telephone:	+44 (0)1787 319001
Email:	danny@pagerpower.com

Issue	Date	Detail of Changes
1	12 August, 2019	Initial issue
2	19 December, 2019	Updated to include Permanent Met Masts
2.1	27 December, 2019	Updated with new site diagram

Pager Power Limited, Stour Valley Business Centre, Sudbury, CO10 7GB, United Kingdom

T: +44 (0)1787 319001 E: info@pagerpower.com W: www.pagerpower.com

1 KEY FINDINGS

1.1 Background

Brookfield Renewable Energy is developing a proposed wind farm named Coom Green Energy Park which lies north of Cork and approximately 27 kilometres from Cork Airport in southern Ireland. The wind development is also referred to as Nagle Mountain.

1.2 Cork Airport Radar

Aircraft using Cork Airport are controlled by radar. Air traffic controllers direct pilots to ensure that aircraft are separated with no risk of collision.

1.3 Radar Vectoring Area Chart

Cork Airport will have a published Radar Vectoring Area Chart that shows the minimum altitude that pilots can be directed to fly in the vicinity of the airport. The Irish Aviation Authority (IAA) has provided an interim version of the chart which is reproduced below:

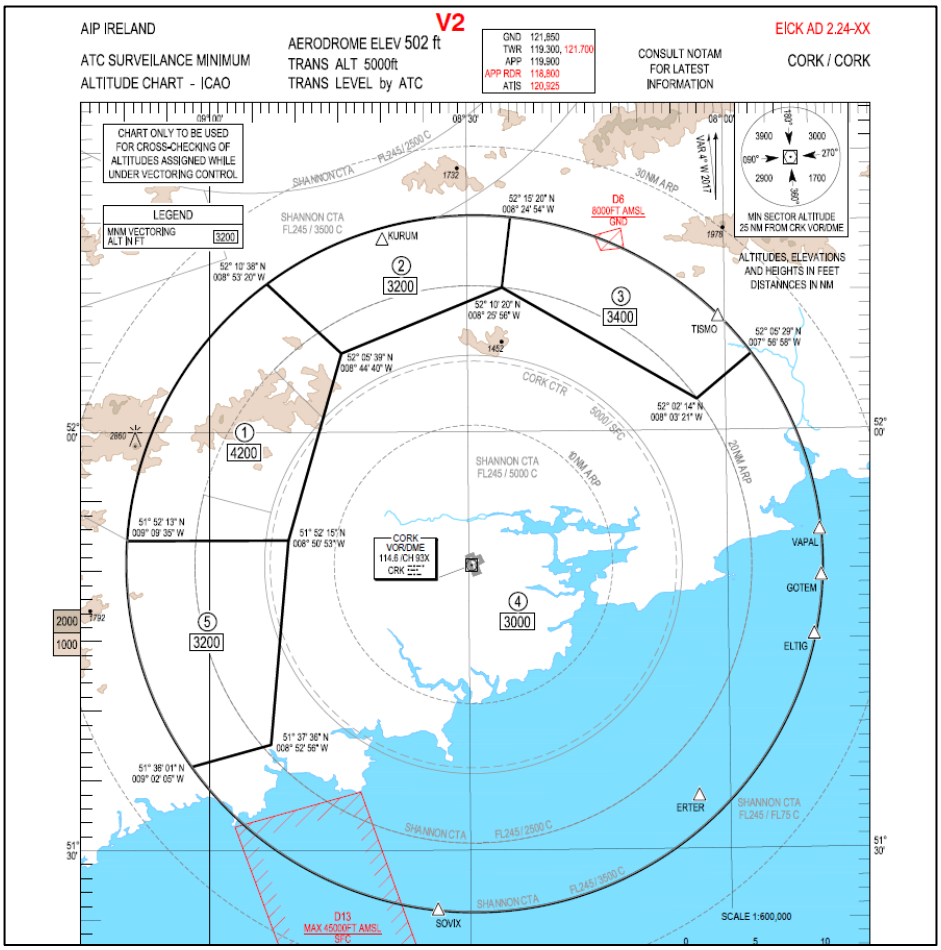


Figure 1 Cork Airport Radar Vectoring Area (Interim Chart)

1.4 Assessment Requirement

The proposed turbines will be located on high ground beneath airspace used to vector aircraft arriving and departing Cork. There have been ongoing discussions with the Irish Aviation Authority (IAA) regarding the proposed development's potential impact on operations at Cork Airport.

Of specific concern is the potential impact of the wind turbines on aircraft under radar control. Pager Power has therefore been invited to assess whether the development could affect aircraft under radar control.

1.5 Assessment Methodology

There are published rules for designing Radar Vectoring Areas and their associated charts. The proposed turbines have been assessed in accordance with these rules to determine whether aircraft flying within the Radar Vectoring Area will have sufficient vertical clearance above the proposed turbines.

The assessment, in this case, consists of the following steps.

1. Determining the maximum altitude of any part of the highest wind turbine or permanent meteorological mast.
2. Determining the minimum altitude aircraft can be directed to fly when under radar control.
3. Confirming that the minimum aircraft altitude is higher than the maximum turbine altitude.
4. Calculating the vertical clearance between the minimum aircraft altitude and the maximum altitude of any wind turbine part.
5. Determining the required vertical clearance according to Irish Aviation Authority (IAA) and International Civil Aviation Organisation (ICAO) guidance material.
6. Confirming the calculated vertical clearance exceeds the required vertical clearance.

1.6 Maximum Wind Turbine Tip Altitude

There are 22 proposed wind turbines each having a maximum tip altitude of 169 metres above ground level. The wind turbine layout is shown on the map below:

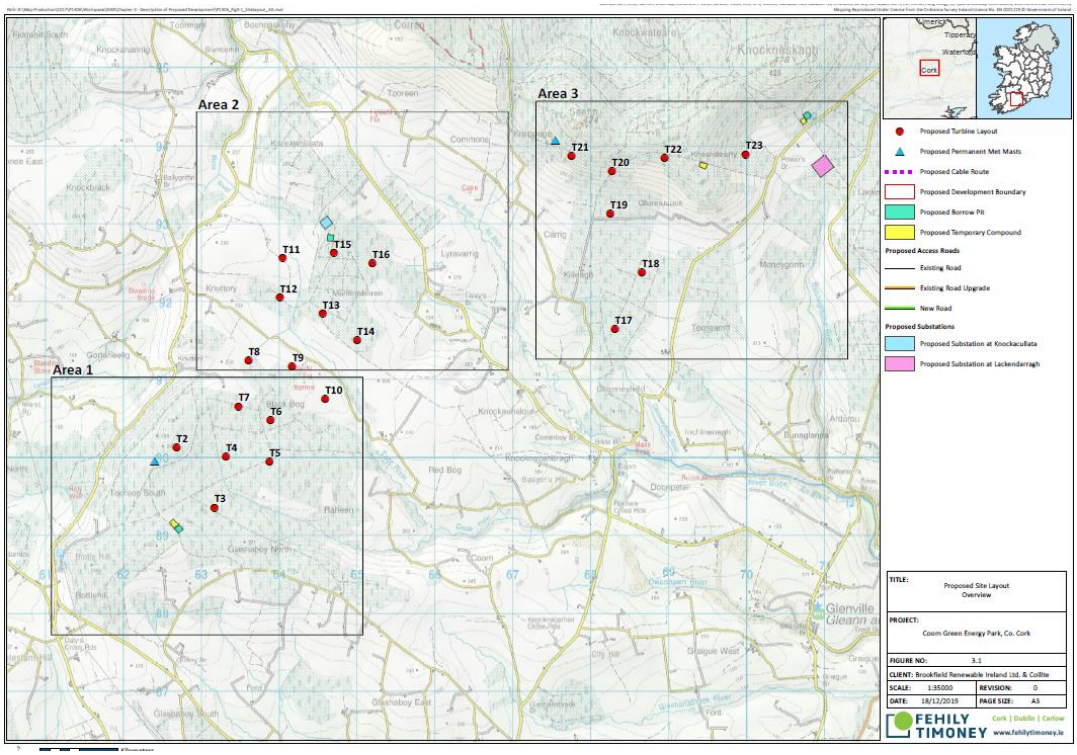


Figure 2 Proposed wind farm layout

Turbine elevation and altitude data is shown in the table below:

Turbine ID	Longitude	Latitude	Base Elevation (m)	Blade Tip Altitude (m)	Blade Tip Altitude (feet)
T2	-8.5448314	52.0624297	299	468	1534
T3	-8.537646	52.0555142	285	454	1491
T4	-8.5353401	52.0614395	276	445	1459
T5	-8.5266832	52.0606874	278	447	1466
T6	-8.5270069	52.0658816	267	436	1431
T7	-8.5354491	52.0668953	284	453	1485
T8	-8.5317379	52.0724852	266	435	1427

Turbine ID	Longitude	Latitude	Base Elevation (m)	Blade Tip Altitude (m)	Blade Tip Altitude (feet)
T9	-8.5232844	52.0718399	266	435	1428
T10	-8.5171003	52.0681098	238	407	1335
T11	-8.5241544	52.0850947	259	428	1404
T12	-8.5256684	52.0798295	241	410	1345
T13	-8.5176811	52.0779771	256	425	1393
T14	-8.5111397	52.0749315	248	417	1367
T15	-8.5156318	52.0849705	270	439	1439
T16	-8.5083962	52.0838334	234	403	1321
T17	-8.4629168	52.0767667	195	364	1194
T18	-8.4579612	52.0829075	237	406	1331
T19	-8.4625076	52.0893977	263	432	1417
T20	-8.463671	52.0946427	332	501	1643
T21	-8.4712923	52.0963204	344	513	1683
T22	-8.4538356	52.0961911	375	544	1784
T23	-8.4386761	52.096644	310	479	1573

Table 1 Turbine Altitude Data

Turbine T22 is highest having a maximum blade tip altitude of 1784 feet.

There are two permanent meteorological masts.

A permanent meteorological mast is planned at ITM coordinates 567452.1 594170.5. The mast will have a maximum height of 100 metres on ground that has an elevation of approximately 350 metres making the maximum mast altitude approximately 450 metres which is 1,476 feet. This is approximately 300 feet lower than the tip of turbine T22.

A further permanent mast is planned at ITM coordinates 562316 590061. This 100 metre mast will have a maximum altitude of approximately 395 metres which is 1,295 feet. This is almost 500 feet lower than the tip of turbine T22.

Both meteorological masts are shorter and lower than turbine T22 and will therefore have no impact.

1.7 Minimum Aircraft Altitude

The Minimum Altitude shown on the Radar Vectoring Area Chart is 3,000 feet.

This is more than the maximum tip altitude of 1,784 feet.

The vertical clearance is 1,216 feet.

1.8 Applicable Guidance

Applicable IAA guidance includes Air Services Advisory Memorandum (ASAM) no. 13 and no. 15 which relate to obstacle data.

Applicable International Civil Aviation Organisation (ICAO) guidance includes ICAO Doc 8168 PANSOPS 8168, Vol II, Section 2, Chapter 6 which specifies a minimum vertical clearance requirement of 984 feet.

1.9 Assessment

The minimum actual vertical clearance of 1,216 feet exceeds the minimum required clearance of 984 feet by 232 feet.

The proposed turbines will therefore not adversely affect aircraft flying under radar control.

1.10 Conclusions and Recommendations

It is recommended that this report is shared with the Irish Aviation Authority.

1.11 Other Reports

There are three assessments that have been undertaken – two as a result of consultation with the Irish Aviation Authority.

These reports are:

- Aviation Risk Assessment
- ILS Calibration Flight Impact Assessment
- Radar Vectoring Area Assessment

PAGERPOWER
Urban & Renewables

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company specializes in assessing the impact of wind turbines on aviation and radar - having undertaken projects in 46 countries within Europe, Africa, America, Asia and Australia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

2 CORK AIRPORT

2.1 Airport Information

Cork Airport is an Irish Aviation Authority (IAA) licensed aerodrome used predominately by private and commercial jet and fixed wing propeller aircraft. An ATC Tower is present on the airport.

2.2 Runway Details

Cork Airport has two physical runways. The main runway 16/34 measures 2,133m by 45m. The runway is shown on the aerodrome chart in Figure 3[1] below.

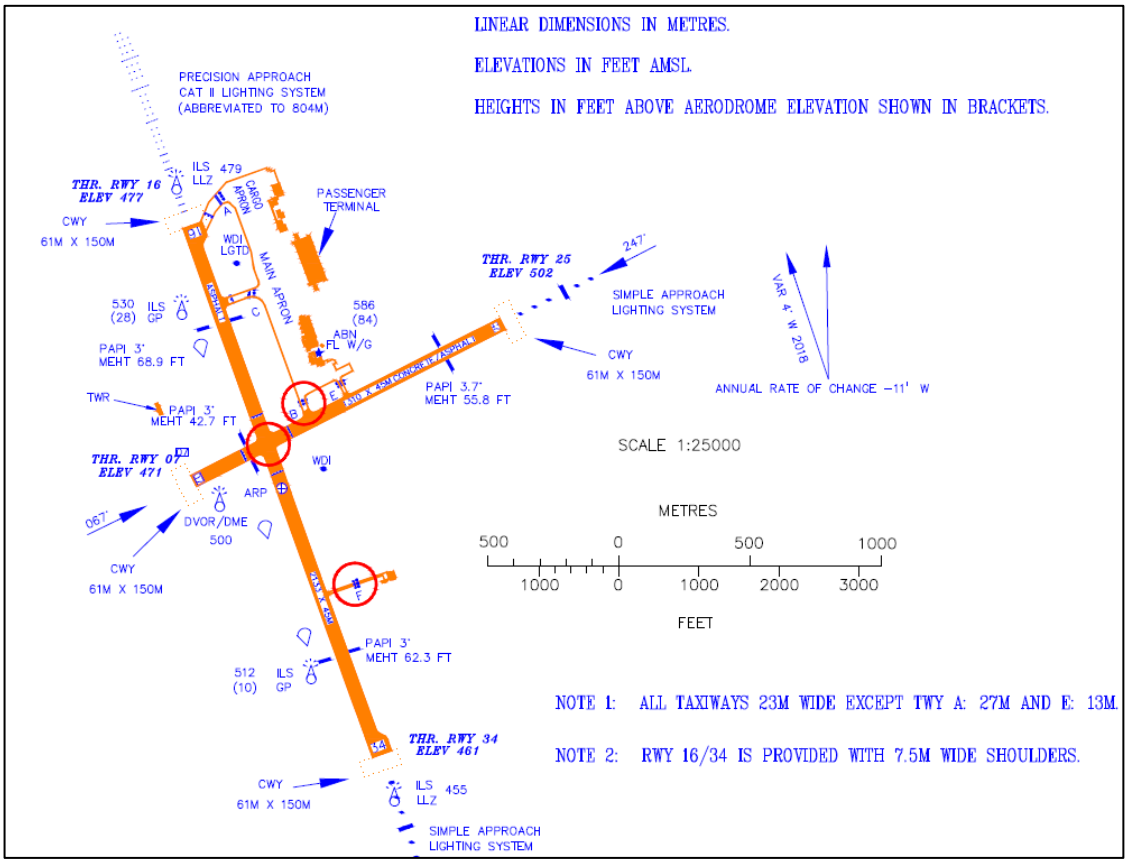


Figure 3 Cork Airport aerodrome chart

[1] Source: Irish Aviation Authority IAP.

PAGERPOWER

Urban & Renewables

Pager Power Limited
South Suffolk Business Centre
Alexandra Road
Sudbury
Suffolk
CO10 2ZX

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com

FEHILY TIMONEY

30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

www.fehilytimoney.ie

CORK OFFICE
Core House
Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6, Bagenalstown Industrial
Park, Royal Oak Road,
Muine Bheag,
Co. Carlow, R21 XA00,
Ireland
+353 59 972 3800