Environmental Impact Assessment Report

Lemanaghan Wind Farm, Co. Offaly

Chapter 5 Population and Human Health

Table of Contents

5. POPULATION AND HUMAN HEALTH 5-1

5.1 Introduction 5-1
5.1.1 Statement of Authority 5-1
5.1.2 Relevant Guidelines and Data Sources 5-2
5.1.3 Scoping and Consultation 5-2
5.2 Assessment Methodology 5-3
5.2.1 Population 5-3
5.2.2 Human Health 5-3
5.2.2.1 National Guidance 5-4
5.2.2.2 ISEP Guidance 5-5
5.2.3 Shadow Flicker 5-6
5.2.3.1 Background 5-6
5.2.3.2 Guidance 5-8
5.2.3.3 Shadow Flicker Prediction Methodology 5-9
5.2.3.4 Shadow Flicker Study Area 5-10
5.3 Baseline Population 5-12
5.3.1 Receiving Environment 5-12
5.3.2 Demographic Trends 5-15
5.3.3 Population Density 5-15
5.3.4 Household Statistics 5-16
5.3.5 Age Structure 5-16
5.3.6 Employment and Economic Activity 5-17
5.3.6.1 Economic Status 5-17
5.3.6.2 Employment and Investment Potential in the Irish Wind Energy Industry 5-18
5.3.7 Land-Use Patterns and Activities 5-21
5.3.7.1 Equine Industry 5-22
5.3.8 Services 5-23
5.3.8.1 Education 5-23
5.3.8.2 Access and Public Transport 5-24
5.3.8.3 Amenities and Community Facilities 5-24
5.3.9 Tourism 5-24
5.3.9.1 Tourism Numbers and Revenue 5-24
5.3.9.2 Tourist Attractions 5-26
5.3.9.3 Tourist Attitudes to Wind Farms 5-28
5.3.10 Public Perception of Wind Energy 5-31
5.3.10.1 Sustainable Energy Authority of Ireland Surveys on Opinions Towards Wind Farms 5-31
5.3.10.2 Wind Energy Attitudes Monitor 2024 5-33
5.3.10.3 Public Perceptions of Wind Power in Scotland and Ireland Survey 2005 5-34
5.4 Baseline Health 5-35
5.4.1 Receiving Environment 5-35
5.4.2 Health Effects of Wind Farms: Studies 5-36
5.4.2.1 Other Studies 5-41
5.4.3 Turbine Safety 5-42
5.4.4 Electromagnetic Interference 5-42
5.4.5 Effects on Human Health 5-43
5.4.6 Vulnerability of the Proposed Project to/from Major Accidents and Natural Disasters 5-44
5.4.6.1 Contamination Events 5-44
5.4.6.2 Major Fire 5-44
5.4.6.3 Summary 5-45
5.5 Property Values 5-45
5.5.1 Property Values and Wind Farms 5-45
5.5.2 Property Values and Grid Infrastructure 5-47
5.6 Residential Amenity 5-48
5.7 Shadow Flicker Assessment Results 5-49
5.7.1 Daily and Annual Shadow Flicker 5-49
5.8 Likely Significant Impacts and Associated Mitigation Measures 5-65
5.8.1 'Do-Nothing' Scenario 5-65
5.8.2 Construction Phase 5-65

5.8.2.1 Population 5-65
5.8.2.2 Health 5-70
5.8.3 Operational Phase 5-78
5.8.3.1 Population 5-78
5.8.3.2 Health 5-84
5.8.4 Decommissioning Phase 5-100
5.8.5 Cumulative Effects 5-100
5.8.5.1 Construction Phase 5-100
5.8.5.2 Operational Phase 5-104
5.8.6 Summary 5-107
5.9 EIA Classification Summary 5-107

GLOSSARY OF TERMS

Term	Definition
Shadow Flicker	A phenomenon when rotating wind turbine blades cast moving shadows over a narrow opening causing a rapidly alternating flickering light intensity
SEVESO site	Industrial facilities storing potentially dangerous substances in high quantities regulated under the EU SEVESO Directives
Sensitive Receptor	A component of the receiving environment which will experience an impact from the Proposed Project in some capacity

GLOSSARY OF ACRONYMS

Acronym	Definition
CAHA	Climate and Health Alliance
CEBR	Centre for Economics and Business Research
CERIS	Centre for Economic Research on Inclusivity and Sustainable
CSCS	Construction Skills Certification Scheme
CSO	Central Statistics Office
ED	Electoral Division
EHS	Environmental Health Service
ELF	Extremely Low Frequency
EMF	Electric Magnetic Fields
GDG	Guideline Development Group
HIA	Health Impact Assessment
HGV	Heavy Goods Vehicle
HSE	Health Service Executive
IAA	Irish Aviation Authority
ICNIRP	International Commission on Non-Ionizing Radiation Protection

IEA	International Energy Agency
IEC	International Electrotechnical Commission
ISEP	Institute of Sustainability and Environmental Professionals
IWEA	Irish Wind Energy Association
LBNL	Lawrence Berkley National Laboratory
LGV	Light Goods Vehicle
NIMBY	Not In My Back Yard
OHL	Overhead Line
OSI	Ordnance Survey Ireland
PSCS	Project Supervisor Construction Stage
PSDP	Project Supervisor Design Process
RESS	Renewable Energy Support Scheme
SCADA	Supervisory Control and Data Acquisition
WHO	World Health Organisation

5. POPULATION AND HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses the potential significant, direct and indirect effects of Lemanaghan Wind Farm (the 'Proposed Project') on population and human health and has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA), in particular the '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (EPA, 2022). The full description of the Proposed Project is provided in Chapter 4 of this EIAR.

As detailed in Section 1.1.1 in Chapter 1 Introduction, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection' and the 'Proposed Project site' or 'site'.

One of the principal concerns in the development process is that individuals or communities should experience no significant diminution in their quality of life from the direct or indirect effects arising from the construction, operation and decommissioning of a development. Ultimately, all the impacts of a development impinge on human health, directly and indirectly, positively and negatively. The key issues examined in this chapter of the EIAR include population, human health, employment and economic activity, land use, residential amenity, community facilities and services, tourism, property values, shadow flicker, noise, and health and safety.

5.1.1 Statement of Authority

This chapter of the EIAR was completed by Catherine Johnson, with input by Edel Mulholland, and reviewed by Ellen Costello and Sean Creedon, all of MKO.

Edel Mulholand is an Environmental Scientist with MKO with over 1 year experience. Edel holds BA (Hons) in Environmental Science from the University of Galway. Prior to taking up her position with MKO in September 2024, Edel worked as an Environmental Chemistry Analyst with Complete Laboratory Solutions, Co. Galway, where she assisted with water quality analysis. Since joining MKO, Edel has assisted in the submission of several renewable energy developments. Edel's key strengths and areas of expertise are in environmental policy, drafting EIAR chapters, field work and QGIS mapping.

Catherine is a Project Environmental Scientist and Climate Practitioner at MKO with over three years of consultancy experience in climate, renewable energy, and sustainability. Prior to joining MKO in 2022, Catherine worked as an Environmental Social Governance (ESG) analyst for Acasta in Edinburgh. Catherine has expertise in international climate law and policy, earth science, and sustainability/ESG processes. Catherine has a BSc in Earth and Ocean Science and an LLM in Global Environment and Climate Change Law. Ellen Costello is a Senior Environmental Scientist with MKO with over 6 years' experience in private consultancy. Ellen holds a BSc (Hons) in Earth Science, and a MSc (Hons) in Climate Change: Integrated Environmental and Social Science Aspects where she focused her studies on renewable energy development in Europe and its implications on environment and society. Ellen's key strengths and expertise are Environmental Protection and Management, Environmental Impact Statements, Project Management, and GIS Mapping and Modelling. Since joining MKO, Ellen has been involved in a range of renewable energy infrastructure projects. In her role as a senior project manager, Ellen works with and co-ordinates large multidisciplinary teams including members from MKO's Environmental, Planning, Ecological and Ornithological departments.

This report has been reviewed by Sean Creedon (B.Sc., M.Sc.). Sean has 23 years' experience in planning and environmental impact elements within all stages of wind farm project delivery.

5.1.2 Relevant Guidelines and Data Sources

In addition to the guidelines referred to in Section 1.2.1 and Section 1.2.2 of Chapter 1 of this EIAR and Directive 2011/92/EU as amended by Directive 2014/52/EU, the following guidelines, plans and reports have also influenced the preparation of this chapter:

- Best Practice Guidelines for the Irish Wind Energy Industry (IWEA, 2012);
- EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects (Fáilte Ireland, 2023);
- Environmental Noise Guidelines for the European Region (The World Health Organisation (WHO), 2018);
- Environmental Impact Assessment of National Road Schemes- A Practical Guide. Revision 1 (Transport Infrastructure Ireland/formerly National Roads Authority, 2008);
- Determining Significance for Human Health in Environmental Impact Assessment (Institute for Environmental Management and Assessment (IEMA), 2022);
- Framework for Human Health Risk Assessment to Inform Decision Making (United States Environmental Protection Agency (US EPA), 2014);
- Health Impact Assessment Guidance: A Manual. Standalone Health Impact Assessment and health in environmental assessment (Institute of Public Health, 2021);
- Health Impact Assessment Resource and Tool Compilation (United States Environmental Protection Agency, 2016);
- Health In Environmental Impact Assessment: A Primer for a Proportionate Assessment (IEMA, 2017);
- Health in Ireland: Key Trends 2024 (Department of Health, 2025);
- Central Statistics Office (CSO): Census of Ireland 2010, Census of Ireland 2016; Census of Ireland 2022; Census of Agriculture 2020;
- Offaly County Development Plan 2021-2027 (Offaly County Council, 2021).

5.1.3 Scoping and Consultation

Section 2.8 of Chapter 2 Background to the Proposed Project of this EIAR describes the scoping and consultation exercise undertaken for the Proposed Project. General scoping was initially conducted in May 2021. Further general scoping was conducted in October 2024 due to time elapsed from when previous scoping was carried out, updates in local and national policy and legislation, updates in relevant EIAR guidance, changes in the environmental baseline and refinement of the Proposed Project layout and design. Relevant responses to this chapter were received from the Health Service Executive (HSE) and Fáilte Ireland.

Health Service Executive

Responses to the scoping exercises were received from the National Environmental Health Services (EHS) of the Health Service Executive (HSE) on 31st May 2021 and 4th December 2024. Of relevance to this chapter were requests relating to shadow flicker, air quality and drinking water.

Both scoping responses from the HSE requested that a shadow flicker assessment, including all proposed mitigation measures, be undertaken to identify any sensitive receptors that may be impacted by shadow flicker. The HSE recommends that the turbines to be constructed on site utilise the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. Impacts from shadow flicker are assessed in Section 5.7, Section 5.8.2.2.8 and Section 5.8.3.2.8.

The HSE also included recommendations relating to air quality in both responses, because airborne dust generated by the proposed construction works has the potential to have significant impacts on sensitive receptors. An assessment of the effects on human health as a result of impacts to air quality is presented in Section 5.8.2.2.2 and Section 5.8.3.2.2, and in more detail within Chapter 10: Air Quality.

In relation to noise and vibration, the 2021 and 2024 scoping response recommends that all Noise Sensitive Locations (NSL) should be clearly identified, with baseline noise monitoring and an assessment of predicted construction and operational noise impacts. An assessment of the effects on human health as a result of noise and vibration impacts is presented in Section 5.8.2.2.5, Section 5.8.3.2.5, and in more detail within Chapter 12: Noise and Vibration.

The HSE requested that all nearby drinking water sources and private wells be identified, with potential impacts assessed and mitigation measures outlined. An assessment of the effects on human health as a result of impacts to water quality is presented in Section 5.8.2.2.4, Section 5.8.3.2.4 and in more detail within Chapter 9: Water.

In both their 2021 and 2024 responses, the HSE recommended that public consultation be conducted to ensure that all potentially significant impacts of the Proposed Project are addressed. It also suggested that a dedicated website be developed by Lemanaghan Wind Farm DAC (the Applicant). The Applicant created a website, which has been and will be maintained throughout the EIA process (www.lemanaghanwindfarm.ie). Public consultation events were also held in September and October 2021, with a further event in August 2024. Full details of the public consultation are available in Chapter 2: Background to the Proposed Project.

Fáilte Ireland

A scoping response was received from Fáilte Ireland on 7th May 2021 and 11th June 2024. The 2021 scoping response provided Fáilte Ireland Guidelines for the Treatment of Tourism in an EIAR. In 2024, an updated document was circulated by Fáilte Ireland, which has informed Section 5.3.9, Section 5.8.2.1.5, and Section 5.8.3.1.5 below.

5.2 Assessment Methodology

5.2.1 Population

A desk-based assessment using the guidelines referenced in Section 5.1.2 above was undertaken to examine relevant information pertaining to the population impact assessment. The following data sources were examined. Information on population statistics, employment and social data for the relevant Electoral Divisions (EDs) were obtained from the Central Statistics Office (CSO) for census years 2016 and 2022, Fáilte Ireland's EIAR Guidelines for the Consideration of Tourism and Tourism-Related Projects, the Offaly County Development Plan 2021-2027, and any other literature pertinent to the area: See Section 5.3 below.

The Population Study Area for this population assessment focuses on the EDs within which the Proposed Project is located and adjacent to, namely Ballycumber, Srah, Doon, and Ferbane but reference is also made to county and national statistics.

5.2.2 Human Health

The human health analysis section was assessed using the guidelines set out in Section 5.1.2 above.

The WHO defines health as:

> *"A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".*

The assessment methodology and relevant national and international guidance will be discussed under the headings below.

The study area to examine Human Health is the same as that utilised for population assessments (i.e., the Population Study Area).

5.2.2.1 National Guidance

The Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022) advises that "*in an EIAR, the assessment of impacts on population and human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in this EIAR e.g., under the environmental factors of air, water, soil etc.*" Environmental Impacts from the Proposed Project which may also have an impact on population and human health are discussed in this chapter but addressed in more detail in the following chapters: Chapter 8: Land, Soils and Geology, Chapter 9: Water, Chapter 10: Air Quality, Chapter 11: Climate, Chapter 12: Noise and Vibration, Chapter 13: Cultural Heritage, Chapter 14: Landscape and Visual, Chapter 15: Material Assets.

As referenced in the Department of Housing, Planning and Local Government (2018) *Guidelines for Planning Authorities and An Bord Pleanála*[1], (taken from the European Commission's Environmental Impact Assessment of Projects: Guidance on the Preparation of the Environmental Impact Assessment Report (2018)), human health is, "*a very broad factor that would be highly project dependent.*" The report continues:

> *'The notion of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study. In addition, these would concern the commissioning, operation, and decommissioning of a Project in relation to workers on the Project and surrounding population.'*

EPA 2022 also states that "*while no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU, the same term was used in 3.3.6 the SEA Directive (2001/42/EC). The Commission's SEA Implementation Guidance states 'The notion of human health should be considered in the context of the other issues mentioned in paragraph (f)*'" of the Directive, where paragraph (f) lists environmental factors such as soils, water, landscape, air, etc. The Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2022) states that this approach is '*consistent with the approach set out in the 2002 EPA Guidelines where health was considered through assessment of the environmental pathways through which it could be affected, such as air, water or soil*'. EPA 2022 notes that the above approach follows the 2002 EPA Guidelines already in place which details the following:

> *'The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of*

[1] *Department of Housing, Planning and Local Government, 2018 Guidelines for Planning Authorities and An Bord Pleanála. Available at:* https://www.gov.ie/en/department-of-housing-local-government-and-heritage/publications/guidelines-for-planning-authorities-and-an-bord-plean%C3%A1la-on-carrying-out-environmental-impact-assessment-august-2018/

reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment'.

5.2.2.2 ISEP Guidance

5.2.2.2.1 Health in EIA: A Primer for a Proportionate Assessment, 2017

The Institute for Environmental Management and Assessment (IEMA) published '*Health in Environmental Impact Assessment: A Primer for a Proportionate Assessment*'[2] in 2017 (hereafter referred to as the Primer Assessment Report), which provided guidance on the proportionate assessment of the impacts on health in Environmental Impact Assessments (EIA). The document states that Health Impact Assessment (HIA) and EIA are separate processes.

> *'HIA is defined as a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, plan, programme or project on both the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects...HIA can inform EIA practice in relation to population and human health but conducting a HIA will not necessarily meet the EIA population and human health requirement. By the same token, conducting an EIA will not automatically meet the requirements of a HIA.'*

The Primer Assessment Report acknowledges that *'disproportionate burdens may be placed on developers if HIA is applied as a proxy for the consideration of population and human health in every future UK EIA'.* The focus of EIA should be on predicting health and wellbeing outcomes, rather than focusing on changes in determinants of health, e.g., expected changes in noise levels. Determining the significance of impacts on population and human health should include a professional judgement, scientific literature; consultation responses; comparison with baseline conditions; local health priorities; and national/international regulatory standards and guidelines. The Primer Assessment Report refers to the WHO 2014 which provides and overview of health in different types of assessment:

> *"The health sector, by crafting and promoting HIA, can be regarded as contributing to fragmentation among impact assessments. Health issues can, and need to, be included [in impact assessment] irrespective of levels of integration. At the same time, from a civic society perspective, it would be unacceptable for HIA to weaken other impact assessments. A prudent attitude suggests optimizing the coverage of health along all three avenues:*
>
> - *better consideration of health in existing impact assessments other than HIA;*
> - *dedicated HIA;*
> - *and integrated forms of impact assessment."*

As such, the WHO does not support a stand-alone HIA unless it could be demonstrated to be of advantage over an EIAR. As the present EIAR incorporates a human health assessment; there is no need for a stand-alone HIA.

5.2.2.2.2 Determining Significance for Human Health in EIA, 2022

The Institute of Sustainability and Environmental Professionals (ISEP, formerly IEMA) Working Group 2022 published "*Determining Significance for Human Health in Environmental Impact Assessment*"[3] in

[2] *IEMA, 2017. Health in Environmental Impact Assessment: A Primer for a Proportionate Approach. Available at: https://www.nzaia.org.nz/uploads/1/2/3/3/12339018/iema_primer_on_health_in_uk_eia_doc_v11.pdf*
[3] *IEMA, 2022. Determining Significance for Human Health in Environmental Impact Assessment. Available at: https://www.iema.net/media/yljb2nbs/iema-eia-guide-to-determining-significance-for-human-health-nov-2022.pdf*

response to gaps and inconsistencies across existing guidance documents as to how health is assessed in EIA, particularly regarding significance. The aim of this report is to assist and streamline discussions for consultants producing the assessments and decision makers reviewing the assessments. The report states that an EIA must identify, describe and assess, in an appropriate manner, the direct and indirect significant effects of a proposed development on human health. It must include the information that may reasonably be required for reaching a reasoned conclusion on the significant effects, considering current knowledge and methods of assessment.

A wind farm is not a recognised source of pollution. It is not an activity which requires EPA licensing under the EPA Act 1992, as amended. As such, a wind farm is not considered to have ongoing significant emissions to environmental media and the subsequent potential for human health effects. In this context, and aligned with the above noted ISEP Guidance, this EIAR provides sufficient information that may reasonably be required for reaching a reasoned conclusion on the significance of effects, without providing the level of detail, for example through the use of the significance matrix set out in the ISEP Guidance, which might be required for an assessment of effects on human health arising from a type of development with potential for emissions-related human health effects.

5.2.3 Shadow Flicker

5.2.3.1 Background

Shadow flicker is an effect that occurs when rotating wind turbine blades cast flickering shadows at a nearby property. Shadow flicker is an indoor phenomenon, which may be experienced by an occupant sitting in an enclosed room when sunlight reaching the window is momentarily interrupted by a shadow of a wind turbine's blade. Outside in the open, light reaches a viewer (person) from a much less focused source than it would through the window of an enclosed room, and therefore shadow flicker assessments are typically undertaken for the nearby adjacent properties around a proposed wind farm site. The frequency of occurrence and the strength of any potential shadow flicker impact depends on several factors which are listed in the UK's *Update of UK Shadow Flicker Evidence Base*[4] report and outlined below.

1. ***Whether the sunlight is direct and unobstructed or diffused by clouds:***

If the sun is not shining, shadow flicker cannot occur. Reduced visibility conditions such as clouds, haze, and fog greatly reduce the chance of shadow flicker occurring.

"*Cloud amounts are reported as the number of eighths (okta) of the sky covered. Irish skies are completely covered by cloud for over 50% of the time. The mean cloud amount for each hour is between five and six oktas. This is due to Ireland's geographical position off the northwest of Europe, close to the path of Atlantic low-pressure systems which tend to keep the country in humid, cloudy airflows for much of the time. A study at 12 weather stations over a 25-year period showed that the mean cloud amount was at a minimum in April and maximum in July. Cloud amounts were less at night than during the day, with the mean minimum occurring roughly between 2100 and 0100 GMT and the mean maximum occurring between 1000 and 1500 GMT at most stations.*" [5]

2. ***The presence of intervening obstructions between the turbine and the observer:***

For shadow flicker to occur, the windows of a potentially affected property must have direct visibility of a wind turbine, with no physical obstructions such as buildings, trees and hedgerows, hills or other structures located on the intervening land between the window and the turbine.

[4] *Department of Energy and Climate Change, 2010. Update of UK Shadow Flicker Evidence Base. Available at: https://assets.publishing.service.gov.uk/media/5a79770bed915d0422068aa3/1416-update-uk-shadow-flicker-evidence-base.pdf*
[5] *Met Éireann, no date. Sunshine. Available at: https://www.met.ie/climate/what-we-measure/sunshine*

Any obstacles such as trees or buildings located between a property and the wind turbine will reduce or eliminate the occurrence and/or intensity of the shadow flicker.

3. ***How high the sun is in the sky at a given time:***

At distances of greater than approximately 500 m between a turbine and a receptor, shadow flicker generally occurs only at sunrise or sunset when the shadow cast by the turbine is longer. The Wind Energy Development Guidelines (2006) (hereafter 'DoEHLG 2006 Guidelines') iterates that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

Plate 5-1 illustrates the shadow cast by a turbine at various times during the day; the red shading represents the area where shadow flicker may occur. When the sun is high in the sky, the length of the shadow cast by the turbine is significantly shorter.

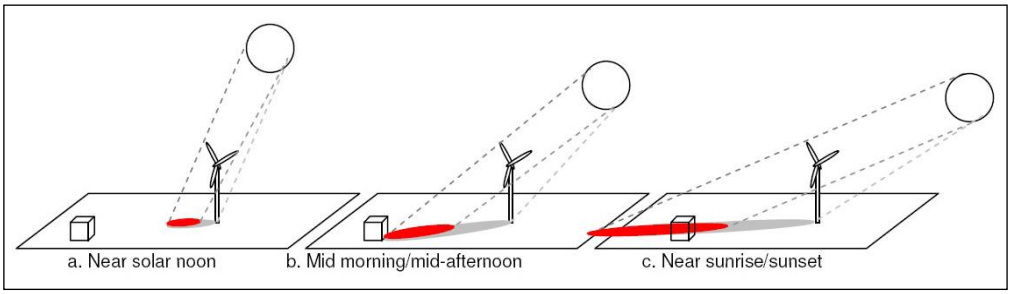

Plate 5-1 Shadow-Prone Area as Function of Time of Day (Source: Shadow Flicker Report, Helimax Energy, Dec 2008)

4. ***Distance and bearing, i.e., where the property is located relative to a turbine and the sun:***

The further a property is from the turbine the less pronounced the effect will be. There are several reasons for this: there are fewer times when the sun is low enough to cast a long shadow; when the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and the centre of the rotor's shadow passes more quickly over the land reducing the duration of the impact.

At a distance, the turbine blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak impact is observed at distance from the turbines[6].

5. ***Property usage and occupancy:***

Where shadow flicker is predicted to occur at a specific location, this does not imply that it will be witnessed. Potential occupants of a property may be sleeping or occupying a room on another side of the property that is not subject to shadow flicker or completely absent from the location during the time of shadow flicker events. As shadow flicker usually occurs only when the sun is at a low angle in the sky, i.e., very early in the morning after sunrise or late in the evening before sunset, even if there is a bedroom on the side of the property affected, the shadow flicker may not be witnessed if curtains or blinds in the bedroom are closed. It should be noted that the below assessment considers a theoretical precautionary assessment as detailed in Section 5.7 below.

[6] *Department of Energy and Climate Change, 2010. Update of UK Shadow Flicker Evidence Base. Available at: https://assets.publishing.service.gov.uk/media/5a79770bed915d0422068aa3/1416-update-uk-shadow-flicker-evidence-base.pdf*

6. Wind direction, i.e., position of the turbine blades:

The direction of wind turbine blades changes according to wind direction, as the turbine rotor turns to face the wind. To cast a shadow, the turbine blades must be facing directly toward or away from the sun, so they are moving across the source of the light relative to the observer. This is demonstrated in Plate 5-2 below.

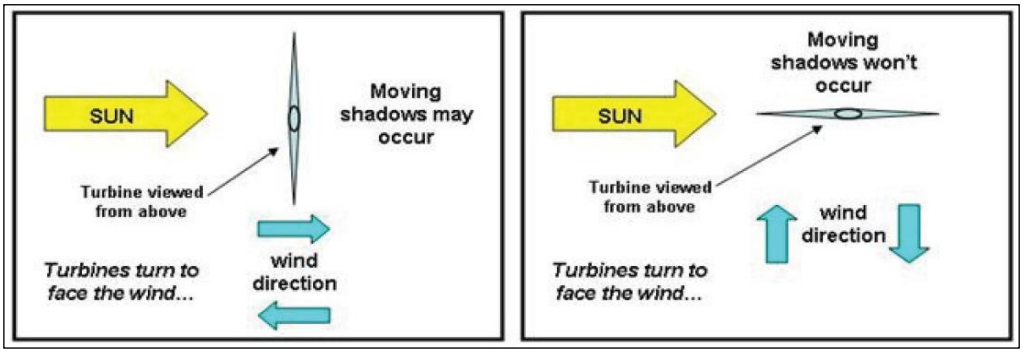

Plate 5-2 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC)

7. Rotation of turbine blades:

Shadow flicker occurs only if there is sufficient wind for the turbine blades to be continually rotating. Wind turbines begin operating at a specific wind speed referred to as the 'cut-in speed', i.e., the speed at which the turbine begins producing power, and cease operating at a specific 'cut-out speed'. Therefore, even during the sunlight hours when shadow flicker has been predicted to occur, if the turbine blades are not turning due to insufficient wind speed, no shadow flicker will occur.

5.2.3.2 Guidance

The DoEHLG 2006 Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Therefore, the study area adopted for the shadow flicker assessment is 10 rotor diameters of the proposed turbine locations (i.e., for the Proposed Project, this is assumed at 1.50 km based on a rotor diameter of 150 metres), hereafter referred to as the 'Shadow Flicker Study Area').

The current adopted guidance for shadow flicker in Ireland is derived from the DoEHLG 2006 Guidelines, and the "*Best Practice Guidelines for the Irish Wind Energy Industry*" (Irish Wind Energy Association, 2012).

The DoEHLG 2006 Guidelines recommend that shadow flicker at neighbouring offices and dwellings within 500 m of a proposed turbine location should not exceed a total of 30 hours per year or 30 minutes per day.

The DoEHLG 2006 Guidelines state that shadow flicker lasts only for a short period of time and occurs only during certain specific combined circumstances, as follows:

- the sun is shining and at a low angle in the sky, i.e., just after dawn and before sunset, **and**
- the turbine is located directly between the sun and the affected property, **and**
- there is enough wind energy to ensure that the turbine blades are moving, **and**
- the turbine blades are positioned so as to cast a shadow on the receptor.

Although the DoEHLG 2006 Guidelines threshold applies to properties located within 500 metres of a proposed turbine location, for the purposes of this assessment, the thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within 10 rotor diameters of the proposed

turbines (1.5 km in the case of the Proposed Wind Farm) (as per Best Practice Guidelines for the Irish Wind Energy Industry, IWEA, 2012).

As stated in Section 1.2.2 of Chapter 1, the DoEHLG 2006 Guidelines are currently under review. The DoEHLG released the '*Draft Revised Wind Energy Development Guidelines*' (hereafter referred to as the Draft DoHPLG 2019 Guidelines) for public consultation in December 2019. The consultation period closed in February 2020; however, no update or final guideline documents was released. The Draft DoHPLG 2019 Guidelines recommend local planning authorities and/or An Coimisiún Pleanála impose conditions to ensure that:

> *"no existing dwelling or other affected property will experience shadow flicker as a result of the wind energy development subject of the planning application and the wind energy development shall be installed and operated in accordance with the shadow flicker study submitted to accompany the planning application, including any mitigation measures required."*

The Climate Action Plan 2025 Annex of Actions, published in April 2025, states that final guidelines will be published in Q1 2025, which has now passed. No date has been provided for an update by the Department for Housing, Local Government and Heritage[78]. The shadow flicker methodology and assessment within this chapter are based on compliance with the DoEHLG 2006 Guidelines, which remain the latest adopted guidelines. However, it should also be noted the proposed turbines can be brought in line with the requirements of the Draft DoHPLG 2019 Guidelines through the stricter implementation of the mitigation measures outlined in Section 5.8.3.2.8.

5.2.3.3 Shadow Flicker Prediction Methodology

Shadow flicker occurs only under certain, combined circumstances, as detailed above. Where shadow flicker does occur, it is generally momentary. The DoEHLG 2006 Guidelines state that careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker, all of which have been employed at the Proposed Wind Farm. Proper siting of wind turbines is key in eliminating the impact of shadow flicker.

The occurrence of shadow flicker can be precisely predicted using specialist computer software programmes specifically developed for the wind energy industry, such as WindFarm (ReSoft) or WindFarmer (DNV.GL), AWS OpenWind or WindPRO: Shadow. The computer modelling of the occurrence and magnitude of shadow flicker is made possible by the fact that the sun rises and sets in the same position in the sky on every day each year.

To set up the model, Ordnance Survey Ireland mapping (OSI 1:50,000 contours) was used to determine the approximate ground elevation at which the wind turbines and surrounding properties are located. The use of these data ensures that realistic elevation variations between the turbines and properties are accounted for.

Any potential impact can be precisely modelled to give the start and end time of any incidence of shadow flicker, at any location, on any day or all days of the year. Where a shadow flicker impact is predicted to occur, the total maximum daily and annual durations can be predicted, along with the total number of days. Any incidence of predicted shadow flicker can be attributed to a particular turbine or group of turbines to allow effective mitigation strategies to be planned and proposed as detailed further below.

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[7] *Wind Energy Guidelines Dáil Éireann Debate. Thursday 15th May 2025.* https://www.oireachtas.ie/en/debates/question/2025-05-15/51/

[8] *Wind Energy Guidelines Dáil Éireann Debate. Wednesday 15th October 2025.* https://www.oireachtas.ie/en/debates/question/2025-10-15/192/

For the purposes of this shadow flicker assessment, the software package "windPRO– Version 4.0.552" was used to predict the level of shadow flicker associated with the Proposed Wind Farm. The windPRO package is a commercially available software tool that enables developers to analyse, design and optimise proposed wind farms. It allows proposed turbine layouts to be optimised for maximum energy yield whilst taking account of environmental, planning and engineering constraints. According to the UK guidance and methodology produced for the UK Department of Energy and Climate Change [9], windPRO is one of the three key computer models (the others being WindFarm and Windfarmer) used by the industry and it has been shown that the outputs of these models do not differ significantly.

5.2.3.3.1 *Shadow Flicker Criteria*

The proposed wind turbines to be installed on the Proposed Wind Farm will have a ground-to-blade tip height, hub height and blade length of the following dimensions:

- Turbine Tip Height – 220 m
- Hub Height – 145 m
- Rotor Diameter – 150 m

5.2.3.4 Shadow Flicker Study Area

At the outset of the Proposed Project, during the constraints mapping process detailed in Section 3.2.5.2.1 of Chapter 3 Site Selection and Reasonable Alternatives of this EIAR, all sensitive receptors within c.2km of the area suitable for siting wind turbines within the site were identified and mapped. This included all inhabitable and uninhabitable properties. In addition, a planning history search to identify properties that may have been granted planning permission, but not yet been constructed, was carried out. Any property with a valid planning permission for a dwelling house was also added to the sensitive receptors' dataset. This dataset has been updated over the project duration and prior to submission of the planning application in March 2026.

The Shadow Flicker Study Area is 10 times the rotor diameter (150 m rotor diameter x 10 = 1.5 km). As noted above, the DoEHLG 2006 Guidelines state that, at distances greater than 10 times the rotor diameter of a proposed turbine, the potential for shadow flicker is very low, and therefore the shadow flicker study area is set at 1.5 km from the proposed turbines. For the purposes of the shadow flicker assessment, all sensitive receptors within the Shadow Flicker Study Area were identified and mapped. In addition, a planning history search to identify properties that may have been granted planning permission, but have not yet been constructed, was carried out. Any property with a valid planning permission/application for a dwelling was also added to the sensitive receptor dataset.

In total, 157 properties were identified within 1.5 km of the proposed turbines, i.e., the Shadow Flicker Study Area. Of these, there are 145 no. inhabitable dwellings, 1 no. derelict property, 10 no. planning permissions for new dwellings and 1 no. office located within 1.5 km of the proposed turbine locations.

The Shadow Flicker Study Area and sensitive receptor locations are shown in Figure 5-3 below, with all dwellings detailed in Table 5-9 in Section 5.7 below.

Equine Industry

There are no registered thoroughbred stud farms or other equestrian facilities located within the Shadow Flicker Study Area. The closest registered stud farm is Erryvale Stud, located in Clara, Co. Offaly, approximately 6.1 km northeast of the nearest proposed turbine (T15). The nearest equestrian facility, not including stud farms, is Brosna View Stables, located approximately 10 km northeast of the

[9] *Department of Energy and Climate Change, 2010. Update of UK Shadow Flicker Evidence Base. Available at: https://assets.publishing.service.gov.uk/media/5a79770bed915d0422068aa3/1416-update-uk-shadow-flicker-evidence-base.pdf*

nearest proposed turbine (T15). Therefore, there are no registered thoroughbred stud farms or other equestrian facilities included as sensitive receptors for the purposes of shadow flicker assessment.

Please refer to Section 5.3.7.1 below for further information on the equine industry.

5.2.3.4.2 Assumptions and Criteria

Due to the latitude of Ireland, shadow flicker impacts are only possible at properties 130 degrees either side of north (i.e., a shadow flicker event can occur within a 260-degree span), as turbines do not cast shadows on their southern side. As such, properties located outside of this potential shadow flicker zone (50 degrees either side of south) will not be impacted. However, a precautionary approach has been taken in relation to the orientation of each individual property with regard to the location of the proposed wind turbines through the use of a feature called 'greenhouse mode' within the WindPRO software. This feature assumes shadows can be seen from 360 degrees at a property as opposed to only through windows facing the wind turbines. Therefore, all 157 no. sensitive receptors within the Shadow Flicker Study Area of the Proposed Project were assessed for shadow flicker impact.

At each property, the windPRO modelling software produced shadow flicker calculations based on 4 no. notional windows facing north, east, south and west, labelled Windows 1, 2, 3 and 4 respectively. The methodology below is standard for all software packages and cannot be manipulated per site, i.e., the conservative approach of assuming shadow flicker from the north, south, east and west of each receptor is modelled. The degrees from north value for each window is:

- Window 1: 0 degrees from North
- Window 2: 90 degrees from North
- Window 3: 180 degrees from North
- Window 4: 270 degrees from North

No screening due to trees or other buildings or vegetation is assumed. It was not considered necessary or practical to measure the dimensions of every window on every property in the Shadow Flicker Study Area. While the actual size of a window will marginally influence the incidence and duration of any potential shadow flicker impact, with larger windows resulting in slightly longer shadow flicker durations, any additional incidences or durations or shadow flicker over and above those predicted in this assessment can be countered by extending the mitigation strategies outlined in Section 5.8.3.2.8.

The use of computer models to predict the amount of shadow flicker that will occur is known to produce an over-estimate of possible impact, i.e., the theoretical precautionary scenario, due to the following limitations:

- The sun is assumed to be shining during all daylight hours such that a noticeable shadow is cast. This will not occur in reality.
- The wind is always assumed to be within the operating range of the turbines such that the turbine rotor is turning at all times, thus enabling a periodic shadow flicker. Wind turbines only begin operating at a specific "cut-in speed", and cease operating at a specific "cut-out speed". In periods where the wind is blowing at medium to high speeds, the probability of there being clear or partially clear skies where the sun is shining and could cast a shadow is low.
- The wind turbines are assumed to be available to operate, i.e., turned on at all times. In reality, turbines may be switched off during maintenance or for other technical or environmental reasons.
- The turbine rotor is considered (as a sphere) to present its maximum aspect to observers in all directions. In reality, the wind direction and relative position of the turbine rotor would result in a changing aspect being presented by the turbine. The rotor will actually present as ellipses of varying sizes to observers from different directions. The time taken for the sun to pass across the sky behind a highly elliptical rotor aspect will be shorter than the modelled maximum aspect.

The total annual shadow flicker calculated for the property assumes 100% sunshine during daytime hours, as referred to above. However, weather data for this region shows that the sun shines on average for 3.2 hours per day or 26.5% of the daylight hours per year. This percentage is based on Met Éireann weather station at Birr, Co. Offaly over the 30-year period from 1979-2008[10]. The actual sunshine hours at the site and therefore the percentage of time shadow flicker could actually occur is 26.5% of daylight hours. Section 5.7 below lists the annual shadow flicker calculated for each property when the regional average of 26.5% sunshine is considered, to give a more accurate annual average shadow flicker prediction. Table 5-10 below outlines whether a shadow flicker mitigation strategy is required for any property within the Shadow Flicker Study Area which may be impacted by shadow flicker.

There are 156 no. sensitive receptors for shadow flicker located within 1.5 kms (i.e., 10 rotor diameters) of any proposed wind turbine location. The closest sensitive receptor for shadow flicker (i.e., inhabitable dwelling) is located approximately 896 m from the nearest proposed turbine location (T10).

5.3 Baseline Population

5.3.1 Receiving Environment

The socio-economic study of the receiving environment included an examination of the population and employment characteristics of the site and the surrounding environs. The relevant methodology pertaining to the population and human health assessment relates to the assessment of desk-based data sourced from the following locations. Information regarding population and general socio-economic data were sourced from the Central Statistics Office (CSO), the Offaly County Development Plan 2021-2027, Fáilte Ireland and any other literature pertinent to the area. Census 2022 was the most recent census for which a complete dataset is available. Data was also obtained from Census of Ireland 2016, the Census of Agriculture 2020 and from the CSO website (www.cso.ie). Census information is divided into State, Provincial, County, Major Town, and Electoral Division (ED) levels.

The Proposed Project is located within several townlands as listed in Table 1-1 Chapter 1 of this EIAR. The Proposed Wind Farm is located 3 km northeast of Ferbane and approximately 3.5 km southwest of the village of Ballycumber in Co. Offaly, from the nearest proposed turbines (T03 and T15, respectively). The Proposed Grid Connection, located in the north of the Proposed Project site, is in the townland of Cooldorragh. Please refer to Figure 1-1 of Chapter 1: Introduction for the site location.

In order to assess the population in the vicinity of the Proposed Project, the "Population Study Area" for the Population section of this EIAR was defined in terms of Electoral Divisions (EDs) where the Proposed Project is located.

The site of the Proposed Project lies within 4 No. EDs: Ballycumber, Srah, Doon, and Ferbane, as shown in Figure 5-1. These EDs will collectively be referred to hereafter as the "Population Study Area" for this chapter.

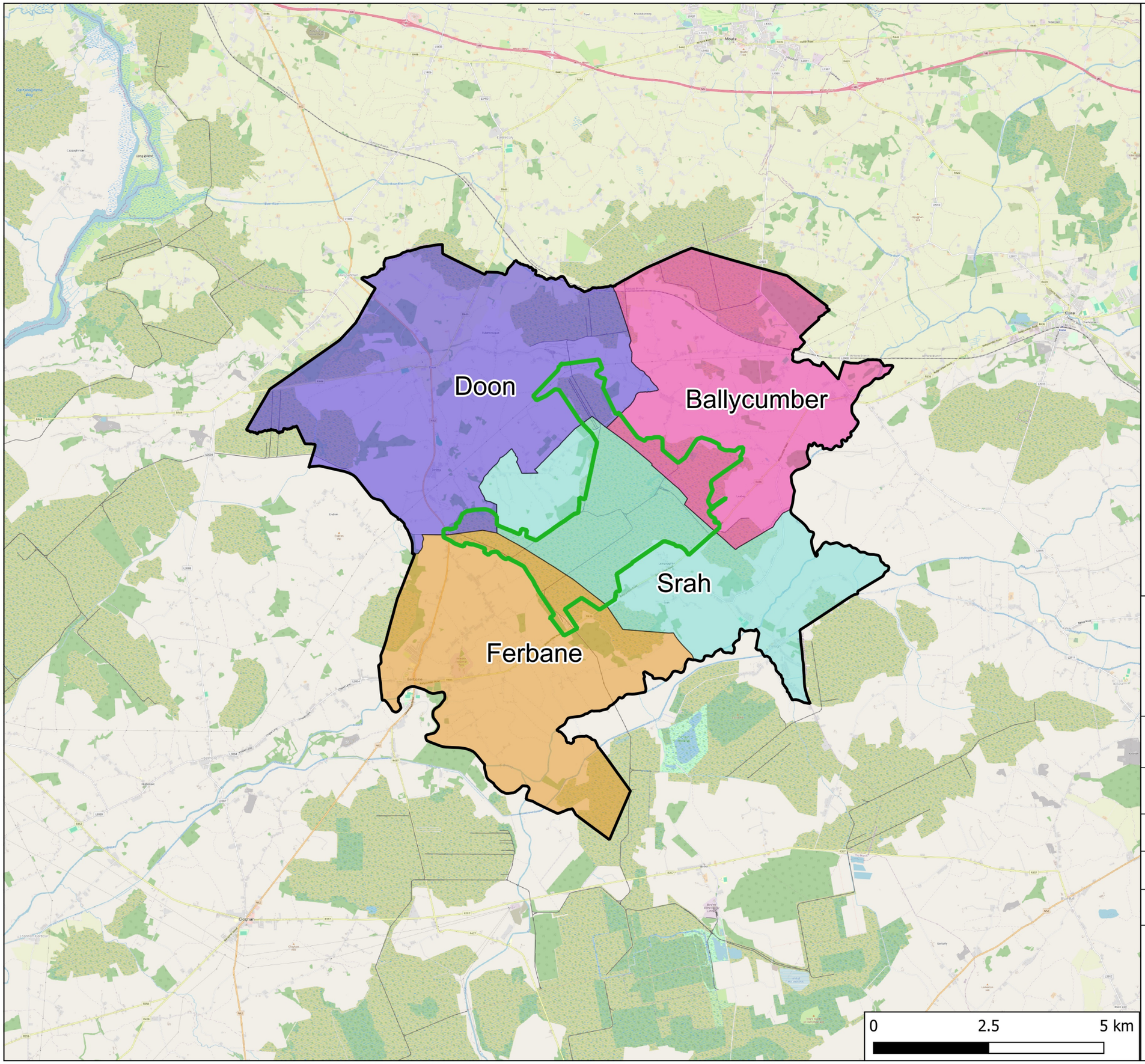
The Population Study Area has a population of 3,286 persons as of 2022 and comprises a total land area of 99.8 km^2 (Source: CSO Census of the Population 2022). The populations and land areas within each ED are as follows:

- Ballycumber (741 persons; land area= 22 km^2)
- Srah (721 persons; land area= 22 km^2)
- Doon (543 persons; land area= 31 km^2)
- Ferbane (1,281 persons; land area= 24 km^2)

[10] *Met Éireann, 2024. Birr 1978-2008 averages. Available at: https://www.met.ie/cms/assets/uploads/2024/07/Birr-1979%E2%80%932008-*

There are 21 no. sensitive receptors (inhabitable dwellings, a derelict property and an office building) located within 1 km of proposed turbines. The closest sensitive residential receptor is located approximately 896 m from the nearest proposed turbine (T10), i.e., above both the minimum recommended setback for properties involved in the project (500 m) and the recommended 4x tip height setback (880 m) from properties not involved in the Proposed Project (as recommended in the Draft DoHPLG 2019 Guidelines). There are 4 no. commercial/warehouse units located less than 780 m from T03. One of these commercial units includes an adjacent office and is considered above as a sensitive receptor. There is an additional Warehouse Unit located approximately 898 m from T11.

The Proposed Grid Connection is located within the Proposed Wind Farm boundary. It includes an overhead line (OHL) cabling from the proposed onsite 220kV substation and will require a break in the existing Shannonbridge-Maynooth 220kV OHL to facilitate the Proposed Project connection to the national electricity grid. In order to assess the population in the vicinity of the Proposed Grid Connection, a review of properties and planning applications in the vicinity of the existing OHL was carried out. There are no properties located within 100 m of the Proposed Grid Connection.



Map Legend

- EIAR Site Boundary
- Population Study Area

Electoral Divisions

- BALLYCUMBER
- DOON
- FERBANE
- SRAH

Drawing Title
Population Study Area

Project Title
Lemanaghan Wind Farm, Co. Offaly

Drawn By	Checked By
EM	EC
Project No. 200804	Drawing No. Figure 5-1
Scale 1:80,000	Date 2026-01-23

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5.3.2 Demographic Trends

In the period 2016 to 2022, the population of Ireland increased by 8.1%. Between 2016 and 2022, the population of Co. Offaly increased by 6.7% to 83,150 persons. Population statistics for the State, County Offaly, and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5-1.

Table 5-1 Population 2016 - 2022 (Source: CSO)

Area	Population		Percentage Population Change
	2016	2022	2016-2022
State	4,761,865	5,149,139	+8.13%
County Offaly	77,961	83,150	+6.66%
Population Study Area	3,133	3,286	+4.8%

The data presented in Table 5-1 shows that the population of the Population Study Area increased by 4.8% between 2016 and 2022. This rate of population increase is lower than that recorded at State and County level. When the population data is examined in closer detail, it shows that the rate of population increased within the Population Study Area in three EDs; Doon at 16.8%, Ferbane at 4.7%, and Srah at 2.4%. The remaining ED in the Population Study Area, Ballycumber, saw no change in population from 2016 to 2022. No ED in the Population Study Area saw a decrease in population.

The ED within the Population Study Area with the highest population recorded in the 2022 Census was Ferbane ED, with a population of 1,281. The lowest population recorded in the 2022 Census was in Doon DED, with a population of 543. This low population is due to the land cover predominantly comprising of peatlands and agricultural land.

5.3.3 Population Density

The population densities recorded within the State, County Offaly and the Population Study Area during the 2016 and 2022 Census are shown in Table 5-2.

Table 5-2 Population Density in 2016 – 2022 (Source: CSO)

Area	Population Density (Persons per square kilometre)	
	2016	2022
State	67.76	73.27
County Offaly	38.96	41.55
Population Study Area	31.40	32.93

The population density of the Population Study Area recorded during the 2022 Census was approximately 33 persons per km^2. This figure is lower than the national population densities of 73.27 persons per km^2. The population density of Co. Offaly is considerably lower than the State.

Similar to the observed population trends, the population density recorded across the Population Study Area varies between EDs. Ferbane had the highest population density at 53.38 persons per km^2 while Doon had the smallest population density at just 17.46 persons per km^2.

5.3.4 Household Statistics

The number of households and average household size recorded within the State, County Offaly, and the Population Study Area during the 2016 and 2022 Censuses are shown in Table 5-3.

Table 5-3 Number of Household and Average Household Size 2016 - 2022 (Source: CSO)

Area	2016		2022	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,702,289	2.75	1,841,152	2.74
County Offaly	27,343	2.64	28,923	2.84
Population Study Area	1,121	2.82	1,203	2.73

The figures in Table 5-3 show that while the number of households within the State, Counties and the EDs increased, the average number of people per household remained the relatively consistent due to the proportionate increase in population during this period. Average household size recorded for the Population Study Area during the 2016 and 2022 Censuses are in line with that observed at State and County level during the same time periods as the decline observed for the average number of people per household is insignificant. The average household sizes recorded for each ED are similar to the above, ranging from 2.65 (Ferbane) to 3.01 (Doon).

5.3.5 Age Structure

Figure 5-2 presents the population percentages of the State, County Offaly and the Population Study Area within different age groups as defined by the CSO during the 2022 Census.

The proportion of the ED Population Study Area population is broadly similar to those recorded at national and county level categories. For the ED Study Area, the highest population percentage occurs within the 45-64 age category. This age category would be considered to be less sensitive to change when compared to other age categories, with higher home ownership and lower geographic mobility. The lowest population percentage within the Population Study Area occurs within the 15-24 range age category, at 11.5%. This is lower than the County population percentage. This age category is considered one of the more sensitive age categories to change, with over one third of emigrants in 2024 falling within this age category[11]. The age category results of the Population Study Area correspond with the trend of younger generations leaving rural areas to move to urban areas with greater education and employment opportunities. Figure 5-2 highlights the different age category percentages within the State, County Offaly, and the Population Study Area.

[11] *CSO, 2024. Migration Classified by Age Group, 2024. Available at: https://data.cso.ie/table/PEA03*

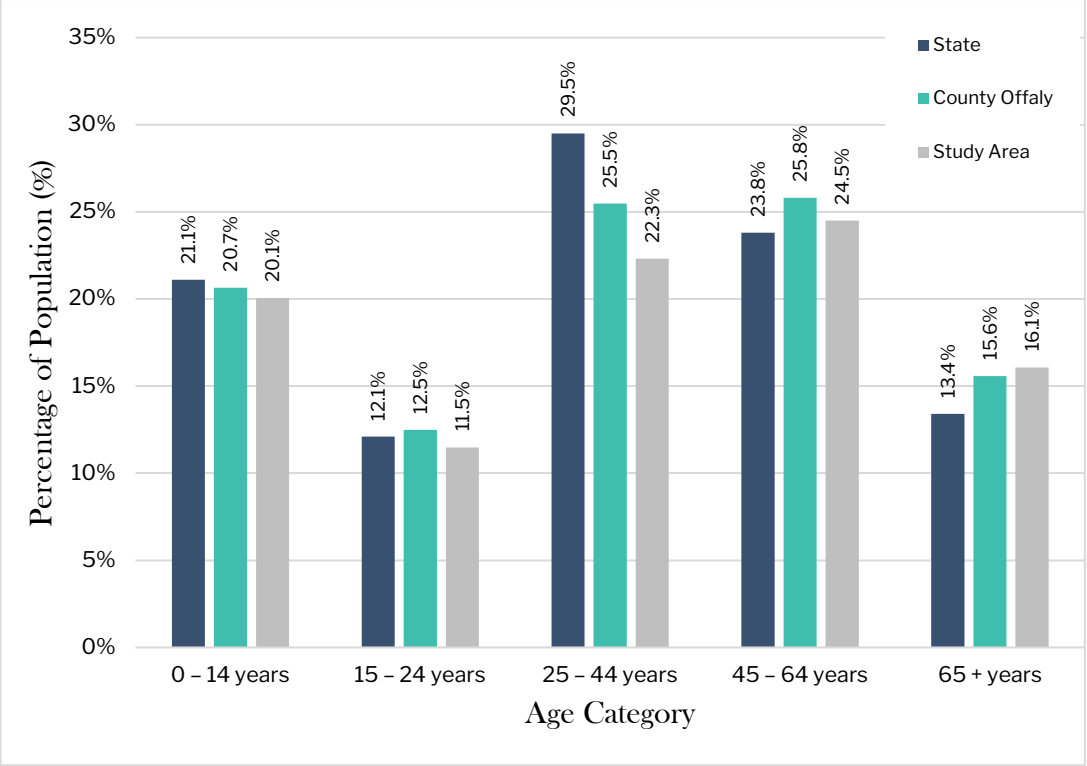

Figure 5-2 Population per Age Category in 2022 (Source: CSO)

5.3.6 Employment and Economic Activity

5.3.6.1 Economic Status

The labour force consists of those who can work, i.e., those who are aged 15+, out of full-time education and not performing duties that prevent them from working. There were 85,901 people (aged 15 and over) at work in Co. Offaly, an increase of 4,961 people (+16.38%) between 2016 and 2022. In 2022, there were 4,136,852 persons in the labour force in the Republic of Ireland. This figure is further broken down into the percentages that were at work, seeking first time employment or unemployed. It also shows the percentage of the total population aged 15+ who were *not* in the labour force, i.e., those who were students, retired, unable to work or performing home duties.

Table 5-4 shows the percentage of the total population aged 15+ who were in the labour force during the 2022 Republic of Ireland Census.

Table 5-4 Economic Status of the Total Population Ages 15+ in 2022 (Source: CSO)

Status		State	County Offaly	Population Study Area
Percentage of population aged 15+ who are in the labour force		**61.2%**	**59.0%**	**53.2%**
Percentage of which are:	At work	91.7%	90.6%	83.1%
	First time job seeker	1.4%	1.7%	2.2%
	Unemployed	7.0%	7.7%	14.7%
Percentage of population aged 15+ who are not in the labour force		**38.6%**	**40.2%**	**46.8%**

Percentage of which are:	Student	29.4%	26.6%	22.7%
	Home duties	21.1%	24.5%	27.1%
	Retired	37.6%	35.5%	36.0%
	Sickness or Disability	10.9%	12.5%	13.1%
	Other	1.0%	0.8%	1.1%

Overall, the principal economic status of those within the labour force living in the Population Study Area is lower to that recorded at State and County level. In comparison with the State and County Offaly, the Population Study Area has 8 and 5.8 percentage points fewer persons in the labour force, respectively.

The largest difference between the State and the Study Area was the "Student" category, with a difference of 8.7 percentage points. Of those who were not in the labour force during the 2022 Census, the highest percentage of the population in the Study Area was in the "Retired" category, which is the same as figures recorded at State and County level, which also show "Retired" as the highest category.

5.3.6.2 Employment and Investment Potential in the Irish Wind Energy Industry

5.3.6.2.1 *Employment Potential*

A report entitled '*Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy*'[12] was published in 2009 by Deloitte, in conjunction with the Irish Wind Energy Association (IWEA). This report focused on the ability of the Irish wind energy industry to create investment and jobs. In terms of the overall economic benefit to be obtained from wind energy, the report states in its introduction:

> *"Ireland is fortunate to enjoy one of the best wind resources in the world. Developing this resource will reduce and stabilise energy prices in Ireland and boost our long-term competitiveness as an economy. It will also significantly reduce our dependence on imported fossil fuels."*

More recently, Siemens in conjunction with the Irish Wind Energy Association (IWEA) published a report in 2014 entitled "*An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland*"[13], concluded that, *"a major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment.*" The report considers the three potential types of direct employment created, as a result of increased investment in wind energy, to be:

- Wind Energy Industry Employment:
  - Installation
  - Development
  - Planning
  - Operation and Maintenance

[12] *Deloitte, Irish Wind Energy Association 2009 Jobs and Investment in Irish Wind Energy Powering Ireland's Economy. Available at: https://windenergyireland.com/images/files/9660bd5e72bcac538f47d1b02cc6658c97d41f.pdf*

[13] *Siemens and IWEA, 2014. An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland. Available at: https://www.esri.ie/system/files/publications/BKMNEXT250%20%281%29.pdf*

- Investor activity
- Electricity Grid Network Employment
- Potential Wind Turbine Manufacturing Employment

The Sustainable Energy Authority of Ireland (SEAI)[14] demonstrates in its '*Wind Energy Roadmap 2011-2050'* report, that "*the wind energy resource represents a significant value to Ireland by 2050. This value is presented in terms of its ability to contribute to our indigenous energy needs, the benefits of enhanced employment creation and investment potential, and the ability to significantly abate carbon emissions to 2050."*

5.3.6.2.2 Energy Targets

The Climate Action Plan 2025[15] (CAP 2025) was launched in April 2025. Following on from Climate Action Plans 2019, 2021, 2023, and 2024, CAP 2025 sets out the roadmap to deliver on Ireland's climate ambition. It aligns with the legally binding economy-wide carbon budgets and sectoral ceilings that were agreed by Government in July 2022 following the Climate Action and Low Carbon Development (Amendment) Act 2021, which commits Ireland to a *legally binding target of net-zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030.* CAP 2025 sets out indicative ranges of emissions reductions for each sector of the economy.

Further information on energy and climate change targets is detailed in Chapter 11: Climate of this EIAR, Chapter 1: Introduction (Section 1.5) and Chapter 2: Background to the Proposed Project (Section 2.3 and Section 2.4)

5.3.6.2.3 Employment Potential

According to a 2021 KPMG report on behalf of Wind Energy Ireland, "*Economic impact of onshore wind in Ireland"*[16], as of 2021, the onshore wind energy sector in Ireland supported 5,130 jobs in 2021 (excluding employment in grid development) through the sector and its supply chain. By 2030, under a scenario of 8,200 MW installed capacity, there is potential for 7,020 jobs. These figures update those estimated in a Siemens and IWEA (2014) report, which predicted that the wind energy sector in Ireland would produce 6,659 direct jobs in a scenario where 4GW capacity is achieved by 2020. It was estimated that 5,596 of these jobs would be associated directly with the construction and installation of windfarms, while the remaining 1,063 jobs would be associated with the national grid. Under this scenario, this translates to 1.66 direct jobs per megawatt (MW) of wind capacity throughout the various stages of installation. Ireland needs to achieve a total of 9GW of onshore wind by 2030 which will further support further employment. According to Wind Energy Ireland, the installed onshore wind capacity in Ireland has exceeded 5,000 MW as of January 2025[17], which would support employment during the last decade.

In its 2011 report '*Wind Energy Roadmap 2011-2050'*[18], the SEAI notes that "*Onshore and offshore wind could create 20,000 direct installation and O&M jobs by 2040".* This Roadmap estimated that onshore and offshore wind could create 20,000 direct installation and operation/maintenance jobs by 2040 and that the wind industry would also have an annual investment potential of approximately €6-12 billion by 2040.

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[14] *SEAI (2019), https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*
[15] *Department of the Environment, Climate and Communications, 2025. Climate Action Plan 2025. Available at: https://assets.gov.ie/static/documents/Climate_Action_Plan_2025_updated_cover.pdf*
[16] *KPMG on behalf of Wind Energy Ireland. 2021. Economic impact of onshore wind in Ireland. Available at: https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf*
[17] *Wind Energy Ireland, 2025. Irish wind farms provide a third of our power in 2024 and set new energy milestone. https://windenergyireland.com/latest-news/7827-irish-wind-farms-provide-a-third-of-our-power-in-2024-and-set-new-energy-milestone*
[18] *The Sustainable Energy Authority of Ireland (SEAI), 2021. Wind Energy Roadmap 2011-2050. Available at: https://www.seai.ie/sites/default/files/publications/Wind_Energy_Roadmap_2011-2050.pdf*

A 2014 report by Pőyry, "*The Value of Wind Energy to Ireland*"[19], stated that growth of the wind sector in Ireland could support 23,850 jobs (construction and operational phases) by 2030. The report states that if Ireland chooses to not develop any more wind, then by 2030 the country will be reliant on natural gas for the majority of electricity generation, at a cost of €671 million per annum in fuel import costs.

A 2017 report issued by WindEurope, entitled '*Wind energy in Europe: Scenarios for 2030*'[20] details various scenarios in Europe in respect to the EU target for renewable energy. According to WindEurope's High Scenario, which assumes favourable market and policy conditions including the achievement of a 35% EU renewable energy target (slightly higher than the 32% EU target for renewables), "*397 GW of wind energy capacity would be installed in the EU by 2030, 298.5 GW onshore and 99 GW offshore. In this scenario, the wind energy industry would invest €351bn by 2030, and it would create 716,000 jobs".*

A March 2021 report by MaREI, the SFI Research Centre for Energy, Climate and Marine, hosted by University College Cork[21], estimates that were Ireland to meet the government's target of net-zero carbon emissions by 2050, at least 25,000 jobs would be created in the onshore and offshore wind sectors.

A more recent report issued by WindEurope in February 2022, titled "*Wind Energy in Europe: 2021 Statistics and the Outlook for 2022-2026*"[22], further details various scenarios in Europe with respect to the EU's targets for renewable energy. According to this report, "*Europe installed 17GW (11 GW in the EU-27) of new wind capacity in 2021. This is not even half of what the EU should be building to be on track to deliver its 2030 Climate Energy Goals.*" The report also states that "*The European Commission modelling shows that we need at least 79 GW offshore wind but National Governments have pledged to build at least 92 GW offshore wind capacity by 2030.*"

As of January 2025, the installed capacity of wind energy on the island of Ireland was 6.3GW[23]. Of this, 4.9GW was installed in the Republic of Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Kerry, Cork, Donegal, Mayo, Galway and Clare, contributing to employment potential on the island of Ireland.

5.3.6.2.4 Economic Value

A 2019 report by Baringa, "*Wind for a Euro: Cost-benefit analysis of wind energy in Ireland 2000-2020*"[24], analysed the financial impact for end consumers of the deployment of wind generation in Ireland over the period 2000-2020. The report calculates how the costs and benefits for consumers would have differed if no wind farms had been built. The analysis indicated that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 (2018-2020 results being projective) would result in a total net cost to consumers, over 20 years, of €63 million, which equates to a cost of less than €1 per person per year since 2000. Further cost benefit analysis noted that wind energy has delivered €2.3 billion in savings in the wholesale electricity market. As such, the economic benefit of renewable energy to consumers is greater than what would have been if Ireland did not invest in wind power. This

[19] *Pőyry, 2014. The Value of Wind Energy to Ireland. Available at:* https://windenergyireland.com/images/files/9660bd6b05ed16be59431aa0625855d5f7dca1.pdf
[20] *WindEurope, 2017. Wind Energy in Europe Scenarios for 2030 Available at:* https://windeurope.org/wp-content/uploads/files/about-wind/reports/Wind-energy-in-Europe-Scenarios-for-2030.pdf
[21] *MaREI, 2021. Our Climate Neutral Future: Zero by 50. Available at:* https://www.marei.ie/wp-content/uploads/2021/03/Our-Climate-Neutral-Future-Zero-by-50-Skillnet-Report-March-2021-Final-2.pdf
[22] *WindEurope, 2022. Wind Energy in Europe 2021 Statistics and the Outlook for 2022-2026 Available at:* https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-2021-statistics-and-the-outlook-for-2022-2026/
[23] *Eirgrid, 2025. Systems and Renewable Data Reports. Available at:* https://www.eirgrid.ie/grid/system-and-renewable-data-reports
[24] *Baringa, 2019. Wind for a Euro: Cost Benefit Analysis of Wind Energy in Ireland 2000-2020 Available at:* https://www.baringa.com/en/insights/low-carbon-futures/our-market-and-policy-studies-in-ireland/wind-for-a-euro/

corresponds with the Deloitte report[25] which indicates that more wind energy feeding into the national grid will result in lower and more stable energy costs for consumers.

Furthermore, in 2020, IWEA released its 70by30 Implementation Plan Reports[26], which further detail the savings that can be made from the continuation of onshore wind. The report, entitled "*Saving Money - 70 by 30 Implementation Plan*", notes that "*Baringa calculated previously that if onshore wind in Ireland can be delivered at €60/MWh, on average, between 2020 and 2030, than the 70 per cent renewable electricity target set out in the Climate Action Plan will actually be cost-neutral for the consumer. If we can achieve prices under €60/MWh then Ireland's electricity consumers will be saving money*".

The Proposed Project will, if consent is granted, contribute to the economic value that renewable energy brings to the country.

5.3.7 Land-Use Patterns and Activities

The land uses within the Proposed Project site are a mixture of peat cutting in areas of active turbary and natural recolonisation of degraded bog. The primary surrounding land use within the Population Study Area comprises a mix of agriculture, peat cutting, and low-density residential. The total area of farmland within the 4 no. EDs around the Proposed Project measures approximately 5,544 hectares, comprising 55.5% of the Population Study Area, according to the CSO Census of Agriculture 2010. The average farm size in the Population Study Area is 27.8 hectares. There are 202 farms located within the EDs. The majority of farmed land is grassland, reflecting a landscape primarily used for grazing.

Table 5-5 Farm Size and Classification within the Population Study Area in 2020 (Source: CSO)

Electoral Division	No of holdings	Average size (ha)	Median age of holder	Livestock units	Area farmed (ha)	Total Cereals (ha)	All grassland (ha)
Ballycumber	38	32.4	58	2,250	1230.5	0	1198.5
Doon	66	27.9	56	2,562	1839.3	0	1805.6
Srah	39	24	62	1,039	937.9	0	926.9
Ferbane	47	27.5	57	1,637	1291.8	0	1248.2
Total	190	27.95 (average)	58.25 (average)	7,487	5299.5	0	5179.2
Size of 4 EDs				9985 hectares			
Total Area Farmed within 3 EDs				5299.5 hectares			
Farmland as % of EDs				53%			

Industrial scale peat extraction was permanently ceased by BnM at the Proposed Project site in June 2020. From June 2020 until the end of 2024, all remaining stockpiled peat was systematically removed from the Proposed Project site. BnM's statutory duties to discharge the conditions of its Integrated

[25] *Deloitte, Irish Wind Energy Association 2009 Jobs and Investment in Irish Wind Energy Powering Ireland's Economy. Available at:* https://windenergyireland.com/images/files/9660bd5e72bcac538f47d1b02cc6658c97d41f.pdf
[26] *IWEA, 2020. 70by30 Implementation Plan. Available at: https://windenergyireland.com/images/files/70by30-implementation-plan-reports.pdf*

Pollution Control Licence (IPC) Licence (Ref. P0500-01) from the Environmental Protection Agency for the Boora Bog Group, which encompasses the Proposed Project site, remain ongoing. These ongoing duties, such as environmental monitoring, do not facilitate the continuation of peat extraction, but rather ensure compliance with BnM's extant IPC Licence.

As part of the IPC licence rehabilitation requirements, BnM is required to produce peatland rehabilitation plans: please see Appendix 2-4 for the Draft Cutaway Bog Decommissioning and Rehabilitation Plan (Draft Rehabilitation Plan) for Lemanaghan Bog. These plans have considered the Proposed Project footprint and demonstrate that both peatland rehabilitation and renewable energy can coexist harmoniously onsite.

5.3.7.1 Equine Industry

2 no. stud farms or equestrian facilities was identified within 10 km of the Proposed Project site; Erryvale Stud, located in Clara, Co. Offaly, approximately 6.1 km northeast of the nearest proposed turbine (T15) and Belmont House Stud, approximately 9 km southwest of the nearest proposed turbine (T03).

There have been no known studies carried out in Ireland on the impacts of wind farms on the equine industry. In 2014 Marshall Day Acoustics published a document entitled *"Summary of research of noise effects on Animals"*[27]. The Marshall Day study specifically assessed the impacts of varying levels of noise on horses in three differing behavioural settings. The three behavioural settings studied included horses in stables, breeding mares and racing horses.

Horses in Stables

The study by Marshall Day Acoustics found that horses, stabled at the Flemington Racecourse in Australia at the same time as a music concert took place on the site, when exposed to $L_{Aeq,15min}$ of 54-70 dB, showed little response to the music noise unless the noise was particularly impulsive. The horses stabled at Flemington Racecourse were thoroughbreds, and stables were located 200 metres from the concert.

Breeding Mares

A study by Le Blanc et al. (1991) and summarised by Marshall Day studied the effects of simulated aircraft noise over 100 dB and visual stimuli on pregnant mares in the United States. Aircraft noise generates infrasound, which is also generated from wind turbine, cars and trains. The study focused on pregnancy success, behaviour, cardiac function, hormonal production, and rate of habitation. Noise levels of 100 dB are similar to that of the Vestas 150 turbine operating at 5m/s wind speed, as indicated in Chapter 12: Noise and Vibration. Le Blanc concluded the following:

> *" [the] birth success of pregnant mares was not affected by F-14 jet aircraft noise. While the 'fright-flight' reaction was initially observed, the mares did adapt to the noise."*

Racehorses

Marshall Day Acoustics concluded the following in relation to their study on the impacts of noise on racehorses:

[27] *Marshall Day Acoustics, 2014. Summary of Research of Noise Effects on Animals Available at: https://www.epa.govt.nz/assets/FileAPI/proposal/NSP000033/Hearings/3a009a795c/BoD-Volume-4-31-Siiri-Wilkening-10-March-2014-Summary-of-research-of-noise-effects-on-animals.pdf*

"Marshall Day Acoustics have observed horses grazing in paddocks directly under the main approach path of the Christchurch International Airport where noise levels are in excess of 90 dB (LAmax) during an aircraft flyover. Although these horses are arguably "used to" the noise, there was generally little recognition by them of an aircraft passing, let alone any sign of disturbance. This tends to support the conclusions by Le Blanc et al. (1991)."

5.3.7.1.2 Guidance

In the absence of national policy or guidance in relation of the development of wind farms near stud farms/equestrian centres, MKO has reviewed the British Horse Society's *'Advice on Wind Turbines and Equestrian Access'*. A copy of the guidance document is included in Appendix 5-3 of this EIAR.

The British Horse Society policy statement states the following in relating to the siting of wind turbines in the vicinity of equine businesses:

"The British Horse Society strongly recommends a minimum separation distance of blade ***tip height plus 10%*** *– 'fallover distance' or 'fallover' – between a commercial turbine, one of multiple on site, and any route used with horses and a separation distance of twice tip height for microgeneration units",*

This is an update from the previous guidance of *"a minimum separation distance of 200m or three times blade tip height (whichever is greater) will be required between a turbine and any route used by horses or a business with horses.'"*

5.3.7.1.3 Summary

On a precautionary basis, i.e., under the assumption that every inhabitable dwelling owns a horse or horses, the closest inhabitable dwelling, not including involved properties, is located approximately 896 metres (over four-times blade tip height) from the nearest proposed turbine location. As mentioned previously, the closest stud farm/equestrian facility is located approximately 9.0 km from the nearest Proposed Wind Farm turbine (T03). In this instance, the proposed turbines are at a distance beyond that of the British Horse Society's recommended minimum separation distance of blade tip height plus 10%. In this instance, the minimum separation distance from proposed turbines exceeds the 370 metres separation distance (based on two times the turbine blade tip height of up to 185 metres) between a turbine and any routes used by horses.

5.3.8 Services

The nearest village is Corbeg, located approximately 2.9 km northwest of the Proposed Project at its closest point (i.e., T01), in Co. Offaly. The village provides a range of services such as educational, recreational, spiritual and retail. Additional services such as large retail units, golfing, rugby clubs, industrial estates can be found in the larger towns of Ferbane, Ballycumber and Pollagh, which are all located within 4.5 km of the proposed turbines.

5.3.8.1 Education

The nearest school to the Proposed Project site is St Cailin's National School, Rashina, located approximately 2.2 km north of the nearest turbine (T01). The nearest Secondary School (Gallen Community School) is located c. 4 km southwest of the proposed T02 turbine, in the town of Ferbane. There are four National and Secondary schools located in the towns of Ferbane, Ballycumber and Pollagh, within 5 km of the Proposed Project site, namely:

- St. Ciarán's & St. Manchan's National School, Ballycumber located approximately 2.2 km northeast of T11;
- St. Mary's National School, Pollagh, located approximately 2.4 km south of T14;

- St. Cynoc's National School, Ferbane, located approximately 3.9 km southwest of T02;
- Gallen Community School (Post-Primary) located approximately 4.0 km southwest of T03.

5.3.8.2 Access and Public Transport

The Proposed Project site is accessed via R436 to the south and the N62 along the east boundary of the Proposed Project site. The R436 regional road adjoins the southeast and southwest of the site. Local roads, the R444, and the N62 provide access to the northern sections of the site. The nearest motorway is the M6, 6.6 km north of the Proposed Grid Connection.

A Local Link service (840/enhanced 840) travels from Banagher to Tullamore every 2-3 hours daily, passing through Ferbane, Boher, Pollagh, Ballycumber, and Clara. This route utilises the R436 road to immediately to the south of the southern Proposed Project site boundary. The 72 Bus Eireann service links Ferbane to Limerick City (Annacotty) via Birr and Nenagh. The 72 service utilises the N62 road along the east boundary of the Proposed Project site.

There is no train service connecting the region to other parts of the country with the nearest train station at Tullamore, c. 16.5 km southeast of the proposed T14 turbine. This train station services the Dublin-Westport/Ballina line and the Dublin-Galway line.

5.3.8.3 Amenities and Community Facilities

Most of the amenities and community facilities, including GAA and other sports clubs, youth clubs and recreational areas available in the area are in the nearby settlements of Ballycumber, Ferbane, Pollagh and Corbeg. Other amenities in the area include the Grand Canal, Lemanaghan Monastic Site, Clara Bog Nature Reserve, and Lough Boora Discovery Park. These amenities are also of relevant from a touristic perspective and are further detailed in Section 5.3.9.

The Offaly Way hiking trailhead is located near the southern boundary of the site in Lemanaghan village. The trail runs for 37 km south towards Cadamstown. Community Benefit proposals, which would enhance local amenities and community facilities with the development of publicly accessible walkways along the Proposed Wind Farm, linking up with existing walks are described in Chapter 4: Description of the Proposed Project.

Directly interacting with the site is the recreational shared cycle and walkway in West Offaly (PL Ref: 25/60014), granted as part as part of the Midlands Tail Network (MTN). If planning permission is granted for the Proposed Project, it will connect into the permitted Offaly West portion of the MTN, the Grand Canal Way and the Lough Boora Discovery Park.

5.3.9 Tourism

5.3.9.1 Tourism Numbers and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full-time and seasonal employment. The report "*Key Tourism Facts 2024*"[28], pertaining to domestic and international tourism volumes for Ireland, was published by Failte Ireland in August 2025 for the year 2024. In 2024, out-of-state (Overseas and Northern Ireland) tourist expenditure amounted to €6.6 billion. With a further €1.5 billion spent by overseas visitors on fares to Irish carriers, taking foreign

[28] *Fáilte Ireland (2025) Key Tourism Facts 2024 National Summary. Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/Research/Key%20Tourism%20Facts%20and%20Figures%202024/FI_Key-Tourism-Facts-2024_National-Summary_1.pdf?ext=.pdf*

exchange earnings to €8 billion. Domestic tourism expenditure amounted to €3.6 billion, making tourism a €12 billion industry. The Central Statistics Office's estimates the number of people employed in 'Tourism Industries' to be 226,300 in Q3 2024 through an alternative method of estimating employment using PAYE tax data. Note that self-employed and primarily pensioners are excluded from the headcount.

Key Tourism Facts 2024, published in 2025 does not provide the same level of detail in terms of tourist numbers and expenditure as previous years of the same report as a result of a change in the CSO's data collection methodology, however, it does note that

"Every €1m of tourist expenditure helps to support 20 employees in tourism industries."

The Republic of Ireland is divided into seven tourism regions. Table 5-6 shows the total revenue and breakdown of overseas tourist numbers to each region in Ireland during 2024 ('*Key Tourism Facts 2024*, Fáilte Ireland, August 2025).

Table 5-6 Overseas Tourists Revenue and Numbers 2014 (Source: Failte Ireland)

Region	Total Revenue (€m)	Total Number of Non-Domestic Tourists (000s)
Dublin	€2,383m	4,094
Mid-East/Midlands	**€536m**	**804**
South-East	€323m	530
South-West	€1,168m	1,442
Mid-West	€536m	827
West	€847m	1,226
Border	€376m	525
Total	**€6,169 m**	**9,448**

The Proposed Project is located within the Mid-East/Midland Region. According to "*Island of Ireland Overseas Tourism Performance Facts and Figures 2023*" (Tourism Ireland, 2023), the Mid-East/Midland Region which comprises Counties Offaly, Kildare, Laois, Longford, Louth, Meath, Westmeath and Wicklow, benefited from approximately 8.7% of the total number of overseas tourists to the country and approximately 9.0% of the associated tourism income generated in Ireland in 2023.

Table 5-7 presents the breakdown of overseas tourist numbers and revenue to the Midlands region during 2017 ('*2017 Topline Tourism Performance by Region,* Fáilte Ireland, August 2018)[29]. As can be seen below, County Offaly has the second highest number of overseas tourists visiting the Region during 2017 and tourism revenue at €46 million.

[29] *Failte Ireland (2018) 2017 Topline tourism performance by region. Available at:* https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/2_Regional_SurveysReports/2017-topline-regional-tourism-performance.pdf?ext=.pdf

Table 5-7 Overseas Tourism to West Region during 2017 (Source: Fáilte Ireland)

County	Revenue Generated by Overseas and Domestic Tourists (€m)	No. of Overseas Tourists (000s)
Laois	44	43
Longford	28	24
Offaly	46	52
Westmeath	64	103

5.3.9.2 Tourist Attractions

1. **The Midlands Trail Network**

As indicated in Section 5.3.8.3 above, the proposed recreational shared cycle and walkway in West Offaly (PL Ref: 25/60014) has been granted as part as part of the Midlands Tail Network (MTN), which directly interacts with the associated amenity pathways south of the Proposed Wind Farm. The Midlands Trail Network plans to deliver a network of connected walking and cycling trails across the midlands that aligns with the tourism priorities as set out by the Regenerative Tourism and Placemaking Scheme for Ireland's Midlands funded by the EU's Just Transition Fund. It is anticipated that the network will span 79 km through counties Westmeath, Offaly, Longford, Roscommon and Tipperary connected by the Grand Canal Greenway when complete.

2. **Banagher Line**

The Banagher Line is a walkway located within the site. It runs approximately parallel to R436 road approximately 230m south of the proposed T14 in the southeast of the site.

3. **The Offaly Way**

The Offaly Way, a 38 km linear walking route, starts at the foot of the Slieve Bloom Mountain range linking the Grand Canal Way with the Offaly Way via Cadamstown and ending in Lemanaghan at an Lemanaghan Monastic Site (St Manchan's Well). The route includes sections of riverbanks, woodlands and stretches of bogland.

4. **The Grand Canal**

The Grand Canal spans 143 km in length, includes 43 Locks and was built between 1756-1804. It functioned as a cargo barge until 1960 and was designated proposed Natural Heritage Area status in 1995. The Canal begins at the River Liffey in Dublin City and travels west for approximately 45 km where it bifurcates into a northern and southern route outside of Roberstown in Co. Kildare. The northern route connects to Tullamore and travels further west towards Pollagh approximately 3.5 km south of the proposed turbine T14. The northern route travels northwest near the northern boundary of the site between Edenderry and Allenwood continuing west to Lock 36 in Co. Offaly where it connects with the River Shannon Callows pNHA. Points of interest along this portion of the Grand Canal include several protected structures listed in the National Inventory of Architectural Heritage: Derry Bridge Henesy's Bridge, 30th Lock, Ballincloghan Bridge and St Mary's Catholic Church. Offaly County Council has designated the Grand Canal as a public Right of Way and Greenway and recognise its role as a valuable tourism asset. The Council encourages promotion of the Canal in relation to these activities and supports the linkage of future recreational routes to the Canal that are compatible with nature conservation and other environmental policies.

5. **Lemanaghan Monastic Site (includes St Manchan's Church and Cemetery, and St Mella's Cell)**

The Lemanaghan Monastic Site was founded by St Manchan in the 7th century. The Lemanaghan Monastic Site consists of a church, a holy well, toghers (wooden roads) and an oratory. The Lemanaghan Monastic Site also provides directions to Boher Church where St Manchan was buried. In the year 645, Diarmait, the King of Ireland gave the Lemanaghan Monastic Site to monks in Clonmacnoise after they prayed for his victory in battle. St Manchan, a respected scholar, left Clonmacnoise and travelled to the Lemanaghan Monastic Site where he founded a monastery at Tuaim nEirc, an island of dry land surrounded by bogs. St Manchan died in the yellow plague of 664. Since then, this area has been known as Lemanaghan, meaning the grey lands of Manchan. The Lemanaghan Monastic Site can be accessed at the end of the Offaly Way walking trail and is situated approximately 1.2 km from south of the proposed T14 turbine.

6. **Lough Boora Discovery Park**

BnM developed this facility in 1995 once commercial peat production ceased. This provided the locals and tourists with outdoor activities surrounding Boora Lake such as walking trails, bike hire, Mesolithic sites, fairy trail, sculpture park, angling, and bird watching. There is a range of habitats which promote biodiversity: Tunduff Beag Wetlands, Leabeg Wetlands, Turraun Wetland and a conservation area supervised by NPWS for grey partridge. This park is open all year round and the services accommodate to all ages. The Irish Wildlife Trust maintain this nature reserve alongside the NPWS. The park's visitor centre is located 8.1 km south of the proposed T03.

7. **Clara Bog Nature Reserve**

This nature reserve, located c. 4.2 km west of the proposed turbine T15, provides a 1 km boardwalk walking trail surrounding a raised bog and a visitor centre that offers talks, workshops and other educational activities. This nature reserve is protected under multiple designations, National Nature Reserve, a Special Area of Conservation, Ramsar Wetland Site, and a Natural Heritage Area. This walking loop is a local recreation and promotes tourism in the area.

Within the wider landscape there are a range of tourist attractions. These include archaeological sites and monuments, which are further detailed in Chapter 13: Cultural Heritage. Tourist attractions within the wider landscape include the following:

Within 10 km

- Lemanaghan Monastic Site, which is part of the Lemanaghan Monastic Complex (comprising the Monastic Site and the Lemanaghan Hermitage) is located approximately 1.3km south-east from the nearest proposed turbine (T05).
- Athlone Cricket Club is situated in Togher, Co. Offaly c. 3.2 km northwest of the Proposed Grid Connection. It was founded in 1975 and provides a venue for amateur sporting events;
- Ferbane Railway Bridge is a historical landmark located c. 3.5 km southwest of proposed turbine T03;
- Doon Motocross Racing Track is c. 3.5 km northwest of the Proposed Grid Connection. It provides a racing track for motocross bikes and also includes a shop with a range of motocross bikes, riding gear and accessories;
- Ferbane Bog Boardwalk is located c. 3.6 km west southwest of proposed turbine T03;
- Coole Castle is a historical landmark located c. 4 km southwest of proposed turbine T03;
- Gallen Priory/Gallen Cemetery is a historical landmark located c. 4 km southwest of proposed turbine T03;
- Moate Golf Club is an 18-hole golf course located approximately 8.4 km north of the Proposed Grid Connection;

- Dun na Si Amenity and Heritage Park is located 8.2 km north of the Proposed Grid Connection in the town of Moate, a visitor attraction offering a range of activities in tourism, culture, heritage and leisure;
- The Gathering of Stones Monument, a historical landmark, is located c. 8.8 km south southeast of proposed turbine T03;
- Rahan Monastic Site and Church Ruins, a historical landmark, is located c. 8.9 km southeast of proposed turbine T14;
- Belmont House Stud Ireland is a holiday destination on a working horse farm. This gives visitors the opportunity to gain horse handling skills. The house also provides training for riders, grooms and trainees to work with foals and young horses. It is situated c. 9 km southwest of the proposed turbine T03;
- Rahan Driving Range is a 15-bay facility located c. 8.8 km southeast of the proposed turbine T14. This facility caters for all levels and provides custom fittings from PGA professional Bernard Quigley for all major golfing brands.

Within 20 km

- Shannon Bridge Fortifications is located c. 18 km west or proposed turbine T01;
- Mount Temple Golf & Country Club, an 18-hole golf course located 10.9 km north of the Proposed Grid Connection;
- Esker Hills Golf Club, an 18-hole course, is located approximately 11.6 km east of the proposed turbine T14;
- Athlone Equestrian Centre is located c. 12.7 km northwest of the Proposed Grid Connection. This club features a range of facilities including a stable and grass livery and showjumping arena;
- Clonmacnoise is a monastery on the banks of the River Shannon c. 13.7 km northwest of the proposed turbine T01. St Ciarán founded the monastery in the 6th Century. The ruins include a Cathedral, two round towers, three high crosses, nine churches and over 700 Early Christian grave slabs.
- Durrow Church and High Cross (Durrow Abbey), a historical landmark, is located c. 14.4 km east of proposed turbine T15;
- Tullamore Golf Club, a championship parkland golf course, is located 16.2 km southeast of the proposed turbine T14;
- Kilbeggan Distillery Experience is located approximately 16.8 km northeast of the proposed turbine T15. This centre is a whiskey distillery, providing tours to the public;
- Tullamore D.E.W. Distillery Experience is located 16.9 km southeast of the proposed turbine T14. This Distillery Experience provides tours in the Old Bonded Warehouse.
- Shannonbridge Marina, a place of recreational activity, is located c. 17.5 km west of proposed turbine T01;
- Drum Monastic Site, a historical landmark, is located c. 18.2 km northwest of the Proposed Grid Connection;

5.3.9.3 Tourist Attitudes to Wind Farms

5.3.9.3.1 *Scottish Tourism Study 2021*

BiGGAR Economics undertook an independent study in 2021, entitled "*Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms*"[30] to understand the relationship, if any, that exists between the development of the onshore wind and sustainable tourism sectors in Scotland. In recent

[30] *BiGGAR Economics, 2021. Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms. Available at https://biggareconomics.co.uk/wp-content/uploads/2021/11/BiGGAR-Economics-Wind-Farms-and-Tourism-2021.pdf*

years, these sectors have grown significantly in Scotland. However, it could be argued that if there was any relationship between the growth of onshore wind energy and tourism, it would be at a more local level. This study therefore considered the evidence at a local authority level and in the immediate vicinity of constructed wind farms.

Since 2009, the onshore wind sector has expanded considerably in Scotland. Employment in tourism-related sectors in Scotland also grew by 20% during the years since 2009.Analysis of the rates of change in the number of onshore wind turbines and in tourism-related employment in local authority areas, found that there is no correlation between the two factors. This applies to whether the analysis covers the decade between 2009 – 2019, or the more recent 2015 – 2019 period.

The research also analysed trends in tourism employment within the immediate vicinity of wind farm developments. This included 16 no. wind farms with a capacity of at least 10MW that became operational between 2015 and 2019. Analysis of trends in tourism employment in the locality of these wind farms (study areas were based on a 15 km radius) found that 11 of these 16 areas had experienced more growth in tourism employment than for Scotland as a whole. For 12 of the 16 wind farms, trends in tourism employment in the locality had outperformed the local authority area in which they were based.

The research also re-examined 28 wind farms constructed between 2009 and 2015 that had been analysed in a previous study published in 2017, finding that the localities in which they were based had outperformed Scotland and their local authority areas in the majority of cases. Moreover, the analysis, found that in the seven areas which had underperformed their local authority areas in the 2017 study, four had done better than their local authorities in the 2015 to 2019 period.

This research analysed trends in tourism employment in the localities of 44 no. wind farms developed in recent years, providing a substantial evidence base.

Overall, the conclusion of this study is that published national statistics on employment in sustainable tourism demonstrate that there is no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level, nor in the areas immediately surrounding wind farm development. However, the report also concluded that:

> "*Although this study does not suggest that there is any direct relationship between tourism sector growth and wind farm development, it does show that wind farms do not cause a decrease in tourism employment either at a local or a national level.*"

5.3.9.3.2 Fáilte Ireland Surveys 2007 and 2012

In 2007, Fáilte Ireland in association with the Northern Ireland Tourist Board carried out a survey of domestic and overseas holidaymakers to Ireland in order to determine their attitudes to wind farms. The purpose of the survey was to assess whether the development of wind farms impacts on the enjoyment of the Irish scenery by holidaymakers. The survey involved face-to-face interviews with 1,300 tourists (25% domestic and 75% overseas). The results of the survey are presented in the Fáilte Ireland Newsletter 2008/No.3 entitled "*Visitor Attitudes on the Environment: Wind Farms*"[31].

The Fáilte Ireland survey results indicate that most visitors are broadly positive towards the idea of building wind farms in Ireland. There exists a sizeable minority (one in seven) however, who are negative towards wind farms in any context. In terms of awareness of wind farms, the findings of the survey include the following:

[31] *Fáilte Ireland, 2008. Visitor Attitudes on the Environment – Wind Farms. Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf*

- Almost half of those surveyed had seen at least one wind farm on their holiday to Ireland. Of these, two thirds had seen up to two wind farms during their holiday.
- Typically, wind farms are encountered in the landscape while driving or being driven (74%), while few have experienced a wind farm up close.
- Of the wind farms viewed, most contained less than ten turbines and 15% had less than five turbines.

Regarding the perceived impact of wind farms on sightseeing, the Fáilte Ireland report states:

> *"Despite the fact that almost half of the tourists interviewed had seen at least one wind farm on their holiday, most felt that their presence did not detract from the quality of their sightseeing, with the largest proportion (45%) saying that the presence of the wind farm had a positive impact on their enjoyment of sightseeing, with 15% claiming that they had a negative impact."*

In assessing the perceived impact of wind farms on beauty, visitors were asked to rate the beauty of five different landscape types: Coastal, Mountain, Farmland, Bogland and Urban Industrial, and then rate on a scale of 1-5 the potential impact of a wind farm being sited in each landscape. The survey found that each potential wind farm must be assessed on its own merits. However, in looking at wind farm developments in different landscape types, the numbers claiming a positive impact on the landscape due to wind farms were greater than those claiming a negative impact, in all cases.

Regarding the perceived impact of wind farms on future visits to the area, the Fáilte Ireland survey states:

> *"Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland. Of those who feel that a potentially greater number of wind farms would positively impact on their likelihood to visit, the key driver is their support for renewable energy and potential decreased carbon emissions."*

The report goes on to state that while there is a generally positive disposition among tourists towards wind development in Ireland, it is important also to take account of the views of the one in seven tourists who are negatively disposed towards wind farms. This requires good planning on the part of the wind farm developer as well as the Local Authority. Good planning has been an integral component of the Proposed Project throughout the site design and assessment processes. Reference has been made to the DoEHLG 2006 Guidelines and the Draft DoHPLG 2019 Guidelines, in addition to WEI (previously IWEA) best practice guidance, throughout all stages, including pre-planning consultation and scoping.

The 2007 survey findings are further upheld by a more recent report carried out by Fáilte Ireland on tourism attitudes to wind farms in 2012. The results of the updated study were published in the Fáilte Ireland Newsletter 2012/No.1 entitled *"Visitor Attitudes on the Environment: Wind Farms – Update on 2007 Research"*[32]. The updated survey found that of 1,000 domestic and foreign tourists who holidayed in Ireland during 2012, over half of tourists said that they had seen a wind turbine while travelling around the country. Of this number of tourists, 21% claimed wind turbines had a negative impact on the landscape. However, 32% said that it enhanced the surrounding landscape, while 47% said that it made no difference to the landscape. Almost three quarters of respondents claim that potentially greater numbers of wind farms would either have no impact on their likelihood to visit or have a strong or fairly strong positive impact on future visits to the island of Ireland.

Further details regarding the general public perception of wind energy, including those living in the vicinity of a wind farm, are presented in Section 5.3.10 below.

[32] *Fáilte Ireland, 2012. Visitor Attitudes on the Environment – Wind Farms. Available at:* https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf

5.3.10 Public Perception of Wind Energy

5.3.10.1 Sustainable Energy Authority of Ireland Surveys on Opinions Towards Wind Farms

5.3.10.1.1 *Irish National Survey of Households Near New Commercial Wind and Solar Farms*

Background

In May 2023 the SEAI published a report on the national survey they commissioned on public opinions of new commercial solar or wind farm projects in Ireland[33]. In 2022, surveyors conducted in-person interviews on the doorstep across rural Ireland. The survey included 1,764 households which included 1,116 households within 5 km of a new commercial wind or solar developments, of which 219 were within 1 km of a proposed development.

Findings

The results of this survey revealed that 67% of respondents hold positive or very positive views towards wind energy, while 73% of respondents who live less than 1 km away from a Renewable Electricity Support Scheme (RESS) wind project hold positive or very positive attitudes towards wind energy, while 70% of those in the control group hold such views.

The attitude of the residents toward wind energy showed that 59% of all respondents, and 65% of respondents living less than 1 km away from a RESS wind project, felt Ireland has too few wind farms, the same proportion as the control group. A few respondents feel Ireland has too many wind farms, regardless of how close they live to a new wind farm.

The results of this survey will form part of a long-term study to understand the effects of government policies under the RESS on the public support for Ireland's energy transition.

5.3.10.1.2 *Sustainable Energy Authority of Ireland Survey 2003*

Background

The first wind farm in Ireland was completed in 1992 at Bellacorrick, Co. Mayo. By mid-2007 there were 67 wind farms and in 2025 there are almost 400 wind farms on the island of Ireland. Since 1992 wind farms have elicited a range of reactions from the Irish people[34]. In response, the SEAI (formerly SEI) commissioned a survey aimed at identifying public attitudes to renewable energy and to wind energy in Ireland[35]. The results of which were published in 2003 and updated in 2017 as a national survey entitled "*Attitudes Towards the Development of Wind Farms in Ireland*". A catchment area survey was also carried out by to focus specifically on people living with a wind farm in their locality or in areas where wind farms are planned. A more recent survey was published in 2023, entitled *"Irish national survey of households near new commercial wind and solar farms*".

[33] *SEAI, 2023. Irish national survey of households near new commercial wind and solar farms. Available at: https://www.seai.ie/sites/default/files/publications/SEAI-RESS-National-Survey.pdf*
[34] *Fáilte Ireland (2008) Visitor Attitudes on the Environment – Wind Farms. Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf*
[35] *Ibid.*

2003 Findings

The 2003 SEAI survey found that the overall attitude to wind farms is very positive, with 84% of respondents rating it positively or very positively, 1% rates wind farms negatively and 14% had no opinion either way. Approximately two thirds of respondents (67%) were found to be positively disposed to having a wind farm in their locality. Where negative attitudes were voiced towards wind farms, the visual impact of the turbines on the landscape was the strongest influence. The report also notes however that the findings obtained within wind farm catchment areas showed that impact on the landscape is not a major concern for those living near an existing wind farm.

With regard to the economic and environmental impacts of wind farm development, the national survey reveals that attitudes towards wind energy are influenced by a perception that wind is an attractive source of energy:

> *"Over 8 in 10 recognise wind as a non-polluting source of energy, while a similar number believe it can make a significant contribution to Ireland's energy requirements."*

The study reveals uncertainty among respondents with regards to the issues of noise levels, local benefits and the reliability or otherwise of wind power as an energy source. It goes on to state however that the finding that people who have seen wind farms rate these economic and environmental factors more favourably is a further indication that experience of such projects tends to translate into positive attitudes towards wind energy.

Similar to the national survey, the surveys of those living within the vicinity of a wind farm also found that the findings are generally positive towards wind farms. Perceptions of the impact of the development on the locality were generally positive, with some three-quarters of interviewees believing it had impacted positively.

In areas where a wind farm development had been granted planning permission but was not yet under construction, three quarters of the interviewees expressed themselves in favour of the wind farm being built in their area. Four per cent were against the development. The reasons cited by those who expressed themselves in favour of the wind farm included the fact that wind energy is clean (78%), it would provide local jobs (44%), it would help develop the area (32%) and that it would add to the landscape (13%). Those with direct experience of a wind farm in the locality are generally impressed with it as an additional feature in the landscape. The report states:

> *"It is particularly encouraging that those with experience of wind turbines are most favourable to their development and that wind farms are not solely seen as good in theory but are also seen as beneficial when they are actually built."*

Few of those living in proximity either to an existing wind farm or one for which permission has been granted believe that the development damages the locality, either in terms of damage to tourism potential or to wildlife. The survey found that there is a clear preference for larger turbines in smaller numbers over smaller turbines in larger numbers.

Survey Update 2017

Additionally, a survey carried out by Interactions in October 2017[36], published by the SEAI, showed that 47% of Irish adults polled were strongly in favour of wind power in Ireland while a further 38% favour it. Overall, this is a 4% increase in favourable attitudes towards wind power compared with similar research in 2013.

[36] *Interactions Research, 2017. Segmentation of the Energy Consumer Market in Ireland. Available at: https://interactions.ie/wp-content/uploads/2020/06/20190212-Full-Report.pdf*

The SEAI survey found that the overall attitude to wind farms is very positive, with 84% of respondents in favour of wind energy in Ireland. Approximately two thirds of respondents (70%) would prefer to power their home with renewable energy over fossil fuels, and 45% would be in favour of a wind farm development in their area.

The survey also captured the perceived benefits of wind power among the public. Of those surveyed, three quarters (75%) selected good for the environment and reduced Carbon Dioxide (CO_2) emissions while fewer people, just over two in three, cited cheaper electricity.

Conclusions

The main findings of the SEAI survey indicate that the overall attitude to wind farms is "almost entirely positive". The study highlights that two-thirds of Irish adults are either very favourable or fairly favourable to having a wind farm built in their locality, with little evidence of a "Not in My Back Yard" (NIMBY) effect. The final section of the report states:

> *"The overwhelming indication from this study is that wind energy enjoys great support and, more specifically, that the development of wind farms is supported and welcomed. The single most powerful indicator of this is to be found among those living in proximity to an existing wind farm: over 60% would be in favour of a second wind farm or an extension of the existing one. This represents a strong vote in favour of wind farm developments – especially important since it is voiced by those who know from direct experience about the impact of such developments on their communities."*

5.3.10.2 Wind Energy Attitudes Monitor 2024

5.3.10.2.1 *Background*

In late 2024, Wind Energy Ireland (WEI) published the results of their most recent nationwide annual poll on attitudes to wind energy, the Public Attitudes Monitor[37]. The objective of the poll was to "*measure and track public perceptions and attitudes around wind energy across ROI*".

5.3.10.2.2 *Findings*

Between 17th November and 1st December 2024, a nationally representative sample of 1,070 Irish adults together with a booster sample of 210 rural residents participated in the survey. The 2024 results reported that 4 in 5 (80%) are now in favour of wind power (55% of those in favour were 'strongly in favour'). Amongst rural residents, 80% were recorded as having favourable attitudes towards wind power. The survey has been run annually since 2017 and while there has been a marginal decrease in those in favour of wind power nationally during this time (from 85% to 80%) there has been a minor increase in those in favour from the rural population (from 79% to 80%).

Amongst those in favour of wind power, the majority cited that the reduction in electricity prices as their primary perceived benefit of wind energy. Other reasons cited for supporting wind energy developments include: 'reduces CO_2 emissions", "good for the environment", "supports energy independence", "creates employment", and "good for local communities".

When questioned about wind energy developments in their local area, 62% of the nationally representative sample either 'favour' or 'tend to favour', an increase from 54% in 2020.

[37] *Wind Energy Attitudes Monitor, 2024. Wind Energy Attitudes Monitor. Available at: https://windenergyireland.com/images/files/wind-energy-ireland-2024-report-key-slides-website.pdf*

The Wind Energy Ireland 2024 survey follows the structure of previous national opinion polls on wind energy undertaken in 2017, 2019, 2019 and 2022. The 2024 survey results are consistent with previous year's figures and thus indicate that approximately 4 out of 5 Irish adults have continued to support wind energy in recent years.

5.3.10.3 Public Perceptions of Wind Power in Scotland and Ireland Survey 2005

5.3.10.3.1 *Background*

A survey of the public perception of wind power in Scotland and Ireland was carried out in 2003/2004 by researchers at the School of Geography & Geosciences, University of St. Andrews, Fife and The Macaulay Institute, Aberdeen ("*Green on Green: Public Perceptions of Wind Power in Scotland and Ireland*"[38]). The aims of the study were to ascertain the extent to which people support or oppose wind power, to investigate the reasons for these attitudes and to establish how public attitudes relate to factors such as personal experience of operational wind farms and their proximity to them.

5.3.10.3.2 *Study Area*

Surveys were carried out at two localities in the Scottish Borders region, one surrounding an existing wind farm and one around a site at which a wind farm had received planning permission but had not yet been built. Surveys were also carried out in Ireland, at two sites in Counties Cork and Kerry, each of which has two wind farms in proximity.

5.3.10.3.3 *Findings*

The survey of public attitudes at both the Scottish and Irish study sites concluded that large majorities of people are strongly in favour of their local wind farm, their personal experience having engendered positive attitudes. Attitudes towards the concept of wind energy were described as "overwhelmingly positive" at both study sites in Scotland, while the Irish survey results showed almost full support for renewable energy and 92% support for the development of wind energy in Ireland.

The results of the survey were found to agree with the findings of previous research, which show that positive attitudes to wind power increase through time and with proximity to wind farms. With regards to the NIMBY effect, the report states that where NIMBY-ism does occur, it is much more pronounced in relation to proposed wind farms than actual wind farms. The Scottish survey found that while positive attitudes towards wind power were observed among those living in proximity to both the proposed and existing wind farm sites, people around the proposed site were less convinced than those living in proximity to the existing site. Retrospective questioning regarding pre- and post-construction attitudes at the existing site found that attitudes remained unchanged for 65% of respondents. Of the 24% of people who altered their attitudes following experience of the wind farm, all but one became more positive. The report states:

> *"These results support earlier work which has found that opposition to wind farms arises in part from exaggerated perceptions of likely impact, and that the experience of living near a wind farm frequently dispels these fears. Prior to construction, locals typically expect the landscape impacts to be negative, whereas, once in operation, many people regard them as an attractive addition."*

The reasons that people gave for their positive attitude to the local wind farm were predominantly of a global kind, i.e., environmental protection and the promotion of renewable energy, together with

[38] *Warren, C.R, Lumsden, C., O'Dowd, S., Birnie, R. V., 2004. Green on Green: Public Perceptions of Wind Power in Scotland and Ireland. Journal of Environmental Planning and Management 48(6): 853-875.*

opposition to a reliance on fossil fuels and nuclear power. Problems that are often cited as negative impacts of wind farms, such as interference with telecommunications and shadow flicker were not mentioned at either site. With regards to those who changed to a more positive attitude following construction of the wind farm, the reasons given were that the wind farm is *"not unattractive (62%), that there was no noise (15%), that community funding had been forthcoming (15%) and that it could be a tourist attraction (8%)".*

The findings of the Irish survey reinforce those obtained at the Scottish sites with regards to the increase in positive attitudes to wind power through time and proximity to wind farms. The survey of public attitudes at the sites in Cork and Kerry found that the highest levels of support for wind power were recorded in the innermost study zone (0 – 5 kilometres from a point in between the pair of wind farms). The data also suggests that *"those who see the wind farms most often are most accepting of the visual impact".* The report also states that a previous Irish survey found that most of those with direct experience of wind farms do not consider that they have had any adverse impact on the scenic beauty of the area, or on wildlife, tourism or property values. Overall, the study data reveals *"a clear pattern of public attitudes becoming significantly more positive following personal experience of operational wind farms".*

With regards to wind farm size, the report notes that it is evident from this and previous research that wind farms with small numbers of large turbines are generally preferred to those with large numbers of smaller turbines.

5.4 Baseline Health

5.4.1 Receiving Environment

As set out in the 2017 Department of Housing, Planning, Community and Local Government "*Key Issues Consultation Paper on the Transposition of 2014 EIA Directive (2014/52/EU) in the Land Use Planning and EPA Licensing Systems*"[39] and the guidance listed in Chapter 1: Introduction, the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters.

The 2022 Census of Ireland as carried out by the Central Statistics Office provides the general health conditions of the population of the EDs which make up the Population Study Area for the Proposed Project. The vast majority of those within the Population Study Area marked their general health as being 'very good' across all EDs. It is not anticipated that the general health of the population of the Population Study Area be altered due to the Proposed Project. Table 5-8 below details the general health of persons by percentage for the State, County Offaly, and the Population Study Area for both the 2016 and 2022 census, which have data publicly available. In general, the percentage health breakdown for the State, Counties and study area populations are very similar. The Population Study Area, State and County all reported in the range of 80% for a combined 'very good' and 'good' health. The majority of electoral divisions in the study area reported a lower percentage than the State and Counties for those who have a 'bad' and 'very bad' health. Therefore, it can be concluded that those living in the Population Study Area consider their health to be in a better condition that the State and County average.

[39] *Department of Housing, Planning, Community and Local Government. Transposition of 2014 EIA Directive (2014/52/EU) in the Land Use Planning and EPA Licensing Systems. Key Issues Consultation Paper. Available at: https://www.publichealth.ie/sites/default/files/resources/IPH%20response%20to%20the%20key%20issues%20consultation%20paper%20on%20Transposition%20of%20EIA%20Directive%20201452EU.pdf*

Table 5-8 Percentage General Health Breakdown for the State, County Offaly and the Population Study Area as reported in the 2016 and 2022 Census. (Source www.CSO.ie)

		Very Good		Good		Fair		Bad		Very Bad		Not Stated	
		2016	2022	2016	2022	2016	2022	2016	2022	2016	2022	2016	2022
State		59.4%	53.2%	27.6%	29.7%	8.0%	8.6%	1.3%	1.4%	0.3%	0.3%	3.3%	6.7%
Offaly		57.3%	51.7%	29.2%	31.2%	9.0%	9.4%	1.5%	1.7%	0.3%	0.4%	2.8%	5.6%
Population Study Area	Doon	61.7%	54.0%	26.9%	34.4%	8.6%	8.8%	1.1%	0.7%	0.0%	0.4%	2.7%	1.6%
	Ferbane	52.7%	48.6%	35.1%	36.5%	9.6%	9.4%	1.2%	2.1%	0.1%	0.2%	2.6%	3.3%
	Srah	47.4%	49.2%	33.2%	32.0%	14.9%	12.2%	2.3%	2.2%	0.7%	0.4%	2.8%	3.8%
	Ballycumber	55.1%	55.1%	25.2%	27.9%	8.6%	12.4%	1.8%	1.1%	0.3%	0.3%	6.9%	3.2%
	Overall	54.6%	51.1%	31.1%	33.3%	0.4%	10.6%	1.6%	1.7%	0.3%	0.3%	2%	3.1%

5.4.2 Health Effects of Wind Farms: Studies

While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research has generally not supported these statements. There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised below.

1. ***"Wind Turbine Sound and Health Effects – An Expert Panel Review"*** *– American Wind Energy Association and Canadian Wind Energy Association, December 2009*[40]

In 2009, an Expert Panel on behalf of the American Wind Energy Association undertook extensive review, analysis and discussion of the large body of peer-reviewed literature on sound and health effects in general, and on sound produced by wind turbines in particular. The panel assessed the plausible biological effects of exposure to wind turbine sound. Following review, analysis, and discussion of current knowledge, the panel reached consensus on the following conclusions:

- *"There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.*
- *The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.*
- *The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences."*

The report found, amongst other things, that:

- *"Wind Turbine Syndrome" symptoms are the same as those seen in the general population due to stresses of daily life. They include headaches, insomnia, anxiety, dizziness, etc.*

[40] *American Wind Energy Association and Canadian Wind Energy Association, 2009. Wind Turbine Sound and Health Effects – An Expert Panel Review. Available at:* https://www.novoco.com/public-media/documents/awea_soundwhitepaper_121109_0.pdf

- *Low frequency and very low frequency 'infrasound' produced by wind turbines are the same as those produced by vehicular traffic and home appliances, even by the beating of people's hearts. Such 'infrasounds' are not special and convey no risk factors;*
- *The power of suggestion, as conveyed by news media coverage of perceived 'wind-turbine sickness', might have triggered 'anticipatory fear' in those close to turbine installations."*

2. ***'Wind Turbine Syndrome – An independent review of the state of knowledge about the alleged health condition'*** *– Expert Panel on behalf of Renewable UK, July 2010*[41]

This report consists of three reviews carried out by independent experts to update and understand the available knowledge of the science relating to infrasound generated by wind turbines. This report was prepared as a critical response to a book entitled "*Wind Turbine Syndrome"*, in 2009 by Dr. Pierpont, which received significant media attention at the time. The report discusses the methodology and assessment carried out in the 2009 publication and assessed the impact of low-frequency noise from wind turbines on humans. The independent review found that:

- *"The scientific and epidemiological methodology and conclusions drawn (in the 2009 book) are fundamentally flawed;*
- *The scientific and audiological assumptions presented by Dr. Pierpont relating infrasound to Wind Turbine Syndrome (WTS) are wrong; and*
- *Noise from Wind Turbines cannot contribute to the symptoms reported by Dr Pierpoint's respondents by the mechanisms proposed."*

Accordingly, the consistent and scientifically robust conclusion remains that there is no evidence to demonstrate any significant health effects in humans arising from noise at the levels of that generated by wind turbines.

3. ***'Wind Turbines and Health: A Rapid Review of the Evidence'*** *– Australian Government National Health and Medical Research Council (NHMRC), July 2010*[42]

The purpose of this paper was to review evidence from current literature on the issue of wind turbines and potential impacts on human health and to validate the finding of the "*Wind Turbine Sound and Health Effects - An Expert Panel Review*" (see Line Item 2 above) that:

- "*There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines.*
- *There is currently no published scientific evidence to positively link wind turbines with adverse health effects.*
- *This review of the available evidence, including journal articles, surveys, literature reviews and government reports, supports the statement that: There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines."*

4. ***'Position Statement on Health and Wind Turbines'*** *– Climate and Health Alliance, February 2012*[43]

[41] *Renewable UK, 2010. Wind Turbine Syndrome - An independent review of the state of knowledge about the alleged health condition. London, UK.*
[42] *Australian Government National Health and Medical Research Council, 2014. Wind Turbines and Health, A Critical Review of the Scientific Literature. Journal of Occupational and Environmental Medicine, 56(11): e108-30.*
[43] *Climate and Health Alliance, 2012. Position Statement on Health and Wind Turbines Available at:* https://www.agl.com.au/content/dam/digital/agl/documents/about-agl/how-we-source-energy/coopers-gap-wind-farm/caha-position-statement-health-wind-turbines.pdf?srsltid=AfmBOordoV3YNsLhog4rlqxpd3PXiW7BAcAuGwPV1R6-UBnwgY8SQSLR

The Climate and Health Alliance (CAHA) was established in August 2010 and is a coalition of health care stakeholders who wish to see the threat to human health from climate change and ecological degradation addressed through prompt policy action. In its Position Statement in February 2012, CAHA states that:

> *"To date, there is no credible peer reviewed scientific evidence that demonstrates a direct causal link between wind turbines and adverse health impacts in people living in proximity to them. There is no evidence for any adverse health effects from wind turbine shadow flicker or electromagnetic frequency. There is no evidence in the peer reviewed published scientific literature that suggests that there are any adverse health effects from infrasound (a component of low frequency sound) at the low levels that may be emitted by wind turbines."*

The Position Statement explores human perceptions of wind energy and notes that some people may be predisposed to some form of negative perception that itself may cause annoyance. It states that:

> *"Fear and anxious anticipation of potential negative impacts of wind farms can also contribute to stress responses, and result in physical and psychological stress symptoms... Local concerns about wind farms can be related to perceived threats from changes to their place and can be considered a form of "place-protection action", recognised in psychological research about the importance of place and people's sense of identity."*

CAHA notes the existence of *"misinformation about wind power"* and, in particular, states that:

> *"Some of the anxiety and concern in the community stems originally from a self-published book by an anti-wind farm activist in the United States which invented a syndrome, the so-called "wind turbine syndrome". This is not a recognised medical syndrome in any international index of disease, nor has this publication been subjected to peer review."*

CAHA notes that:

> *"Large scale commercial wind farms however have been in operation internationally for many decades, often in close proximity to thousands of people, and there has been no evidence of any significant rise in disease rates."*

This, it states, contrasts with the health impacts of fossil fuel energy generation.

5. ***'Wind Turbine Health Impact Study – Report of Independent Expert Panel'*** *– Massachusetts Departments of Environmental Protection and Public Health, January 2012*[44]

An expert panel was established with the objective to, inter alia, evaluate information from peer-reviewed scientific studies, other reports, popular media and public comments and to assess the magnitude and frequency of any potential impacts and risks to human health associated with the design and operation of wind energy turbines. In its final report, the expert panel set out its conclusions under several headings, including noise and shadow flicker.

In relation to noise, the panel concluded that there was limited or no evidence to indicate any causal link between noise from wind turbines and health effects, including the following conclusions:

> *"There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a 'Wind Turbine Syndrome'.*

[44] *Massachusetts Departments of Environmental Protection and Public Health, 2012. Wind Turbine Health Impact Study -Report of Independent Expert Panel. USA. Available at:* https://www.mass.gov/doc/wind-turbine-health-impact-study-report-of-independent-expert-panel/download

The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems. There were two smaller, weaker, studies: one did note an association, one did not. Therefore, we conclude the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems.

None of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."

In relation to shadow flicker, the expert panel found the following:

"Scientific evidence suggests that shadow flicker does not pose a risk for eliciting seizures as a result of photic stimulation.

There is limited scientific evidence of an association between annoyance from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects."

6. ***"Wind Turbines and Health, A Critical Review of the Scientific Literature"*** *– Massachusetts Institute of Technology (Journal of Occupational and Environmental Medicine Vol. 56, Number 11, November 2014)* [45]

This review assessed the peer-reviewed literature regarding evaluations of potential health effects among people living in the vicinity of wind turbines. The review posed a number of questions around the effect of turbines on human health, with the aim of determining if stress, annoyance or sleep disturbance occur as a result of living in proximity to wind turbines, and whether specific aspects of wind turbine noise have unique potential health effects. The review concluded the following with regard to the above questions:

- Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines. The levels of infrasound at customary distances to homes are typically well below audibility thresholds.
- No cohort or case–control studies were located in this updated review of the peer-reviewed literature. Nevertheless, among the cross-sectional studies of better quality, no clear or consistent association is seen between wind turbine noise and any reported disease or other indicator of harm to human health.
- Components of wind turbine sound, including infrasound and low frequency sound, have not been shown to present unique health risks to people living near wind turbines.
- Annoyance associated with living near wind turbines is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison with other factors in leading people to report annoyance in the context of wind turbines.

7. ***'Environmental Noise Guidelines for the European Region'*** *– World Health Organisation, Regional Office for Europe January 2019*[46]

The WHO Environmental Noise Guidelines provide recommendations for protecting human health from exposure to environmental noise originating from various sources such as transportation noise,

[45] *McCunney, R., Mundt, K.A., Colby, W. D., Dobie, Kaliski, K., Blais, M., 2014. Wind Turbines and Health, A Critical Review of the Scientific Literature. Journal of Occupational and Environmental Medicine, 56(11): e108-30.*
[46] *The World Health Organisation (WHO), 2018. Environmental Noise Guidelines for the European Region. Available at: https://www.who.int/europe/publications/i/item/9789289053563*

wind turbine noise and leisure noise. The Guideline Development Group (GDG) defined priority health outcomes and from this were able to produce guideline exposure levels for noise exposure.

For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden. The GDG recognise the potential for increased risk of annoyance at levels below this value but cannot determine whether this increased risk can impact health. Wind turbine noise above this level is associated with adverse health effects.

The GDG points out that evidence on health effects from wind turbine noise (apart from annoyance) is either absent or rated low/very low quality and effects related to attitudes towards wind turbines are hard to differentiate from those related to noise and may be partly responsible for the associations. The GDG also recognises that the percentage of people exposed to noise from wind turbines is far lower than other sources such as road traffic and state that any benefit from specifically reducing population exposure to wind turbine noise in all situations remains unclear.

That being said, the GDG conditionally[47] recommends renewable energy policies include provisions to ensure noise levels from wind farm developments do not rise above the guideline values for average noise exposure. The GDG also provides a conditional recommendation for the implementation of suitable measures to reduce noise exposure.

As outlined in Section 12.3.2.4.5 of Chapter 12: Noise and Vibration, it is considered that the conditional WHO recommended average noise exposure level, if applied as target noise criteria for an existing or proposed wind turbine development in Ireland, should be done with caution. The conditional WHO recommendation for average noise exposure level may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.

8. ***'Infrasound Does Not Explain Symptoms Related to Wind Turbines'*** *– Finnish Government's Analysis, Assessment and Research Activities (VN TEAS), June 2020*[48]

The study targeted to adverse health effects of wind turbine infrasound and was funded by the Finnish Government's Analysis, Assessment and Research Activities (VN TEAS).

It found that the low-frequency, inaudible sounds made by wind turbines are not damaging to human health despite fears that they cause unpleasant symptoms. The project, which was carried out over two years, examined the impact of low-frequency, or infrasound, emissions which cannot be picked up by the human ear.

People in many countries have blamed the infrasound waves for symptoms ranging from headaches and nausea to tinnitus and cardiovascular problems, researchers said.

Interviews, sound recordings and laboratory tests were used to explore possible health effects on people living within 20 kilometres of the generators.

The report notes:

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[47] *The GPG makes recommendations which are rated as having either strong or conditional recommendation in favour of an intervention. The GPG define a strong recommendation as one that "*can be adopted as policy in most situations*". A conditional recommendation represents a scenario where there "*is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply*" Further, a conditional recommendation "*requires a policy-making process with substantial debate and involvement of various stakeholders*".*

[48] *Publications of the Government's analysis, assessment and research activities, 2020. Infrasound Does Not Explain Symptoms Related to Wind Turbines. Available at:* https://www.researchgate.net/publication/342434513_Infrasound_Does_Not_Explain_Symptoms_Related_to_Wind_Turbines

"the behavioral findings of the current study suggest that wind turbine infrasound cannot be reliably perceived, and it does not result in increased annoyance. Participants that showed health effects did not show signs of increased infrasound sensitivity and did not rate wind turbine sounds more annoying."

As a result:

"These findings do not support the hypothesis that infrasound is the element in turbine sound that causes annoyance. Instead, they suggest that people who have health symptoms which they associate with wind turbine sound are not likely to have these symptoms because they perceive turbine sound more annoying than controls, at least in laboratory settings. It is more likely that these symptoms are triggered by other factors such as symptom expectancy".

9. ***'The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive Health Adults'*** *– Woolcock Institute for Medical Research et al. (Environmental Health Perspectives, Vol. 131, Number 3, March 2023)*[49]

The purpose of this study was to examine the potential health effects of audible sound and inaudible infrasound has on noise sensitive adults over a period of 72 hours. Sufferers of Wind Turbine Syndrome (WTS) have attributed their ill-health and particularly their sleep disturbance to the signature of infrasound. On this basis, the objectives of the study were to test the effects of 72 hours of infrasound exposure on human physiology, particularly sleep. The results of the study are outlined below:

- All staff and participants were asked whether they were able to differentiate in any way between infrasound and sham infrasound (the control), and none were able to.
- The study found that 72 hours of the simulated wind turbine infrasound (~90dB pk re 20 µPa) in controlled laboratory conditions did not worsen any measure of sleep quality compared with the same speakers being present but not generating infrasound (sham infrasound).
- The study found no evidence of that 72 hours of exposure to a sound level of ~90dB pk re 20 µPa of simulated wind turbine infrasound in double-blind conditions perturbed any physiological or psychological variable.
- None of the participants in the study who were exposed to infrasound developed what could be described as WTS.
- This study suggests that the infrasound component of WTS is unlikely to be a cause of any ill-health or sleep disruption, although this observation should be independently replicated.

5.4.2.1 Other Studies

A further 25 reviews of the scientific evidence that universally conclude that exposure to wind farms and the sound emanating from wind farms does not trigger adverse health effects, were compiled in September 2015[50] by Professor Simon Chapman, of the School of Public Health and Sydney University Medical School, Australia, and is included as Appendix 5-1 of this EIAR. Another recent publication by Chapman and Crichton (2017) entitled "*Wind turbine syndrome; A communicated disease*"[51] critically discusses why certain health effects might often be incorrectly attributed to wind turbines.

[49] *Marshall N.S., Cho G., Toelle B.G., Tonin R., Bartlett D.J., D'Rozario A.L., Evans C.A., Cowie C.T., Janev O., Whitfeld C.R., Glozier N., Walker B.E., Killick R., Welgampola M.S., Phillips C.L., Marks G.B., Grunstein R.R., 2023. The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive Health Adults. Environmental Health Perspectives, 131(3):37012.*
[50] *Chapman, S., Simonetti, T, 2015. Summary of main conclusions reached in 25 reviews of the research literature on wind farms and health. Sydney University Medical School. Available at: https://ses.library.usyd.edu.au/bitstream/handle/2123/10559/WindHealthReviews_3.pdf*
[51] *Chapman, S., Crichton, F., 2020. Wind turbine syndrome; A communicated disease. Sydney University Press.*

5.4.3 Turbine Safety

Wind turbines pose no threat to the health and safety of the general public. The DoEHLG 2006 Guidelines and Draft DoHPLG 2019 Guidelines iterate that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations and should be kept to a minimum. People or animals can safely walk up to the base of the turbines.

The DoEHLG 2006 Guidelines and Draft DoHPLG 2019 Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. Modern turbine blades are composite structures with no bolts or separate components and the danger is therefore minimised. Furthermore, the proposed wind turbines will be fitted with anti-vibration sensors which will detect any imbalance caused by icing of the blades. These sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation. As such, turbines are designed in such a way that ice throw/projection is not a significant risk. Furthermore, the site (and the State) falls within the International Energy Agency (IEA) Ice Class 1 Category, which correlates to a *Low* icing frequency.

The International Electrotechnical Commission (IEC) is a global organization that develops and publishes international standards for electrical and electronic technologies. One of the areas where the IEC has played a significant role is in the standardization of wind turbines. The IEC has developed a series of standards specifically for wind turbines, which cover various aspects such as design, testing, and performance. The IEC 61400-1 "*Wind turbines – Part 1: Design requirements*"[52] provides guidelines and requirements for the design of wind turbines, including considerations for environmental conditions. This standard covers a range of conditions that wind turbines may encounter, including those related to icing. It sets out criteria for the structural design, safety systems, and other aspects to ensure that wind turbines can operate safely and effectively in various environments. As such, the Proposed Project, and like those across Ireland and in many other countries, is generally designed and assessed according to international standards, with the IEC standards being frequently employed in this process. Additionally, regulatory entities and energy authorities at the national level, such as the SEAI, often refer to and align their guidance with internationally recognized standards, including those established by the IEC, such as IEC 61400-1 for wind turbines. In conclusion, the Proposed Project adheres to the criteria specified in both the IEC 61400-1 design requirements and the SEAI guidance.

Turbine blades are manufactured of fiberglass and wood which will prevent any likelihood of an increase in lightning strikes within the site or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbine. The conduction cables will be earthed adjacent to the turbine base. The earthing system will be installed during the construction of the turbine foundations.

5.4.4 Electromagnetic Interference

The provision of underground electric cables and Overhead Lines of the capacity proposed is common practice throughout the country and installation to the required specification does not give rise to any specific health concerns.

The extremely low frequency (ELF) electric and magnetic fields (EMF) associated with the operation of the proposed cables fully comply with the international guidelines for ELF-EMF set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a formal advisory agency to the World Health Organisation, as well as the EU guidelines for human exposure to EMF. Accordingly, there will be no operational impact on properties (residential or other uses) as the ICNIRP guidelines will not be exceeded at any distances even directly above the cables.

[52] *International Electrotechnical Commission. IEC 61400-1: Wind turbines – Part 1: Design requirements. Geneva.*

The ESB document "EMF & You" (ESB, 2017)[53] provides further practical information on EMF.

Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in Section 15.2 of Chapter 15: Material Assets.

5.4.5 Effects on Human Health

As set out in the Department of Housing, Planning, Community and Local Government "*Key Issues Consultation Paper on the Transposition of the EIA Directive 2017*"[54] and the guidance listed in Section 1.2.1 of Chapter 1: Introduction, the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters.

Chapter 5: Population and Human Health (including Shadow Flicker), Chapter 8: Land, Soils and Geology, Chapter 9: Water, Chapter 10: Air Quality, Chapter 11: Climate, Chapter 12: Noise and Vibration and Chapter 15: Material Assets (Section 15.1: Traffic and Transport) provide an assessment of the effects of the Proposed Project on these areas of consideration. There is the potential for negative effects on human health during the wind farm construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions.

The Proposed Project design and mitigation measures outlined in Chapter 9: Water ensures that the potential for effects on the water environment are not significant. No significant effects on local water supplies are anticipated.

As set out in Chapter 9: Water, potential health effects are associated with negative effects on public and private water supplies and potential flooding. The Proposed Project overlies the Clara, Inny, Ferbane and Boor Gravel groundwater bodies (GWB). The bedrock geological formations which underlie the Proposed Project site are predominantly classified by the GSI as being Locally Important Aquifers - Bedrock which is Moderately Productive only in Local Zones (Ll) (www.gsi.ie). Chapter 9: Water assesses the potential for impact on public water supply and private wells during the construction, operation and decommissioning phases.

The detailed Flood Risk Assessment in Appendix 9-1 has also shown that the risk of the Proposed Project contributing to downstream flooding is very low.

A wind farm is not a recognised source of pollution. It is not an activity which requires Environmental Protection Agency licensing under the Environmental Protection Agency Act 1992, as amended. As such, a wind farm is not considered to have ongoing significant emissions to environmental media and the subsequent potential for human health effects.

The Proposed Project is for the development of a renewable energy project, a wind farm, capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage the Proposed Wind Farm will have a long term, moderate, positive effect on air quality as set out in Section 10.3.3 of Chapter 10: Air Quality. As described in Section 11.5.3 of Chapter 11: Climate, the operational phase of the Proposed Wind Farm will have a long-term, moderate, positive effect on climate. Therefore, the Proposed Wind Farm will contribute to positive effects on human health.

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[53] *ESB, 2017. EMF & You: Information about Electric & Magnetic Fields and the electricity transmission system in Ireland. Available at: https://www.esbnetworks.ie/docs/default-source/publications/esb-networks-electrical-and-magnetic-fields-.pdf?sfvrsn=43304888_13*

[54] *Department of Housing, Planning, Community and Local Government. Transposition of 2014 EIA Directive (2014/52/EU) in the Land Use Planning and EPA Licensing Systems. Key Issues Consultation Paper. Available at: https://www.publichealth.ie/sites/default/files/resources/IPH%20response%20to%20the%20key%20issues%20consultation%20paper%20on%20Transposition%20of%20EIA%20Directive%20201452EU.pdf*

The provision of aviation lighting on permitted turbines is a standard and accepted part of any wind farm development. This is a safety requirement of the Irish Aviation Authority (IAA). The standard lighting required by the IAA are medium-intensity lights. Such lighting is designed specifically for aviation safety and is not intended to be overbearing or dominant when viewed from the ground thus striking a reasonable balance between aviation safety and visual effect. The IAA generally only confirm lighting arrangements required for wind farm developments once a consent is in place.

It is considered that aviation lighting on the proposed turbines will have no significant effect on human health, beyond increasing aircraft safety in the context of the Proposed Project. The Applicant will continue its engagement with IAA as required in relation to aviation lighting. An assessment of impacts on aviation assets is included in Section 15.2 of Chapter 15: Material Assets.

The assessments show that the residual effects are not significant and do not have the potential to cause negative health effects for human beings. On this basis, the potential for negative health effects associated with the Proposed Project is imperceptible.

5.4.6 Vulnerability of the Proposed Project to/from Major Accidents and Natural Disasters

An assessment of the Proposed Project's vulnerability to natural disasters can be found in Chapter 16: Major Accidents and Natural Disasters of this EIAR. There is low potential for significant natural disasters to occur at Proposed Project site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited and these have been assessed in the context of the whole project, cumulatively in Chapter 16 and in the wider EIAR.

This assessment was based upon The Major Emergency Plan prepared by Offaly County Council (2019)[55], while also considering site-specific major emergency scenarios. A brief discussion can be found below of scenarios which received the highest risk scores.

5.4.6.1 Contamination Events

A wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur the potential sources of pollution onsite during both the construction, operational and decommissioning phases are limited and of low environmental risk. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited.

The risk of contamination is 'very unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction, operation and decommissioning phases.

It is therefore considered that there will be unlikely, temporary, moderate, negative effects, which are Not Significant associated with contamination events during the construction, operation and decommissioning of the Proposed Project. Therefore, a significant effect on human health is similarly very unlikely.

5.4.6.2 Major Fire

The likelihood of a major fire occurring at the Proposed Project site is anticipated to be low due to best practice measures of storing fuel in bunded containers during the construction phase. The likelihood of

[55] *Offaly County Council, 2019. Major Emergency Plan. Available at: https://www.offaly.ie/app/uploads/Council/Council_Services_A-Z/Emergency_Services/Offaly-County-Major-Emergency-Plan-2019-1.pdf*

fire occurring will be further lowered by the implementation of good site management practices during the construction, operational and decommissioning phases.

Therefore, the risk of fire occurring at the Proposed Project resulting in a major accident and/or disaster is 'very unlikely' to occur and having 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction, operational and decommissioning phases.

It is therefore considered that there will be unlikely, temporary, moderate, negative effects, which are Not Significant associated with major fire during the construction, operation and decommissioning of the Proposed Project. Therefore, a significant effect on human health is similarly very unlikely.

5.4.6.3 Summary

Chapter 8: Land, Soils and Geology, Chapter 9: Water, Chapter 10: Air Quality, Chapter 11: Climate, Chapter 12: Noise and Vibration and Chapter 15: Material Assets (Section 15.1: Traffic and Transport) provide an assessment of the effects of the Proposed Project on these areas of consideration. Chapter 16 assesses the vulnerability of the project to and from major accidents and natural disasters. There is the potential for negative effects on human health during the wind farm construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions. The assessments in the chapters listed show that the residual impacts are not significant and will not lead to significant effects on any environmental media with the potential to lead to health effects for humans. On this basis, the potential for negative health effects associated with the Proposed Project is imperceptible. Furthermore, the Proposed Project is capable of offsetting carbon emissions associated with the burning of fossil fuels (see Section 11.4.3.2 of Chapter 11). During the operational stage the wind farm will have a long term, moderate, positive effect on air quality as set out in Chapter 10 which will contribute to positive effects on human health and assist in Ireland reaching its emissions targets and renewable energy goals.

5.5 Property Values

5.5.1 Property Values and Wind Farms

This section summarises the largest and most recent studies from the United States and the UK and also provides a summary of an Irish working paper from the Centre for Economic Research on Inclusivity and Sustainable (CERIS).

In 2023, CERIS published a working paper entitled *"Wind Turbines and House Prices Along the West of Ireland: A Hedonic Pricing Approach"*[56]. This paper looked at wind turbine developments in Donegal, Leitrim, Sligo, Mayo, Galway, Kerry and Cork and associated property values. This working paper utilised satellite imagery to identify individual turbines and sourced its housing data from www.daft.ie; while the published price on Daft.ie is not equivalent to the final agreed sale price, it was assumed that the listing and transaction prices are correlated. The findings of this research revealed a potential decrease in property values of 14.7% within a 0-1 km radius of a wind turbine. However, the sample size of only 225 houses within this range does not adequately represent the broader landscape of Irish rural housing and the distribution of wind turbines. The author states that there are "*no significant reductions in house prices beyond 1km*" and that the effects seen within the 1 km band were not persistent and diminished over the operational lifetime of the turbines. Considering that this is a working paper which has not been subject to peer review, and that it is based on a small sample size where local conditions have the potential to disproportionately impact the local housing market, further research is required before relying on its findings.

[56] *Centre for Economic Research on Inclusivity and Sustainability (CERIS), 2023. Wind Turbines and House Prices Along the West of Ireland: A Hedonic Pricing Approach, Centre for Economic Research on Inclusivity and Sustainability (CERIS) Working Paper Series, 2023/01. Available at: https://www.universityofgalway.ie/media/researchsites/ceris/files/WP-2023-01.pdf*

One of the largest studies of the impact of wind farms on property values has been carried out in the United States. "*The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis*"[57], was carried out at the Lawrence Berkley National Laboratory (LBNL) for the U.S Department of Energy. This study collected data on almost 7,500 sales of single-family homes situated within c. 16km (ten miles) of 24 existing wind farms in nine different American states over a period of approximately ten years. The conclusions of the study are drawn from eight different pricing models including repeat sales and volume sales models. Each of the homes included in the study were visited to demonstrate the degree to which the wind facility was visible at the time of the sale, and the conclusions of the report state that *"The result is the most comprehensive and data rich analysis to date on the potential impacts of wind energy projects on nearby property values."*

The main conclusion of this study is as follows:

> *"Based on the data and analysis presented in this report, no evidence is found that home prices surrounding wind facilities are consistently, measurably, and significantly affected by either the view of wind facilities or the distance of the home to those facilities. Although the analysis cannot dismiss the possibility that individual or small numbers of homes have been or could be negatively impacted, if these impacts do exist, they are either too small and/or too infrequent to result in any widespread and consistent statistically observable impact."*

This study has been updated by LBNL who published a further paper entitled "*A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States*"[58]. This study analysed more than 50,000 home sales near 67 wind farms in 27 counties across nine U.S. states yet was unable to uncover any impacts to nearby home property values. The homes were all within c. 16km (10 miles) of the wind energy facilities - about 1,100 homes were within c. 1.6km (1 mile), with 331 within c. 800m (half a mile). The report is therefore based on a very large sample size and represents an extremely robust assessment of the impacts of wind farm development on property values. It concludes that:

> *"Across all model Specifications, we find no statistical evidence that home prices near wind turbines were affected in either the post-construction or post announcement/pre-construction periods."*

The LBNL studies note that their results do not mean that there will never be a case of an individual home whose value goes down due to its proximity to a wind farm, however if these situations do exist, they are considered to be statistically insignificant.

In September 2023, Brunner et al. published "*Commercial wind turbines and residential home values: new evidence from the universe of land-based wind projects in the United States*"[59]. This study targeted urban counties in the United Stated with populations over 250,000 persons, and found that on average, after a commercial wind energy project is announced, houses located within c. 1.6km (1 mile) of a proposed wind energy project experience a decrease in value of 11% relative to homes located within c. 4.8-8km (3-5 miles) of the proposed wind energy project. The decline in property values was found to recover post construction with property value impacts becoming relatively small (~2%) and statistically insignificant 9 years or more after project announcement (roughly 5 years after operation begins). This suggests that the housing market is reacting negatively to the expectation of likely impacts (after announcement) and the heightened activity during construction, but after operation begins, those negative perceptions and related home price impacts appear to fade.

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[57] *Hoen, B., Wiser, R. H., Cappers, P., Thayer, M. A., Sethi, G., 2009. The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis. Available at: https://emp.lbl.gov/publications/impact-wind-power-projects*

[58] *Hoen, B., Brown, J.P., Jackson, T., Wiser, R. H., Thayer, M. A., Cappers, P., 2013. A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Available at: https://emp.lbl.gov/publications/spatial-hedonic-analysis-effects-wind*

[59] *Brunner, E.J., Hoen, B., Rand, J., Schwegman, D., 2023. Commercial wind turbines and residential home values: new evidence from the universe of land-based wind projects in the United States. Energy Policy, 185, 113837.*

The US-based scientific literature on the topic is therefore inconclusive, with the studies summarised above providing contradictory conclusions. The text below summarises the UK studies on the topic.

A study was commissioned by RenewableUK and carried out by the Centre for Economics and Business Research (Cebr) in March 2014. The findings of the study were produced in a report titled "*The effect of wind farms on house prices*"[60], the main conclusions of which are:

- Overall, the analysis found that the county-wide property market drives local house prices, not the presence or absence of wind farms.
- The econometric analysis established that construction of wind farms at the five sites examined across England and Wales has not had a detectable negative impact on house price growth within a 5 km radius of the sites.

A study issued in October 2016 '*Impact of wind Turbines on House Prices in Scotland*'[61] was published by Climate Exchange. Climate Exchange is Scotland's independent centre of expertise on climate change, which exists to support the Scottish Governments policy development on climate and the transition to a low carbon economy. A copy of the report is included as Appendix 5-2 of this EIAR.

The report presents the main findings of a research project estimating the impact on house prices from wind farm developments. It is based on analysis of over 500,000 property sales in Scotland between 1990 and 2014. The key findings from the study are:

- No evidence of a consistent negative effect on house prices: Across a very wide range of analyses, including results that replicate and improve on the approach used by Gibbons (2014), we do not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in price of properties within 2 km or 3 km or find the effect to be positive.
- Results vary across areas: The results vary across different regions of Scotland. Our data does not provide sufficient information to enable us to rigorously measure and test the underlying causes of these differences, which may be interconnected and complex.

The UK's scientific literature is strong in its conclusions that there are no significant effects on the change in price of properties close to wind farm developments, and that generally the county-wide property market drives local house prices, not the presence or absence of wind farms. This literature is contradictory to the working paper containing the only Irish study on the topic.

The literature described above demonstrates that there is insufficient evidence from the scientific literature and studies conducted to determine that there is the potential for a significant effect on property values as a result of the Proposed Project.

5.5.2 Property Values and Grid Infrastructure

In May 2016, EirGrid conducted a literature review and evidence-based field study on the effects of high voltage transmission development on patterns of settlement and land use. The objectives of '*EirGrid Evidence Based Environmental Studies Study 9: Settlement and land use*'[62] were to:

[60] *RenewableUK, 2014. The effect of wind farms of house prices. Available at:* https://tethys.pnnl.gov/sites/default/files/publications/RenewableUK_2014.pdf.
[61] *Heblich, S., Olner, D., Pryce, G., Timmins, C., 2016. Impact of wind Turbines on House Prices in Scotland. Available at:* https://www.climatexchange.org.uk/wp-content/uploads/2023/09/cxc_wind_farms_impact_on_house_prices_final_17_oct_2016.pdf
[62] *EirGrid, 2016. EirGrid Evidence Based Environmental Studies Study 9: Settlement and land use Available at:* https://cms.eirgrid.ie/sites/default/files/publications/EirGrid-Evidence-Based-Environmental-Study-9-Settlement-and-Landuse.pdf

- To gather information on patterns of settlement and land use near to existing transmission infrastructure.
- To establish the effects of existing transmission infrastructure on patterns of settlement and land use.
- To review land use planning policy in various Development Plans to determine whether any policy change has arisen as a result of the construction and operation of existing transmission projects.

A literature review of transmission projects from around the world was carried out, including review of EIAs. To investigate effects of transmission projects on patterns of land use and settlement, 31 case studies were chosen: 17 with existing overhead line (OHL) circuits, 10 with substations and 4 in construction. Sites were located in rural, rural/urban and urban areas. Land uses included agricultural, commercial and amenity. Four control sites had no infrastructure. Coexistence, development density, planning policy and planning application history were all investigated. Planning and land use policy over the previous 20 years was reviewed to see if it had influenced, or had been influenced by, recent programmes of transmission infrastructure development. This study has established no evidence of any significant impact arising from the construction or existence of transmission infrastructure in terms of patterns of settlement and land use; however, transmission infrastructure can be a local physical constraint on development.

5.6 Residential Amenity

Residential amenity relates to the human experience of one's home, derived from the general environment and atmosphere associated with the residence. The quality of residential amenity is influenced by a combination of factors, including site setting and local character, land-use activities in the area and the relative degree of peace and tranquillity experienced in the residence.

The Proposed Project is located approximately 3 kilometres (km) northeast of Ferbane and approximately 2.5 km southwest of the village of Ballycumber in Co. Offaly. The Proposed Wind Farm is primarily located in a peatland setting, comprising a mixture of bare cutaway peat, re-vegetated bare peat, degraded raised bog, scrub, low woodland and remnants of high bog. Current land-use on the Proposed Wind Farm comprises peat cutting in areas of active turbary and natural recolonisation of degraded bog. As such, the amount of people accessing the site relates mainly to those cutting peat in nearby areas. Current land use at the Proposed Grid Connection comprises peatland and pastures. The identified land uses within and around the site will be retained in the surrounding landscape during the operational phase of the Proposed Project. As part of condition 10 attached to BnM IPC licence (Ref. P0500-01), decommissioning and habitat rehabilitation work is currently being carried out on the site. Irrespective of the Proposed Project, the measures outlined in the Draft Rehabilitation Plan (Appendix 2-4) will be implemented by BnM in agreement with the EPA, per BnM's IPC Licence Obligations. Therefore, the continuation of existing activities and land use and the obligations under the IPC License will assist in the assimilation of the Proposed Project into the receiving environment.

When considering the amenity of residents in the context of a Proposed Project, there are three main potential impacts of relevance: 1) Shadow Flicker, 2) Noise, and 3) Visual Amenity. Shadow flicker and noise are quantifiable aspects of residential amenity while visual amenity is more subjective. Detailed shadow flicker and noise modelling assessments have been completed as part of this EIAR (Section 5.7 below refers to the outputs of shadow flicker modelling, Section 12.3 of Chapter 12 addresses noise and vibration). A comprehensive landscape and visual impact assessment have also been carried out, as presented in Chapter 14 of this EIAR. Impacts on the local population during the construction, operational and decommissioning phases of the Proposed Project is assessed in relation to each of these key issues and other environmental factors such as noise, traffic and dust; see impacts in Section 5.8 below. The impact on residential amenity is then derived from an overall judgement of the combination of impacts due to shadow flicker, changes to land-use and visual amenity, noise, traffic, dust and general disturbance.

There are 21 no. sensitive receptors (inhabitable dwellings, a derelict property and an office building) located within 1 km of proposed turbines. There are 4 no. commercial/warehouse units located less than 780 m from T03. One of these commercial units includes an adjacent office and is considered above as a sensitive receptor. There is an additional Warehouse Unit located approximately 898 m from T11. The closest residential sensitive receptor is located approximately 896 m from the nearest proposed turbine (T10), i.e., above both the minimum recommended setback for properties involved in the project (500 m) and the recommended 4 times the maximum tip height setback (880 m) from properties not involved in the Proposed Project (as recommended in the Draft DoHPLG 2019 Guidelines). The turbine locations thus adhere to the DoEHLG 2006 Guidelines and Draft DoHPLG 2019 Guidelines in relation to turbine setback: a minimum 500 m set back from sensitive receptors and a minimum setback of four times the tip height of the proposed turbines.

5.7 Shadow Flicker Assessment Results

5.7.1 Daily and Annual Shadow Flicker

The WindPRO computer software was used to model the predicted daily and annual shadow flicker levels in significant detail, identifying the predicted daily start and end times, maximum daily duration and the individual turbines predicted to give rise to shadow flicker.

The model results assume worst-case conditions, including:

- 100% sunshine during all daylight hours throughout the year,
- No cloud cover during all daylight hours throughout the year,
- An absence of any screening (vegetation or other buildings),
- That the turbine rotors are facing the property, and
- That the turbine rotors are moving.

The shadow flicker model assumes that daylight hours consist of 100% sunshine. This is a conservative assumption which represents theoretical precautionary conditions. Following the detail provided above on sunshine hours, a sunshine factor of 26.46% has been applied. Taking these probabilities into consideration, an approximation of the 'estimated actual' annual shadow flicker occurrence has been calculated and is presented in Table 5-9.

The predicted maximum daily and annual shadow flicker levels are then considered in the context of the DoEHLG 2006 Guidelines daily threshold of 30 minutes per day and annual threshold of 30 hours per year. If there is a predicted exceedance of the threshold limits at any property, the turbines that contribute to the exceedance are also identified.

The DoEHLG 2006 Guidelines recommend that shadow flicker at dwellings within 500 m of a proposed turbine location should not exceed a total of 30 minutes per day or 30 hours per year. As detailed in Section 5.2.3.4 there are no sensitive receptors within 500 m of the proposed turbine locations.

The predicted shadow flicker levels have been modelled for all 157 no. sensitive receptors located within the Shadow Flicker Study Area. The predicted shadow flicker model results indicate:

- 29 sensitive receptors are theoretically predicted to experience zero shadow flicker;
- 128 sensitive receptors are theoretically predicted to experience some shadow flicker;
    - Of the 128 sensitive receptors, 58 sensitive receptors are theoretically predicted to experience shadow flicker that exceeds the DoEHLG 2006 Guidelines thresholds for daily shadow flicker. Please see Table 5-9 below for details.

- No sensitive receptors are theoretically predicted to experience shadow flicker that exceeds the DoEHLG 2006 Guidelines thresholds for annual shadow flicker.

It is worth noting that the predicted exceedances of shadow flicker listed in Table 5-9 are considered conservative and in reality, the occurrence and/or duration of shadow flicker at these properties is likely to be eliminated or significantly reduced as the following items are not considered by the model:

- Receivers may be screened by topography, cloud cover and/or vegetation/built form, i.e., adjacent buildings, farm buildings, garages or barns;
- Each receiver will not have windows facing in all directions which look towards turbines;
- At distances greater than 500-1000 m the rotor blade of a wind turbine will not appear to be chopping the light but the turbine will be regarded as an object with the sun behind it. Therefore, it is generally not necessary to consider shadow casting at such distances.

Section 5.8.3.2.8 below details the mitigation measures that will be employed at the potentially affected properties to ensure that the DoEHLG 2006 Guidelines are complied with at any dwelling within the Shadow Flicker Study Area. The same mitigation measures (with stricter implementation of shadow flicker controls) also demonstrate that the proposed turbines can be operated in accordance with the shadow flicker requirements of the Draft DoHPLG 2019 Guidelines, should they be adopted as currently proposed, while the planning application is being determined.

Figure 5-3 illustrates the houses that are potentially impacted by shadow flicker exceedances from the Proposed Wind Farm.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Sensitive Receptors
- Shadow Flicker Study Area (1.5km)-10x150m Rotor Diameter

Drawing Title: Shadow Flicker Study Area and Sensitive Receptors

Project Title: Lemanaghan Wind Farm, Co. Offaly

Drawn By	Checked By
EM	EC
Project No. 200804	**Drawing No.** Figure 5-3
Scale 1:24,000	**Date** 2026-01-21

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Table 5-9 Maximum Potential Daily and Annual Shadow Flicker at the Proposed Wind Farm

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
794	614752	725822	Commercial	780	T03	00:00:00	00:00:00	00:00:00	N/A	No	No
3	614836.1	729560	Dwelling	896	T10	00:39:00	35:53:00	10:33:56	T10	Yes	No
2	616826.8	727288.5	Dwelling	897	T05	01:02:00	78:49:00	23:12:26	T05	Yes	No
4	618252.5	728024.3	Dwelling	910	T14	00:39:00	50:33:00	14:53:03	T14	Yes	No
5	613335.6	727075.9	Dwelling	913	T01	00:40:00	56:39:00	16:40:49	T01, T02	Yes	No
6	614466.8	728460.3	Dwelling	916	T08	00:38:00	61:50:00	18:12:23	T07, T08	Yes	No
7	616833.1	727227.4	Dwelling	924	T05	01:03:00	80:29:00	23:41:52	T05	Yes	No
9	614788.7	729283.1	Dwelling	936	T10	00:37:00	63:50:00	18:47:43	T08, T10	Yes	No
8	616374.4	730287.1	Dwelling	938	T11	00:34:00	37:03:00	10:54:33	T10	Yes	No
1243	618460.4	728368.8	Dwelling	945	T15	00:31:00	30:12:00	8:53:32	T14	Yes	No
10	613282.9	727125.7	Dwelling	949	T01	00:38:00	44:11:00	13:00:34	T01	Yes	No
1207	618401	728280.6	Dwelling	952	T15	00:33:00	29:12:00	8:35:52	T14	Yes	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
13	618504.1	728413.9	Dwelling	957	T15	00:35:00	40:29:00	11:55:12	T14, T15	Yes	No
12	616904.2	727327.2	Dwelling	960	T05	00:54:00	53:49:00	15:50:46	T05	Yes	No
11	616910.4	730149.5	Dwelling	960	T11	00:56:00	64:05:00	18:52:08	T11	Yes	No
17	613255.4	727091.7	Dwelling	985	T01	00:37:00	42:42:00	12:34:22	T01	Yes	No
14	616245.3	726632.3	Dwelling	985	T05	00:36:00	50:50:00	14:58:03	T04	Yes	No
15	616886	727188.4	Dwelling	988	T05	01:00:00	73:49:00	21:44:06	T05	Yes	No
19	616635.5	726840	Dwelling	999	T05	01:01:00	62:45:00	18:28:35	T05	Yes	No
25	616579.4	726792.4	Dwelling	1008	T01	00:36:00	38:23:00	11:18:06	T01	Yes	No
24	616872.3	727133.4	Dwelling	1010	T10	00:35:00	38:52:00	11:26:39	T10	Yes	No
23	616497.2	726721.4	Dwelling	1012	T05	00:31:00	26:17:00	7:44:20	T04	Yes	No
29	616657.2	726839	Dwelling	1018	T01	00:35:00	40:40:00	11:58:27	T01	Yes	No
30	613223.9	727118.5	Dwelling	1018	T14	00:51:00	53:48:00	15:50:28	T05	Yes	No
31	617275	727177.9	Dwelling	1021	T08	00:38:00	72:08:00	21:14:21	T08, T10	Yes	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
32	614708.9	729449.8	Dwelling	1025	T01	00:36:00	44:06:00	12:59:06	T01	Yes	No
35	616683.2	726855.4	Dwelling	1035	T05	00:32:00	39:40:00	11:40:47	T04	Yes	No
37	616406	726662.7	Dwelling	1042	T01	00:36:00	42:49:00	12:36:26	T01	Yes	No
42	614021	728371	Dwelling	1057	T15	00:33:00	30:39:00	9:01:29	T15	Yes	No
40	616465.5	726686.5	Dwelling	1058	T11	00:36:00	36:19:00	10:41:36	T11	Yes	No
41	613228.2	727066.2	Dwelling	1060	T05	00:35:00	34:29:00	10:09:12	T05	Yes	No
43	616970.1	727242.2	Dwelling	1066	T15	00:34:00	32:51:00	9:40:21	T15	Yes	No
45	614585.3	728992.1	Dwelling	1078	T10	00:32:00	54:13:00	15:57:50	T08, T10	Yes	No
47	616436.2	726666.9	Dwelling	1078	T15	00:33:00	35:35:00	10:28:38	T15	Yes	No
48	613550.9	728168.1	Dwelling	1079	T15	00:33:00	31:06:00	9:09:26	T15	Yes	No
49	616552.9	726721.8	Dwelling	1085	T05	00:34:00	41:58:00	12:21:25	T05	Yes	No
51	616752.5	726893.5	Dwelling	1093	T10	00:31:00	16:28:00	4:50:55	T10	Yes	No
56	616347.2	726612.9	Dwelling	1113	T10	00:31:00	15:43:00	4:37:40	T10	Yes	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
59	616741.9	726874.9	Dwelling	1122	T10	00:31:00	15:42:00	4:37:22	T10	Yes	No
58	613525.2	728168.2	Dwelling	1122	T11	00:34:00	30:29:00	8:58:32	T11	Yes	No
60	616157	726499.1	Dwelling	1126	T10	00:31:00	18:21:00	5:24:11	T10	Yes	No
61	616800.4	726924.8	Dwelling	1130	T10	00:31:00	15:32:00	4:34:25	T10	Yes	No
64	618725.9	728732.5	Dwelling	1142	T05	00:33:00	33:27:00	9:50:57	T05	Yes	No
66	616968.8	730228.6	Dwelling	1145	T01	00:32:00	31:01:00	9:07:58	T02	Yes	No
65	616965.2	727193.1	Dwelling	1151	T11	00:32:00	24:46:00	7:17:33	T11	Yes	No
69	618719.4	728652.1	Dwelling	1152	T01	00:31:00	29:18:00	8:37:38	T02	Yes	No
70	617877.4	729962.9	Dwelling	1155	T14	00:31:00	35:11:00	10:21:34	T05	Yes	No
1453	614641.8	729326.4	Dwelling	1176	T10	00:31:00	17:16:00	5:05:03	T10	Yes	No
73	618713.6	728587	Dwelling	1181	T11	00:32:00	24:18:00	7:09:18	T11	Yes	No
75	618736.9	728673.8	Dwelling	1182	T03	00:31:00	26:51:00	7:54:21	T03	Yes	No
76	616871	726968.6	Dwelling	1186	T14	00:31:00	36:51:00	10:51:01	T05	Yes	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
77	616971.9	727144.1	Dwelling	1191	T02	00:31:00	23:57:00	7:03:07	T03	Yes	No
16	616692.2	726755.9	Dwelling	990	T05	00:27:00	12:44:00	3:44:57	N/A	No	No
18	614666.4	729697.8	Dwelling	991	T05	00:27:00	14:30:00	4:16:10	N/A	No	No
20	614497.9	725457	Dwelling	1003	T05	00:29:00	18:25:00	5:25:22	N/A	No	No
21	617131.1	727109.8	Dwelling	1005	T05	00:26:00	12:21:00	3:38:11	N/A	No	No
26	616826	726874.4	Dwelling	1010	T14	00:27:00	14:38:00	4:18:31	N/A	No	No
22	616711.3	726747.1	Dwelling	1011	T05	00:25:00	11:37:00	3:25:14	N/A	No	No
1454	614630	729636.4	Dwelling	1013	T01	00:29:00	29:59:00	8:49:42	N/A	No	No
27	616856.2	726888.2	Dwelling	1018	T05	00:30:00	20:49:00	6:07:46	T04	Yes	No
28	614635.9	729696.7	Dwelling	1022	T05	00:30:00	23:25:00	6:53:42	T04	Yes	No
33	616999.8	730284.9	Dwelling	1033	T05	00:28:00	16:07:00	4:44:44	N/A	No	No
34	614760.7	729992.8	Dwelling	1035	T05	00:24:00	10:14:00	3:00:47	N/A	No	No
36	614653.3	729777.4	Dwelling	1039	T05	00:25:00	10:27:00	3:04:37	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
38	616053.5	730479.4	Dwelling	1043	T04	00:26:00	14:31:00	4:16:28	N/A	No	No
39	616888.2	726900.4	Dwelling	1051	T05	00:23:00	9:14:00	2:43:07	N/A	No	No
44	616972.7	727017.5	Dwelling	1074	T15	00:00:00	0:00:00	0:00:00	N/A	No	No
46	613390.6	726562.6	Dwelling	1082	T05	00:25:00	13:00:00	3:49:40	N/A	No	No
50	614600.8	729673.3	Dwelling	1090	T05	00:25:00	11:53:00	3:29:56	N/A	No	No
52	616991.6	730324.7	Dwelling	1097	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
54	613370.6	726573.1	Dwelling	1098	T14	00:29:00	22:41:00	6:40:44	N/A	No	No
53	616726.1	726701.8	Dwelling	1103	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
55	617076	727064.3	Dwelling	1110	T05	00:25:00	11:30:00	3:23:10	N/A	No	No
57	616729.9	726693.3	Dwelling	1118	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
63	613312.2	726615.6	Dwelling	1132	T10	00:00:00	0:00:00	0:00:00	N/A	No	No
62	614725	730029	Dwelling	1136	T05	00:07:00	1:00:00	0:17:40	N/A	No	No
67	613344.8	726559.9	Dwelling	1150	T10	00:30:00	14:39:00	4:18:49	T10	Yes	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
68	617019.9	730341.6	Dwelling	1154	T05	00:24:00	11:22:00	3:20:49	N/A	No	No
71	613694.4	726048.2	Dwelling	1163	T05	00:24:00	11:20:00	3:20:13	N/A	No	No
72	617049	727038.8	Dwelling	1167	T01	00:29:00	24:53:00	7:19:36	N/A	No	No
74	613674.9	726064.2	Dwelling	1180	T01	00:30:00	27:42:00	8:09:22	T02	Yes	No
78	618879	728855	Dwelling	1196	T15	00:29:00	14:39:00	4:18:49	N/A	No	No
79	613635.1	728439	Dwelling	1205	T01	00:23:00	10:11:00	2:59:54	N/A	No	No
82	614397.8	725360.4	Dwelling	1218	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
84	614437.5	729123	Dwelling	1219	T08	00:30:00	32:48:00	9:39:28	T08	Yes	No
80	614607.6	729907.6	Dwelling	1221	T10	00:29:00	13:56:00	4:06:09	N/A	No	No
85	614214.5	728726.6	Dwelling	1222	T08	00:28:00	22:23:00	6:35:26	N/A	No	No
83	616139.6	730548.8	Dwelling	1223	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
81	616763.5	726641.4	Dwelling	1224	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
86	614616.4	725303.1	Dwelling	1225	T03	00:00:00	0:00:00	0:00:00	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
88	618909.4	728794.8	Dwelling	1231	T15	00:28:00	14:16:00	4:12:03	N/A	No	No
87	616767.8	726634.3	Dwelling	1232	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
90	613638.6	726039.2	Dwelling	1234	T02	00:30:00	21:58:00	6:28:05	T03	Yes	No
92	613616.1	728464.8	Dwelling	1237	T01	00:21:00	8:20:00	2:27:13	N/A	No	No
91	614480.9	729365.1	Dwelling	1237	T10	00:28:00	39:48:00	11:43:08	N/A	No	No
89	617019.3	730415.3	Dwelling	1243	T11	00:26:00	14:39:00	4:18:49	N/A	No	No
93	618926.2	728815.7	Dwelling	1246	T15	00:28:00	13:46:00	4:03:13	N/A	No	No
94	613583.5	728461.6	Dwelling	1250	T01	00:24:00	11:15:00	3:18:45	N/A	No	No
1463	614217	728819	Dwelling	1252	T08	00:28:00	13:04:00	3:50:51	N/A	No	No
96	614426.4	729166.2	Dwelling	1255	T08	00:29:00	31:37:00	9:18:34	N/A	No	No
97	613518.1	726131	Dwelling	1258	T02	00:27:00	14:09:00	4:09:59	N/A	No	No
98	613569	726073.9	Dwelling	1258	T02	00:28:00	16:59:00	5:00:02	N/A	No	No
95	616790.6	726617	Dwelling	1260	T05	00:00:00	0:00:00	0:00:00	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
99	617029.3	726873.4	Dwelling	1266	T05	00:27:00	16:37:00	4:53:34	N/A	No	No
100	618949.3	728832.5	Dwelling	1268	T15	00:28:00	13:12:00	3:53:12	N/A	No	No
101	618402.6	729952.8	Dwelling	1269	T15	00:30:00	25:22:00	7:28:09	T15	Yes	No
102	614196.7	728826.1	Dwelling	1273	T08	00:28:00	12:59:00	3:49:22	N/A	No	No
103	614446.2	729279.7	Dwelling	1277	T10	00:28:00	35:32:00	10:27:45	N/A	No	No
104	618968	728858.3	Dwelling	1285	T15	00:27:00	12:40:00	3:43:47	N/A	No	No
105	618761.4	729612.4	Dwelling	1288	T15	00:28:00	14:19:00	4:12:56	N/A	No	No
106	617056.3	726851.9	Dwelling	1301	T05	00:26:00	16:13:00	4:46:30	N/A	No	No
107	617051.5	726822.8	Dwelling	1313	T05	00:22:00	11:01:00	3:14:38	N/A	No	No
109	618481.5	729955.3	Dwelling	1318	T15	00:29:00	28:16:00	8:19:23	N/A	No	No
110	614330.6	729150.3	Dwelling	1319	T08	00:28:00	25:45:00	7:34:55	N/A	No	No
108	616813.7	726557.7	Dwelling	1320	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
111	618803.4	729609.9	Dwelling	1322	T15	00:27:00	13:22:00	3:56:09	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
112	617106.4	726878.2	Dwelling	1328	T05	00:29:00	24:01:00	7:04:18	N/A	No	No
114	614167.3	725335.7	Dwelling	1330	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
115	614302.5	729131.8	Dwelling	1331	T08	00:27:00	24:24:00	7:11:04	N/A	No	No
113	616820.7	726549.8	Dwelling	1331	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
116	614275	729108.4	Dwelling	1339	T08	00:27:00	23:15:00	6:50:45	N/A	No	No
117	614127.1	728839.9	Dwelling	1343	T08	00:26:00	10:55:00	3:12:52	N/A	No	No
118	619028.9	728913.9	Dwelling	1345	T15	00:26:00	11:19:00	3:19:56	N/A	No	No
119	614222.3	725291.9	Dwelling	1346	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
120	618864.9	729573	Dwelling	1356	T15	00:26:00	12:15:00	3:36:25	N/A	No	No
121	617136.7	726842	Dwelling	1360	T14	00:27:00	21:30:00	6:19:50	N/A	No	No
1858	614243	729097	Dwelling	1360	T08	00:27:00	12:40:00	3:43:47	N/A	No	No
122	613428.1	726044.3	Dwelling	1383	T02	00:25:00	12:30:00	3:40:50	N/A	No	No
1843	616238	730727	Dwelling	1385	T11	00:00:00	0:00:00	0:00:00	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
123	612898.5	726831.1	Dwelling	1409	T01	00:26:00	14:53:00	4:22:56	N/A	No	No
124	614115.3	728977.1	Dwelling	1410	T08	00:25:00	10:20:00	3:02:33	N/A	No	No
125	613785.6	725509	Dwelling	1416	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
126	614146.8	725244.3	Dwelling	1421	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
127	613677.3	725612	Dwelling	1426	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
129	618783.5	729822.1	Dwelling	1431	T15	00:25:00	14:12:00	4:10:52	N/A	No	No
130	614116.6	725245.9	Dwelling	1434	T03	00:00:00	0:00:00	0:00:00	N/A	No	No
131	612878.2	726812.8	Dwelling	1435	T01	00:26:00	14:24:00	4:14:24	N/A	No	No
128	617081.5	730603.7	Dwelling	1437	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
133	618945.2	729604.3	Dwelling	1442	T15	00:25:00	10:54:00	3:12:34	N/A	No	No
132	616831.7	730720.6	Dwelling	1444	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
134	619073.7	729331.8	Dwelling	1454	T15	00:24:00	9:32:00	2:48:25	N/A	No	No
136	619134.8	729031.7	Dwelling	1456	T15	00:24:00	9:25:00	2:46:22	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
138	618912.6	729689.2	Dwelling	1457	T15	00:24:00	11:22:00	3:20:49	N/A	No	No
140	618924.4	729671.2	Dwelling	1457	T15	00:24:00	11:12:00	3:17:52	N/A	No	No
135	614368	729951.6	Dwelling	1458	T10	00:24:00	8:46:00	2:34:53	N/A	No	No
141	613375.2	728582.8	Dwelling	1463	T01	00:22:00	11:12:00	3:17:52	N/A	No	No
137	617030.9	730663	Dwelling	1466	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
139	617354.9	730445.9	Dwelling	1468	T11	00:26:00	23:51:00	7:01:21	N/A	No	No
142	612854.2	726785.1	Dwelling	1468	T01	00:25:00	13:53:00	4:05:16	N/A	No	No
637	616915.2	730748.1	Derelict	1469	T03	00:25:00	16:16:00	4:47:23	N/A	No	No
143	617252.3	730544.4	Dwelling	1480	T11	00:24:00	15:12:00	4:28:32	N/A	No	No
144	617276	730530.3	Dwelling	1483	T11	00:25:00	17:38:00	5:11:31	N/A	No	No
145	617035.4	730679.9	Dwelling	1483	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
146	616983.2	730712.3	Dwelling	1491	T11	00:00:00	0:00:00	0:00:00	N/A	No	No
147	616976.6	730716.2	Dwelling	1492	T11	00:00:00	0:00:00	0:00:00	N/A	No	No

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	Description	Distance to Nearest Turbine (metres)	Nearest Proposed Turbine No.	Max. Daily Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Proposed Turbine(s) Giving Rise to Daly Shadow Flicker Exceedance	Mitigation Strategy Required (Daily)	Mitigation Strategy Required (Annual)
148	617108.8	726606	Dwelling	1492	T05	00:00:00	0:00:00	0:00:00	N/A	No	No
149	616915.2	730748.1	Dwelling	1498	T11	00:00:00	0:00:00	0:00:00	N/A	No	No

5.8 Likely Significant Impacts and Associated Mitigation Measures

The below assessment evaluates the impact (where there is the potential for an impact to occur) on population levels, employment and investment, land-use patterns and activities, property values, tourism, residential amenity, health and safety, air quality (dust and exhaust emissions), climate, water quality, noise and vibration, traffic and transport, major accidents and natural disasters, shadow flicker, and interference with telecommunications systems and EMF during the construction, operation and decommissioning phases, as a result of the Proposed Project.

5.8.1 'Do-Nothing' Scenario

If the Proposed Project were not to proceed, the site would continue to be managed under the requirements of the relevant IPC licence and therefore the ongoing site management and environmental monitoring and wind measurement would continue. In addition, if the Proposed Project were not to proceed, the implementation of the Draft Rehabilitation Plan included as Appendix 2-4 of this EIAR as required under IPC Licence would still occur. These land uses and activities will also continue if the Proposed Project does proceed per BnM's IPC Licence Obligations. If the Proposed Project were not to proceed, the opportunity to capture part of Offaly's valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

5.8.2 Construction Phase

Within this section, the impact will consider the Proposed Project, i.e., both the Proposed Wind Farm and the Proposed Grid Connection, as a whole. Where the Proposed Wind Farm and the Proposed Grid Connection are required to be considered separately, this is identified within the assessment.

5.8.2.1 Population

5.8.2.1.1 *Population Levels*

Pre-Mitigation Impact

Proposed Project

Those working on the construction phase of the Proposed Project will travel daily to the site from the wider area. The construction phase will have no impact on the population of the area in terms of changes to population trends or density, household size or age structure, which is Not Significant.

Mitigation Measures

No mitigation required.

Residual Effects

No residual effects.

Significance of Effects

The effect on population levels due to the construction phase of the Proposed Project are Not Significant.

5.8.2.1.2 *Employment and Investment*

Pre-Mitigation Impact

Proposed Project

The design, construction, operation and decommissioning of the Proposed Project will provide employment for technical consultants, contractors and maintenance staff. Up to approximately 100-120 jobs are likely to be created during the construction phase of the Proposed Project. The construction phase of the Proposed Project will last between approximately 24-30 months, and the decommissioning phase will likely last approximately 12 months.

The majority of construction workers will be sourced locally, thereby helping to sustain employment in the construction trade. Where appropriate, engineering fill and higher quality, surfacing granular fill and sand will be sourced from local, authorised quarries. This will have a positive, moderate, short-term, direct impact, which is Not Significant.

The salaries and wages earned by those employed during the construction phase of the Proposed Project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a positive, slight, short-term, indirect impact on their cash flow, which is Not Significant.

The Proposed Project will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of the wind energy industry is likely to lead to additional opportunities for those staff as additional wind farms are constructed in Ireland. This will have a positive, moderate, long-term, indirect impact, which is Not Significant. Wind Energy Association estimates that there are over 5,000 people employed in roles related to wind energy in Ireland in 2023. This figure is anticipated to grow significantly in the coming years as the race to achieve the targets set out in CAP25 accelerates.

Commercial rates from the wind farm will contribute significant funds to Offaly County Council to support the provision of public services within these counties. These services include road maintenance, fire services, environmental protection, street lighting, footpath maintenance, etc. along with other community and cultural support initiatives. This will have a positive, slight, long-term, direct impact which is Not Significant.

Mitigation Measures

No mitigation required.

Residual Effects

The injection of money in the form of salaries and wages to those employed during the construction phase of the Proposed Project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a positive, moderate, short-term effect on their cash flow, and is therefore Not Significant.

Significance of Effects

The effect on employment and investment levels due to the construction of the Proposed Project is Not Significant.

5.8.2.1.3 *Land Use Patterns & Activities*

Pre-Mitigation Impact

Proposed Project

Peat extraction at the site ceased in June 2020, with all stockpiled peat removed from the site by the end of 2024. Furthermore, IPC licence for the site requires the production of rehabilitation plans which are to be agreed with by the EPA prior to their implementation. The Draft Rehabilitation Plan for Lemanaghan Bog, located in Appendix 2-4, consider the construction, operation, and decommissioning phases of the Proposed Project.

The existing land-uses of site management and environmental monitoring (as required under IPC Licence No. 500-01) and wind measurement will continue on the site of the Proposed Project. There are also a number of BnM rail lines that pass through the site, it is envisioned that these will be decommissioned prior to construction. Therefore, there is short-term slight negative impact on existing land-use patterns, which is Not Significant.

Mitigation Measures

No mitigation required.

Residual Effects

Due to the small permanent footprint of the Proposed Project infrastructure on a site scale and even more so on a local scale, the residual effect is considered negative, slight, short-term effect on land use and activities, and is therefore Not Significant.

Significance of Effects

The effect on land use patterns and activities due to the construction of the Proposed Project is Not Significant.

5.8.2.1.4 *Property Values*

Pre-Mitigation Impact

Proposed Wind Farm

As noted in Section 5.5.1 above, the available scientific literature demonstrates that there is insufficient evidence from the scientific literature and studies conducted to determine that there is the potential for a significant effect on property values as a result of the Proposed Wind Farm. The impact assessment on property values outlined below takes a precautionary approach and assumes that based on the inconclusive evidence summarised above in Section 5.5.1, there is the potential for negative, slight, short-term impacts on property values, which is Not Significant, located within 1 km of the proposed turbines during the construction phase of the Proposed Wind Farm.

Proposed Grid Connection

As noted in Section 5.5.2 above, the conclusions from available EirGrid studies indicate that property values (residential and agricultural) show no correlation with the presence of grid infrastructure in the area, with opinions on nearby grid infrastructure diminishing over time. In some cases, property values were demonstrated to increase however, causation with grid infrastructure cannot be determined. Therefore, there is no potential for the Proposed Grid Connection to impact on property values in the area.

The available scientific literature detailed in Section 5.5.1 above is inconclusive, with large-scale studies conducted in the UK concluding that property values are generally driven by market conditions rather than proximity to wind farms. These studies comprise a much larger sample size than the only Irish study on the topic, a working paper which has not been subject to peer review and where the small sample size has the potential to result in individual circumstances having had an outsized bearing on the conclusions drawn from the study.

Mitigation Measures

- All mitigation relevant to property values, outlined above and the corresponding chapters: Chapter 10: Air Quality, Chapter 12: Noise and Vibration, Chapter 14: Landscape and Visual, and Chapter 15: Material Assets, will be implemented in order to reduce insofar as possible, impacts on property values at properties located in the vicinity of Proposed Wind Farm construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.
- The Proposed Wind Farm has been designed in accordance with the parameters set out in the DoEHLG 2006 Guidelines and with cognisance of the Draft DoHPLG 2019 Guidelines, adhering to the required setback distances from sensitive receptors set out in those documents.

Residual Effects

With the above mitigation and monitoring measures adhered to, it can be concluded that there is the uncertain potential for a short-term negative imperceptible residual effect on property values from the construction phase of the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on property values due to the construction of the Proposed Project is Not Significant.

5.8.2.1.5 *Tourism*

Pre-Mitigation Impact

Proposed Project

The Proposed Project site has some rural aesthetic qualities given the relative lack of buildings and infrastructure present on the site. It is primarily composed of peatland; these views are common throughout the local area and due to the Proposed Project site historical use for industrial peat extraction and ancillary activities, it is noted that the landscape has been subject to substantial levels of human interference and modification.

While there is a tourist attraction located within the Proposed Project site (i.e., Banagher Line), considering the human interference there is potential for a negative, slight, short-term impact on tourism during the construction phase of the Proposed Project, which is Not Significant. Please note, a number

of archaeological features and cultural heritage sites have been identified within and adjacent to the Proposed Project. The potential effect on these archaeological features and cultural heritage sites from the construction phase of the Proposed Project have been addressed in detail within Chapter 13: Cultural Heritage and Chapter 14: Landscape and Visual.

With regard to tourist attractions and amenity use around the site, described in Section 5.1.3 and Section 5.3.9, traffic management safety measures will be in place, where required.

Mitigation Measures

With regard to tourist attractions and amenity use surrounding the Proposed Project, Section 5.8.2.2.6 below outlines the mitigation measures proposed in relation to traffic management. Please see Section 15.2 of Chapter 15: Material Assets for mitigation measures relating to the Proposed Project.

Please see Section 13.3.2 and Section 13.3.3 of Chapter 13 and Section 14.7.2 of Chapter 14 for associate mitigation on tourism from a cultural heritage and landscape perspective, respectively. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

Based on the above it is concluded that there would be a negative, imperceptible, short term, residual effect on tourism in the wider landscape due to the construction phase the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on tourism in the wider landscape due to the construction of the Proposed Project is considered to be Not Significant.

5.8.2.1.6 *Residential Amenity*

Pre-Mitigation Impact

Proposed Project

There is the potential for impacts on amenity during the construction phase due to air, traffic, noise and vibration emissions, impeded tourism and visitor experience to attractions and visual nuisance due to additional traffic and plant machinery. This will have a negative, moderate, short-term impact, which is Not Significant. The potential for impacts on residential amenity is discussed above in Section 5.6.

Mitigation Measures

All mitigation as outlined above and the corresponding chapters: Chapter 10: Air Quality, Chapter 12: Noise and Vibration, Chapter 13: Cultural Heritage, Chapter 14: Landscape and Visual, and Chapter 15: Material Assets will be implemented in order to reduce insofar as possible, impacts on residential amenity at properties located in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

Based on the above it is concluded that there would be a short-term, negative, sight, residual effect on residential amenity due to the construction phase of the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on residential amenities due to the construction of the Proposed Project is Not Significant.

5.8.2.2 Health

The following impact assessment is produced in accordance with guidance as set out in Section 5.2.2.

5.8.2.2.1 *Health and Safety*

Pre-Mitigation Impact

Proposed Wind Farm

Construction of the Proposed Project will necessitate the presence of a construction site and travel on the local public road network to and from the Proposed Project site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a potential negative, significant, short-term impact on health and safety, which is Significant.

Proposed Grid Connection

The construction of the Proposed Grid Connection will include working under existing overhead transmission lines near the proposed onsite 220kV substation and existing Shannonbridge-Maynooth 220kV OHL, which may impact on electrical infrastructure and supply in the area and along a local road which may give rise to traffic impacts. Furthermore, working in the cavity of power lines and traffic flow is potential health and safety hazard for construction workers. This will have a potential negative, significant, short-term impact on health and safety, which is Significant.

Mitigation Measures

The Proposed Project will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation, including:

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2016 (S.I. No. 36 of 2016);
- S.I. No. 528/2021 - Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021 and
- Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2023.

The following measures below are also detailed in Appendix 4-4: Construction and Environment Management Plan and Chapter 18: Schedule of Monitoring and Mitigation Measures.

- A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared on a preliminary basis at the procurement stage and developed further at construction stage.
- All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project. SafePass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The developer is required to ensure a competent contractor is appointed to carry out the construction

works. The contractor will be responsible for the implementation of procedures outlined in the Safety and Health Plan. Public safety will be addressed by restricting site access during construction. Fencing will be erected in areas of the site where uncontrolled access is not permitted.

- Appropriate warning signs will be posted, directing all visitors to the site manager. Appropriate warning measures including 'goalposts' will be used as appropriate to prevent contact with any overheads lines that traverse the site.
- Goal posts will be established, where necessary, under overhead electricity lines for the entirety of the construction phase of the Proposed Project.
- The suitability of machinery and equipment for use near power lines will be risk assessed.
- All staff will be trained on operating voltages of overhead electricity lines running over the site. All staff will be trained to be aware of the risks associated with overhead lines. All contractors that may visit the site are made aware of the location of lines before they come on to site.
- Barriers will run parallel to the overhead line at a minimum horizontal distance of 6 metres on plan from the nearest overhead line conductor wire.
- When activities must be carried out beneath overhead lines, e.g., component delivery or substation construction, a site-specific risk assessment will be undertaken prior to any works. The risk assessment must take into account the maximum potential height that can be reached by the plant or equipment that will be used prior to any works. Overhead line proximity detection equipment will be fitted to machinery when such works are required.
- Information on safe clearances will be provided to all staff and visitors.
- Signage indicating locations and health and safety measures regarding overhead lines will be erected in canteens and onsite.
- All staff will be made aware of and adhere to the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2013 to 2021"* This will encompass the use of all necessary Personal Protective Equipment and adherence to the Site Health and Safety Plan.

The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013*'[63].

The PSDP appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to):

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project;
- Where possible, eliminate the hazards or reduce the risks;
- Communicate necessary control measures, design assumptions or remaining risks to the PSCS so they can be dealt with in the Safety and Health Plan;
- Ensure that the work of designers is coordinated to ensure safety;
- Organise co-operation between designers;
- Prepare a written Safety and Health Plan;
- Prepare a safety file for the completed structure and give it to the client; and

[63] *HSA, 2017. Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013. Available at:* https://www.hsa.ie/eng/publications_and_forms/publications/construction/guidelines_on_the_procurement_design_and_management_requirements_of_the_safety_health_and_welfare_at_work_construction_regulations_2013_updated_.html

- Notify the Authority and the client of non-compliance with any written directions issued.

The PSCS appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to):

- Development of the Safety and Health Plan for the construction stage with updating where required as work progresses;
- Compile and develop safety file information.
- Reporting of accidents / incidents;
- Weekly site meeting with PSCS;
- Coordinate arrangements for checking the implementation of safe working procedures. Ensure that the following are being carried out:
  - Induction of all site staff including any new staff enlisted for the project from time to time;
  - Toolbox talks as necessary;
  - Maintenance of a file which lists personnel on site, their name, nationality, current SafePass number, current Construction Skills Certification Scheme (CSCS) card (where relevant) and induction date;
  - Report on site activities to include but not limited to information on accidents and incidents, disciplinary action taken and PPE compliance;
  - Monitor the compliance of contractors and others and take corrective action where necessary; and
  - Notify the Authority and the client of non-compliance with any written directions issued.

Residual Effects

With consideration of the implementation of the detailed mitigation measures there will be potential negative, slight, short-term residual effects on health and safety during the construction phase of the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on health and safety due to the construction of the Proposed Project is Not Significant.

5.8.2.2.2 *Air Quality: Dust and Exhaust Emissions*

Chapter 10: Air Quality assesses the potential for impact to human health from dust, CO_2 and other noxious emissions generated by additional vehicles and plant machinery as well as the release of CO_2 through excavations.

Pre-Mitigation Impact

Proposed Project

Potential dust emission sources during the construction phase of the Proposed Project include upgrading of existing access tracks and construction of new access roads, turbine and meteorological mast foundations, temporary construction compounds, and electrical substation.

An increase in dust and exhaust emissions has the potential to cause a nuisance to sensitive receptors in the immediate vicinity of the Proposed Project site. The entry and exit of construction vehicles from the Proposed Project site may result in the transfer of mud to the public road, particularly if the weather is wet. This may cause nuisance to residents and other road users. The transport of construction material

to and within the Proposed Project site also has the potential to create dust, which could affect nearby sensitive receptors. These effects will have a short-term, slight, negative impact on air quality, which is Not Significant. The potential dust impacts that may occur during the construction phase of the Proposed Project are further described in Chapter 10: Air Quality.

Mitigation Measures

All mitigation as outlined in Chapter 10: Air Quality will be implemented in order to reduce insofar as possible, impacts on climate in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

With the implementation of the above mitigation measures, there will be a short-term, imperceptible, negative, residual effect due to dust emissions from the construction of the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on air quality from dust and exhaust emissions due to the construction of the Proposed Project is Not Significant.

5.8.2.2.3 *Climate*

Chapter 11: Climate identifies, describes, and assesses the potential significant direct and indirect effects on climate arising from the Proposed Project.

Pre-Mitigation Impact

Proposed Project

Greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide and nitrogen oxides, associated with the production of construction materials, and operation of vehicles and plant will arise as a result of the construction activities. There will be a short-term, negative and slight only impact, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase. The potential climate impacts that may occur during the construction phase of the Proposed Project are further described in Chapter 11: Climate.

Mitigation Measures

All mitigation as outlined in Chapter 11: Climate will be implemented in order to reduce insofar as possible, impacts on climate in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

Following implementation of the mitigation measures identified in Chapter 11: Climate (Section 11.5.2), greenhouse gas emissions arising from the construction phase of the Proposed Project will have a negative, imperceptible, short-term residual effect. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from construction phase activities will have a negative, imperceptible, permanent residual effect on Climate, and is therefore Not Significant.

Significance of Effects

The effect on climate due to the construction of the Proposed Project is Not Significant.

5.8.2.2.4 *Water Quality*

Pre-Mitigation Impact

Proposed Project

There are no mapped Public Water Supplies (PWS) or Group Water Schemes (GWS) within the Proposed Project site. The closest mapped GWS is the Boher Lamonaghan GWS, located approximately 0.6km northeast of the Proposed Project site in the townland of Castlearmstrong. The mapped source protection area for this GWS does not fall within the Proposed Project site. At its closest point the southern boundary of the source protection area is 400m north of the Proposed Project site. The closest mapped Public Water Supply (PWS) is the Ferbane PWS, located approximately 2.5km southwest of Ferbane in the townland of Skehanagh, Co. Offaly. An Uisce Eireann mapped source supply well located a significant distance from the closest proposed turbine (>850m from T15).

Section 9.5.2 of Chapter 9: Water assesses the potential for impact on public water supply and private wells during the construction phase. The assessment concludes that there will be a negative, significant, direct, long-term effect during the construction phase of the Proposed Project, which is Significant.

Mitigation Measures

All mitigation as outlined in Section 9.5.2 of Chapter 9: Water will be implemented in order to reduce insofar as possible, impacts on climate in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

For the reasons given in the above and in Chapter 9: Water (separation distances, and prevailing geology, topography and groundwater flow directions), it is considered that the residual effects are be negative, imperceptible, long term, indirect effects in terms of quality or quantity on local groundwater well supplies.

Significance of Effects

The effect on water quality due to the construction of the Proposed Project is Not Significant.

5.8.2.2.5 *Noise and Vibration*

Pre-Mitigation Impact

Proposed Project

There will be an increase in noise levels associated with several stages and elements associated with the construction phase of the Proposed Project, including but not limited to:

- Construction of new entrance(s) and hardcore existing entrance, construction of internal roads;
- Excavation and operation of borrow pits;
- Construction of turbines and hard standing areas;
- Construction of temporary construction compounds;

- Enhancement Areas;
- Construction of proposed onsite 220kV substation;
- Construction of new Proposed Grid Connection OHL cabling.

The noisiest construction activities associated with wind farm development are general construction of turbines, hardstand areas and anemometry mast, construction of internal roads and amenity track, borrow pit excavation and reinstatement, and peat deposition areas, substation and ancillary construction works. The highest predicted noise levels are expected to occur for short periods of time at a limited number of properties. Construction noise levels will be lower than these levels for most of the time at most properties in the vicinity of the Proposed Project.

Construction noise and vibration at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise and vibration impacts that will occur during the construction phase of the Proposed Project are further described in Chapter 12: Noise and Vibration. The predicted pre-mitigation noise impacts during the construction of the Proposed Project are assessed as negative, not significant and short-term, which is Not Significant.

Mitigation and Monitoring Measures

All mitigation as outlined in Chapter 12: Noise and Vibration will be implemented in order to reduce insofar as possible, impacts on climate in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

With the implementation of the above mitigation measures, there will be a negative, not significant and short-term residual effect due to noise and vibration arising during the construction phase of the Proposed Project and is therefore Not Significant.

Significance of Effects

The effect on human health due to noise and vibration arising from the construction of the Proposed Project is Not Significant.

5.8.2.2.6 *Traffic and Transport*

Pre-Mitigation Impact

Proposed Project
The proposed delivery route of all turbine components and plan is detailed in Chapter 4 of this EIAR, with a summary provided below:

- Turbine infrastructure will be imported to Galway Port and be transported via Lough Atalia Road, R339, R336, N6/M6, and east to the Proposed Wind Farm.
- The large wind turbine plant will be delivered via the M6, turning south onto the N52 at Junction 5, then south past Tullamore, Blue Ball, Kilcormac, and Five Alley. Deliveries will turn right at Kennedy's Cross onto the N62 and continue north for ~22 km to Site Entrance 1 (Table 4-9 in Chapter 4).
- All other construction materials will be delivered to the site via the proposed haul routes shown on Figure 4-40 and will access the site using the appropriate site access location based on the source of the construction material which will be included in the TMP for the Proposed Project, included as Appendix 15-2 to the EIAR.

- All other construction materials will be delivered via the haul routes shown in Chapter 4, using the appropriate site access points as detailed in the TMP.

All deliveries of turbine components to the site will only be by way of this proposed turbine delivery routes. Non-turbine construction traffic will be comprised of Heavy Goods Vehicle (HGV) and Light Goods Vehicle (LGV) movements and will involve the delivery of construction materials to the site and the export of excess construction materials and plant from the site via the appropriate site entrance.

A complete Traffic and Transportation Assessment (TTA) of the Proposed Project has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Section 15.1 of Chapter 15: Material Assets.

The types of vehicles that will be required to negotiate the local network represent abnormal size loads and a detailed assessment of the geometry of the proposed route was therefore undertaken. This will have a temporary, slight, negative impact on existing road users, in the absence of mitigation, which is Not Significant.

Mitigation Measures

A complete TTA of the Proposed Project has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Chapter 15: Material Assets.

A Traffic Management Plan (TMP) has been developed in order to minimise any potential effect on the local population during the construction phase of the Proposed Project due to traffic.

Prior to commencement of any works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be made known. Local access to properties will also be maintained throughout any construction works and local residents will be supplied with the number of the works supervisor to ensure that disruption will be kept to a minimum. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

Once a traffic management plan is implemented for the construction phase of the Proposed Project, there will be a slight, temporary, negative residual effect on local road users, and is therefore Not Significant.

Significance of Effects

The effect on traffic and transport due to the construction of the Proposed Project is Not Significant.

5.8.2.2.7 *Major Accidents and Natural Disasters*

Pre-Mitigation Impact

Proposed Project

A risk register has been developed which contains all potentially relevant risks identified during the construction phase of the Proposed Project. A total of nine risks specific to the construction of the Proposed Project have been identified and are presented in Chapter 16: Major Accidents and Natural Disasters: flooding, major road traffic accident, contamination event, major fire, bog fire, civil disorder at large events, adverse weather conditions, loss of critical infrastructure, peat instability. As outlined in Section 16.4 of this EIAR, the scenarios with the highest risk score in terms of the occurrence of major accident and/or disaster during the construction were identified as ‘Contamination Event’, and ‘Major

Fire'. The risk of contamination is 'very unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction. The risk of Major Fire is 'very unlikely' to occur and having 'limited' consequences should it do so, representing a 'low-risk scenario' during the construction, Therefore, in the absence of mitigation, the impact of both contamination and major fires unlikely, temporary, moderate, negative effects, which are Not Significant

Mitigation Measures

Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures which details all proposed mitigation and monitoring measures for the construction, operation and decommissioning of the Proposed Project, which include the following:

- The Proposed Project is designed and will be constructed in line with current best practice and, as such, mitigation against the risk of major accidents and/or disasters will be embedded through the design. In accordance with the provision of the European Commission '*Guidance on the preparation of Environmental Impact Assessment Reports'* 2017, a Risk Management Plan will be prepared and implemented on site to ensure an effective response to disasters or the risk of accidents. The plan will include sufficient preparedness and emergency planning measures.
- Potential effects associated with contamination during construction are addressed fully in Chapter 8: Land, Soils and Geology and Chapter 9: Water of this EIAR. Potential effects associated with bog fires during construction are addressed within Chapter 16: Major Accidents and Natural Disasters, Additionally, potential effects associated with peat instability is detailed in Chapter 8: Land, Soils and Geology. The mitigation measures outlined therein to protect environmental receptors as well as the procedures and measures described in the Construction and Environmental Management Plan (CEMP) (Appendix 4-4) will ensure that the risk from these sources is low.
- A CEMP has been prepared for the Proposed Project and is included in Appendix 4-4 of this EIAR. Upon a grant of planning permission for the Proposed Project, the CEMP will be updated prior to the commencement of the development. The CEMP will be a live document maintained by the contractor that will work to ensure that potential risks of major accident and/or disaster are identified, avoided, and mitigated, as necessary. Refer to Appendix 4-4 for the CEMP that sets out the minimum standards to be employed by the contractor.

Residual Effects

The impact assessment concludes that the risk of a major accident and/or disaster during the construction phase of the Proposed Project is considered 'low' in accordance with the '*Guide to Risk Assessment in Major Emergency Management*'[64]. It is considered that when the mitigation and monitoring measures outlined in the CEMP (Appendix 4-4) are implemented and adhered to there the residual effects associated with the construction of the Proposed Project will be unlikely, temporary, slight, negative effects, which are Not Significant.

Significance of Effects

The effect to/from Major Accidents and Natural Disaster due to the construction of the Proposed Project is Not Significant.

[64] *Department of Environment, Heritage and Local Government, 2010. A Guide to Risk Assessment in Major Emergency Management. Available at: https://assets.gov.ie/117528/e06a7ca8-a634-4f70-a9a7-b405ee08429a.pdf*

5.8.2.2.8 *Shadow Flicker*

Shadow flicker, which occurs during certain weather conditions due to the movement of wind turbine rotor blades, as described in Section 5.2.3 and Section 5.7 of this chapter, occurs only during the operational phase of a wind energy development. There is therefore no shadow flicker impact associated with the construction phase of the Proposed Project.

5.8.2.2.9 *Interference with Telecommunication Systems and EMF*

There is no potential to interfere with telecommunications systems during the construction phase. The potential for interference with telecommunication links that traverse the site can only occur during the operational phase of a wind energy development. There are therefore no communication system impacts associated with the construction phase of the Proposed Project.

5.8.3 Operational Phase

5.8.3.1 Population

The effects set out below relate to the operational phase of the Proposed Project.

5.8.3.1.1 *Population Levels*

Pre-Mitigation Impact

Proposed Project

The operational phase of the Proposed Project will have no impact on the population of the area with regards to changes to trends, population density, household size or age structure, which is Not Significant.

Mitigation and Monitoring Measures

No mitigation required.

Residual Effects

No residual effects.

Significance of Effects

The effect on population levels during the operational phase of the Proposed Project are Not Significant.

5.8.3.1.2 *Employment and Investment*

Pre-Mitigation Impact

Proposed Project

The operational phase of the Proposed Project will present an opportunity for mechanical, civil, and electrical contractors and craftspeople to become involved with the maintenance and operation of the wind farm. On a long-term scale, the Proposed Project will create approximately 2-3 jobs during the

operational phase relating to the maintenance and control of the wind farm, having a positive, slight, long-term impact, which is Not Significant.

In addition to employment during the construction and operational phases of the Proposed Project and annual rates that will be paid to the local authority by the Developer, a range of other benefits associated with the Proposed Project will be provided to the local community through the annual Community Gain Scheme. The aim of this scheme is to provide financial assistance to local communities and not-for-profit organisations around the Proposed Project.

The Near Neighbour Scheme will offer electricity bill payers living within a prescribed distance of a wind turbine an annual contribution towards their electricity usage. In addition to the electricity contribution payment, the scheme will also offer participants a contribution towards the completion of energy measures on the property and/or education support. This is in line with existing near neighbour schemes that are active at other BnM Wind Farms.

As detailed in Chapter 4: Description of the Proposed Project (Section 4.8.2). The Renewable Electricity Support Scheme (RESS) is a Government of Ireland initiative that provides support to renewable electricity projects in Ireland. The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by DECC in August 2023, make some high-level provisions for how this type of community benefit fund will work, and are summarised in Chapter 4. Further details on the proposed Community Gain proposals are presented in Section 4.8 Chapter 4 of this EIAR. These measures will have a positive, slight, long-term impact, which is Not Significant, on investment.

Mitigation Measures

No mitigation required.

Residual Effects

During the operational phase of the Proposed Project there will be positive, slight, long-term residual effect on employment and investment.

Significance of Effects

The effect on employment and investment due to the operation of the Proposed Project is Not Significant.

5.8.3.1.3 *Land Use Patterns and Activities*

Pre-Mitigation Impact

Proposed Project

The footprint of the Proposed Project site, including turbines, roads, substation, etc., will occupy approx. 3% of the site, as defined in Section 1.1.1 of Chapter 1. The existing land-uses include site management and environmental monitoring as required under IPC Licence No. 500-01, and wind measurement. Please note that irrespective of the consenting or construction of the Proposed Project, the measures outlined in the Draft Rehabilitation Plan (Appendix 2-4) will be implemented by BnM in agreement with the EPA, per BnM's IPC Licence Obligations.

As such, the small scale of the Proposed Project footprint relative to the Population Study Area, its ability to coexist with ongoing site activities and activities within the landscape indicate that the Proposed Project will have no significant impact on other land-uses within the site and the wider area.

The pre-mitigation impact is considered to be negative, slight, permanent and direct, which is Not Significant.

Mitigation Measures

No mitigation required.

Residual Effects

Due to the small footprint of the Proposed Project infrastructure on a site scale and even more so on a local scale, the residual effect is considered to be a negative, slight, permanent direct effect on land use and activities during the operational phase. Due to the small scale and ability of the design to coexist with ongoing site activities, it is considered that there will be neutral, indirect, not significant, long-term negative effect, which is Not Significant, on peatland rehabilitation under IPC within the Proposed Project site which will continue regardless of the operational status of the Proposed Project.

Significance of Effects

The effect on land use/activities due to the operation of the Proposed Project is Not Significant.

5.8.3.1.4 *Property Values*

Pre-Mitigation Impact

Proposed Wind Farm

As noted in Section 5.5.1 above, the available scientific literature demonstrates that there is insufficient evidence from the scientific literature and studies conducted to determine that there is the potential for a significant effect on property values as a result of the Proposed Wind Farm. The impact assessment on property values outlined below takes a precautionary approach and assumes that based on the inconclusive evidence summarised above in Section 5.5.1, there is the potential for negative, slight, short-term impacts on property values, which is Not Significant, located within 1 km of the proposed turbines during the early operational phase of the Proposed Wind Farm.

Proposed Grid Connection

As noted in Section 5.5.2 above, the conclusions from available EirGrid studies indicate that property values (residential and agricultural) show no correlation with the presence of grid infrastructure in the area, with opinions on nearby grid infrastructure diminishing over time. In some cases, property values were demonstrated to increase however, causation with grid infrastructure cannot be determined. Therefore, there is no potential for the Proposed Grid Connection to impact on property values in the area during the operational phase, which is therefore Not Significant.

Mitigation Measures

All mitigation relevant to property values, outlined above and the corresponding chapters: Chapter 10: Air Quality, Chapter 12: Noise and Vibration, Chapter 14: Landscape and Visual, and Chapter 15: Material Assets, will be implemented to reduce insofar as possible, impacts on property values at properties located in the vicinity of Proposed Wind Farm. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

The Proposed Wind Farm has been designed in accordance with the parameters set out in the Guidelines and with cognisance of the draft DoEHLG 2006 Guidelines, adhering to the required setback distances from sensitive receptors set out in those documents.

The available scientific literature on the topic is inconclusive, with large scale studies conducted in the UK concluding that property values are generally driven by market conditions rather than proximity to wind farms. These studies comprise a much larger sample size than then only Irish study on the topic, a working paper, where the small sample size has the potential to result in individual circumstances having had an outsized bearing on the conclusions drawn from the study.

The available literature that does identify a short-term decrease in property values all note that the decrease in value reduces and becomes statistically insignificant, in general, 5 years after the commencement of the operational phase.

Residual Effects

It can be concluded that there is the potential for a negative, imperceptible, short-term residual effect on property values from the operational phase of the Proposed Project, which is Not Significant.

Significance of Effects

The effect on property values due to the operation of the Proposed Project is Not Significant.

5.8.3.1.5 *Tourism*

Pre-Mitigation Impact

Proposed Project

As part of the Proposed Project design, approximately 1.14 km of existing access tracks and 16.9 km of new roads will be open for use as amenity pathways including walkways and cycleways. A further 3.9 km dedicated amenity pathways will be constructed, and an additional 1.8 km of existing track will be upgraded for the purpose of amenity. Three carparks with a total capacity for approximately 18 spaces per car park (15 no. standard spots and 3 no. accessible parking) will be available in the operational phase, although it is anticipated that many locals will walk or cycle to the site. Each carpark will feature bus parking and bike racks for those who want to cycle to the area and walk the wind farm amenity loops. The amenity tracks and loops will provide a safe visitor experience and open the site up and its archaeological features to locals, tourists, trail runners etc. These dedicated amenity tracks will connect into the granted Offaly West portion of the Midlands Trail Network (MTN), providing connectivity with the Grand Canal Way and Lough Boora Discovery Park.

As identified in Section 5.3.9.2, a number of tourist attractions are located in proximity of the Proposed Project. In addition to the Grand Canal Way, MTN and Offaly Way described above, the nearest tourist attraction is Lemanaghan Monastic Site (Saint Manchan's Well), located c. 0.5 km from the southern boundary of the site. Based on the literature review in Section 5.3.9.3, the majority of studies indicate that wind farm developments do not deter visitors to tourist attractions or scenic landscapes where turbines are visually evident.

While there is a tourist attraction located within the Proposed Project site (i.e., Banagher Line), considering the human interference there is potential for a negative, slight, long-term impact on tourism, which is Not Significant, during the operational phase of the Proposed Project. The potential effect on archaeological features and cultural heritage sites in proximity to the site from the operational phase of the Proposed Project have been addressed in detail within Chapter 13: Cultural Heritage and Chapter 14: Landscape and Visual.

Mitigation Measures

Please see Section 13.3.4 of Chapter 13 and Section 14.7.3 of Chapter 14 for associate mitigation on tourism from a cultural heritage and landscape perspective, respectively. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

The Proposed Project will have a positive, slight, long-term impact on tourism due to the social and recreational benefits associated with the recreational amenity walkways/ paths, which is Not Significant. The operational wind farm will have no impact on the running or operation of local and regional tourist attractions. It is considered that the Proposed Project will have a negative, imperceptible, long-term, residual effect of visitor experience to attractions in the wider landscape which is Not Significant.

Significance of Effects

The effect on tourism due to the operation of the Proposed Project is Not Significant.

5.8.3.1.6 *Residential Amenity*

Pre-Mitigation Impact

Proposed Wind Farm

Potential impacts on residential amenity during the operational phase of the Proposed Wind Farm could arise primarily due to noise, shadow flicker or changes to visual amenity. Detailed noise and shadow flicker modelling have been carried out as part of this EIAR, which shows that the Proposed Wind Farm will be capable of meeting all required guidelines in relation to noise thresholds and the shadow flicker thresholds set out in the DoEHLG 2006 Guidelines or Draft DoHPLG 2019 Guidelines if adopted.

An air quality impact assessment can be found in Chapter 10, which details potential impacts from emissions to air during the construction and operational phase. There will be a long-term, imperceptible, negative effect on air quality due to dust and exhaust emissions during the operational phase, which is Not Significant.

The noise and vibration assessment is detailed in Chapter 12. It should be noted that the Proposed Wind Farm will be brought in line with the noise thresholds imposed on the development by the consenting authority should permission be granted for the Proposed Project. The Proposed Wind Farm will have a negative, not significant, long-term impact on noise sensitive locations, which is Not Significant.

The visual impact of the Proposed Project is addressed comprehensively in Chapter 14: Landscape and Visual. The Proposed Project has been designed to maximise turbine separation distances to dwellings in the area, with no turbines located within 880 m of an occupied dwelling. An assessment of roadside screening was carried out for roads within 5 km of the proposed turbine locations, with both the methodology and findings of this described in Chapter 14. Many of these roads have partial/intermittent screening or dense/full visual screening, and therefore intermittent views rather than full visibility of the site. A negative, moderate, long term visual impact is anticipated which is Not Significant.

VP11, captured along the R436 Regional Road in the townland of Lemanaghan, is representative of residential receptors with open views towards the site in close proximity (within <1km from the site). A significant, long term, negative visual impact was deemed to occur here however, this location represents one of the few areas where such open views toward the proposed turbines are available; most residential receptors in the surrounding area will not experience comparable levels of visibility.

As part of the scoping and consultation exercise undertaken by MKO, the national and regional broadcasters and fixed and mobile phone operators were contacted with regard to potential interference from the Proposed Wind Farm. Full details are provided in Section 2.8 of the EIAR (in Chapter 2: Background to the Proposed Project) and Section 15.2 of the EIAR (in Chapter 15: Material Assets – Other Material Assets). Copies of scoping replies received are presented in Appendix 2-1 of the EIAR. The Proposed Wind Farm will have no impact on telecommunications.

Proposed Grid Connection

Potential impacts on residential amenity during the operational phase of the proposed 220KV substation could arise primarily due to noise and changes to visual amenity. Detailed noise modelling has been carried for the proposed substation, please see below and Chapter 12: Noise and Vibration for details. The visual effects of the proposed onsite 220kV onsite substation and the OHL have been assessed in Chapter 14 of this EIAR, and the nearest sensitive receptor is located approximately 350 m north of the proposed 220kV substation location and will be further screened by hedgerows and topography.

In the absence of mitigation, the Proposed Grid Connection will have a negative, not significant and long-term impact in terms of noise and vibration during the operational phase, which is Not Significant. In terms of visual amenity, in the absence of mitigation the Proposed Grid Connection will have a negative, moderate, long-term impact during the operational phase, which is Not Significant.

Mitigation Measures

- There are no turbines proposed within 880 m (4 x tip height) of any sensitive receptors.
- All mitigation measures outlined in Chapter 12 (Noise and Vibration), shadow flicker (Section 5.7 of this chapter) and Chapter 14 (Landscape and Visual) in this EIAR will be implemented in order to reduce insofar as possible, impacts on residential amenity at properties located within the in the vicinity of the Proposed Project;
- A 2.6 m high palisade fence will be erected around the substation which will be painted RAL 6005 (green) to help blend the substation infrastructure in with the surrounding rural landscape;
- Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effects

With the implementation of the mitigation measures outlined in relation to noise, and shadow flicker, and air quality, the Proposed Project will have a negative, slight, long-term, residual effect on residential amenity, which is Not Significant.

Significance of Effects

The effect on residential amenity due to the operation of the Proposed Project is Not Significant.

5.8.3.2 Health

5.8.3.2.1 *Health and Safety*

Pre-Mitigation Impact

Proposed Project

It is not anticipated that the operation of the Proposed Project will present a danger to the public and livestock. Rigorous safety checks are conducted on the turbines, substation and ancillary infrastructure during design, construction, commissioning and operation to ensure the risks posed to staff, landowners and general public are negligible. This will have a potential negative, slight, long-term, impact on health and safety during the operation phase, which is Not Significant. Any waste generated at the Proposed Project will be managed in accordance the Waste Management Act 1996 and under the relevant EU legislation.

Mitigation Measures

The following mitigation measures will be implemented during the operation of the Proposed Project to ensure that the risks posed to staff, landowners and general public remain negligible throughout the operational life of the Proposed Project.

- Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits. The doors will only be unlocked as required for entry by authorised personnel and will be locked again following their exit.
- Signs will be erected at suitable locations such as, amenity access points and carparks, setting out the conditions of public access under the relevant legislation and providing normal hours (and out of hours) contact details. Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed, faded, or are becoming hidden by vegetation or foliage, with prompt action taken as necessary.
- Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include:
    - Buried cable route markers at 50 m (maximum) intervals and change of cable route direction;
    - Directions to relevant turbines at junctions;
    - "No access to Unauthorised Personnel" at appropriate locations;
    - Speed limits signs at site entrance and junctions;
    - "Warning these Premises are alarmed" at appropriate locations;
    - "Danger HV" at appropriate locations;
    - "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance;
    - "No unauthorised vehicles beyond this point" at specific site entrances; and
    - Other operational signage required as per site-specific hazards.
- The proposed onsite 220kV substation, which will be operated by EirGrid will be locked and fenced off from public access. The proposed onsite 220kV substation will be operational remotely and manually 24 hours per day, 7 days a week. Supervisory operational and monitoring activities will be carried out remotely using a SCADA system, with the aid of computers connected via a telephone modem link.
- Periodic service and maintenance work which include some vehicle movement.
- For operational and inspection purposes, substation access is required.
- Servicing of the substation equipment will be carried out in accordance with the manufacturer's specifications, which would be expected to entail the following:
    - Six-month service – three-week visit

- Annual service – six-week visit
- Weekly visits as required.

An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site. Access for emergency services will be available at all times.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The Health and Safety Plan for the operational phase will be completed in accordance with the most up to date health and safety legislation in force at the time of operation and will be submitted to the relevant local authority prior to the operational phase of the Proposed Project.

The components of a wind turbine are designed to last up to 30-35 years and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the Proposed Wind Farm regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site's health and safety requirements.

Residual Effects

With the implementation of the above mitigation measures, there will be a negative, imperceptible, long-term, residual effect on health and safety during the operational life of the Proposed Project, which is Not Significant.

Significance of Effects

The effect on health and safety due to the operation of the Proposed Project is Not Significant.

5.8.3.2.2 *Air Quality: Dust and Exhaust Emissions*

Pre-Mitigation Impact

Proposed Project

The sources of dust and other emissions generated during the operational phase will be from visits by maintenance staff in light good vehicles (LGVs) approximately 1-2 visits per day, and private LGVs from tourists who may use the amenity car parks that will be provided to the public to utilise the internal amenity tracks within the site and the greater connectivity of the site to the Midlands Trail Network. Pre-mitigation impacts are considered to be slight, negative and long term, which is Not Significant.

Mitigation Measures

All mitigation as outlined in Section 10.3.3 of Chapter 10: Air Quality will be implemented in order to reduce insofar as possible, impacts on air quality in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

Residual Effect

With the implementation of the mitigation measures outlined in Chapter 10 and Chapter 18, there will be long-term, imperceptible, negative residual effects to sensitive receptors access and maintenance during the operational phase, which is Not Significant.

Significance of Effects

The effect on air quality due to the operation of the Proposed Project is Not Significant.

5.8.3.2.3 *Climate*

Pre-Mitigation Impact

Proposed Project

As detailed in Section 11.3.2.3 of Chapter 11: Climate, the EPA reported Ireland is not on track to meet the 51% emissions reduction target by 2030 (as compared to 2018 levels) based on most up to date EPA projections which include many of Climate Action Plan 2024 measures[65]. The first two carbon budgets (2021-2030), which aim to support achievement of the 51% emissions reduction goal, are projected to be exceeded by a significant margin. Carbon Budget 1 to be exceeded by a margin of 8 to 12 $MtCO_2e$. Carbon Budget 2 to be exceeded by a margin of 77 to 114 MtCO2e (with carryover from Carbon Budget 1). From 10.6 $MtCO_2e$ in 2018, emissions from the Energy Industries sector are projected to decrease to between 3.4 and 4.4 $MtCO_2e$ in 2030 (a 59 to 68% reduction). Renewable energy generation at the end of the decade is projected to range from 69 to 68% of electricity generation. From 21.4 $MtCO_2e$ in 2018, total emissions from the agriculture sector are projected to be between 18.0 and 21.6 $MtCO_2e$ in 2030 (a 16% reduction in WAM and 1% increase in WEM). Transport emissions are projected to decrease from 12.3 MtCO2e in 2018 to between 9.7 $MtCO_2e$ and 11.2 $MtCO_2e$ in 2030 (a 9 to 21% reduction). The EPA report highlights that whilst emissions are beginning to reduce, transformative measures will be needed to meet National Climate ambitions.

Ireland will therefore have to meet even more demanding climate change and renewable energy supply obligations in order to play its part in achieving the European climate and energy ambitions. As announced in December 2022, the Irish Government have pledged to generate 80% of the country's electricity supply from renewable sources by 2030[66]. The development of additional indigenous wind energy generating capacity, such as that proposed from the Proposed Wind Farm, will help to reduce carbon emissions and improve Ireland's security of energy supply.

The Proposed Project will offer significant benefits in terms of renewable energy production and reductions in greenhouse gas emissions and other air pollutants. In this regard, it will have a positive, moderate, long-term impact, which is Not Significant. The carbon loss and savings due to the Proposed Project are discussed in Section 11.5.2 of Chapter 11 of this EIAR.

Long-term imperceptible negative effects on climate are predicted in relation to the generation of additional traffic during the operational phase, in the form of light goods vehicles (LGV's) visiting the site for inspections and maintenance, and in the form of public vehicle access to amenity car parks. Waste is not proposed to be generated onsite during the operational phase, any waste that does arise will be minimal and any impact will be short-term, negative and imperceptible, which is Not Significant.

Mitigation Measures

All mitigation as outlined in Chapter 11: Climate will be implemented in order to reduce insofar as possible, impacts on climate in the vicinity of Proposed Project construction works. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of measures.

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[65] *EPA, 2025. Ireland's Provisional Greenhouse Gas Emissions 2024-2055 Available at: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-Provisional-1990-2024-GHG-Report-1716.pdf*

[66] *Department of the Environment, Climate and Communications (2025) Climate Action Plan 2025 < https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/climate-action-plan-2025/>*

Residual Effects

It is estimated that the Proposed Project, with a potential installed capacity of 90MW which will result in the net displacement of approximately 56,375 tonnes of Carbon Dioxide (CO_2) per annum (Against EU FFC). There will be positive, moderate, long-term residual effect, which is Not Significant, on CO_2 emissions and energy targets with the implementation of the Proposed Project.

Significance of Effects

The effect on climate due to the operation of the Proposed Project is Not Significant.

5.8.3.2.4 *Water Quality*

Pre-Mitigation Impact

Proposed Wind Farm

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads, hardstand areas and amenity pathways. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works. These minor activities could, however, result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality. During such maintenance works there is a small risk associated with release of hydrocarbons from site vehicles, although it is not envisaged that any significant refuelling works will be undertaken on site during the operational phase. The assessment concludes that there will be negative, slight, temporary impacts during the operational phase of the Proposed Wind Farm, which is Not Significant.

Placed concrete in turbine bases and foundations can also have minor local effects on groundwater quality over time. However, due to the limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts considered to be imperceptible.

Proposed Grid Connection

During the operational phase the wind farm control building, included in the onsite substation compound, will include staff welfare facilities. The release of untreated wastewater can affect groundwater quality. The assessment concludes that there will be direct, negative, slight, temporary, unlikely effect on local groundwater, which is Not Significant.

Mitigation Measures

Please see Section 9.5.3 of Chapter 9 for relevant mitigation and monitoring proposals for the Proposed Project. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of mitigation and monitoring measures for the Proposed Project.

Residual Effects

With the implementation of the Proposed Project drainage measures identified in Chapter 9, and based on the post-mitigation assessment of runoff, residual effects on water quality are considered to be negative, imperceptible and temporary, which is Not Significant.

Significance of Effects

The effect on water quality due to the operation of the Proposed Project is Not Significant.

5.8.3.2.5 *Noise and Vibration*

Pre-Mitigation Impact

Proposed Wind Farm

A baseline assessment of the existing background noise conditions was carried out, the results of which are presented in Chapter 12 of the EIAR. A noise assessment of the operational phase of the Proposed Project has also been carried out through modelling of the Proposed Project using noise prediction software. The findings of the assessment confirmed that the predicted operational noise levels from the Proposed Wind Farm will be within the relevant best practice noise criteria for the detailed potential turbine specification. Pre-mitigation impacts from noise and vibration from the Proposed Wind Farm during the operational phase are considered negative, not significant and long term, which is Not Significant.

Details of the noise assessment carried out by AWN Consulting are presented in Chapter 12 of the EIAR.

Proposed Grid Connection

The predicted noise level from the operation of the proposed onsite 220kV substation at the nearest sensitive receptor is 33 dB L_{Aeq},T. This is considered unlikely to result in any adverse impacts at nearby NSLs. Pre-mitigation impacts from noise and vibration from the Proposed Grid Connection during the operational phase are considered negative, not significant and long term, which is Not Significant.

Mitigation Measures

Please see Section 12.6.2 of Chapter 12 for noise and vibration mitigation and monitoring proposals for the Proposed Project during the operational phase. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures for a full list of mitigation and monitoring measures for the Proposed Project.

Residual Effects

The predicted residual operational turbine noise, substation and ancillary works operation effects at the nearest noise sensitive locations are negative, not significant and long-term, which is Not Significant.

The noise assessment notes that these effects should be considered in terms that the effect is variable, and that this assessment considers periods of the greatest potential effect.

Significance of Effects

The effect on human health from noise and vibration due to the operation of the Proposed Project is Not Significant.

5.8.3.2.6 *Traffic and Transport*

Pre-Mitigation Impact

Proposed Project

Major component failures are considered unlikely with the implementation of normal operational and maintenance activities and therefore the presence of HGVs at the site is considered extremely rare until the decommissioning phase begins. Should a turbine component need replacing, the measures detailed in 5.8.2.2.6 and Chapter 15 will be implemented.

All site visits for maintenance and inspection purposes will be done so via LGVs with just 1-2 visits per month. Likewise, amenity visitors to the site are likely to use private vehicles and utilise one of the three amenity car parks located at access points spread around the site to minimise volumes of traffic arriving at one location. Amenity visitors will also access the site on foot, via connectivity with the amenity tracks with the wider MTN. Pre-mitigation impacts are considered negative, imperceptible, long term on existing road users, which is Not Significant.

Mitigation Measures

Due to the very low volumes of traffic forecast to be generated during this stage no mitigation measures are required.

Residual Effects

Impacts on local road users during the operational phase are considered to be a negative, imperceptible, long term residual effect, which is Not Significant.

Significance of Effects

The effect on traffic due to the operation of the Proposed Project is Not Significant.

5.8.3.2.7 *Major Accidents and Natural Disasters*

Pre-Mitigation Impact

A risk register has been developed which contains all potentially relevant risks identified during the construction phase of the Proposed Project. A total of nine risks specific to the construction of the Proposed Project have been identified and are presented in Chapter 16: Major Accidents and Natural Disasters: flooding, major road traffic accident, contamination event, major fire, bog fire, civil disorder at large events, adverse weather conditions, loss of critical infrastructure, peat instability. As outlined in Chapter 16 Section 16.4 of this EIAR, the scenarios with the highest risk score in terms of the occurrence of major accident and/or disaster during the operation were identified as ‘Contamination Event’, and ‘Major Fire’. Therefore, in the absence of mitigation, the impact of both contamination and major fires unlikely, temporary, moderate, negative effects, which are Not Significant

Mitigation Measures

Mitigation measures have been outlined in Section 5.8.2.2.7 above, and in Chapter 8: Land, Soils and Geology, Chapter 9: Water and Chapter 16: Major Accidents and Natural Disasters. Please refer to Chapter 18: Schedule of Mitigation and Monitoring Measures which details all proposed mitigation and monitoring measures for the operation of the Proposed Project.

Residual Effects

The impact assessment concludes that the risk of a major accident and/or disaster during the construction phase of the Proposed Project is considered 'low' in accordance with the "*Guide to Risk Assessment in Major Emergency Management*"[67]. It is considered that when the mitigation and monitoring measures outlined in the CEMP (Appendix 4-4) are implemented and adhered to there the residual effects associated with the operation of Proposed Project will be unlikely, temporary, slight, negative effects, which are Not Significant.

Significance of Effects

The effect to/from Major Accidents and Natural Disaster due to the operation of the Proposed Project is Not Significant.

5.8.3.2.8 *Shadow Flicker*

Pre-Mitigation Impact

Proposed Project

As indicated in Table 5-9, a total of 58 residential properties may experience daily shadow flicker as a result of the Proposed Wind Farm in excess of the DoEHLG 2006 Guidelines threshold of 30 minutes per day. No properties will experience an exceedance of the DoEHLG 2006 Guidelines total annual guideline limit of 30 hours per year. The prediction modelling does not take vegetation screening, screening by adjacent buildings or extant window orientation into account. Therefore, in reality, shadow flicker occurrences may be less than predicted. However, excluding these circumstances and relying on the prediction modelling alone, shadow flicker could potentially have a long-term, slight, negative impact on each sensitive receptor, which is Not Significant.

There is no potential for the Proposed Grid Connection infrastructure to cause shadow flicker, and so no impact is predicted.

Mitigation Measures

Where daily shadow flicker exceedances have been predicted at buildings by the modelling software, a site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. This will determine if the receptor has an actual line of sight to any turbine and actual potential for shadow flicker to occur. Once this exercise is completed and all the potentially affected properties, the following measures will be employed.

Wind Turbine Control Measures

If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented.

Wind turbines can be fitted with shadow flicker control units to allow the turbines to be controlled to prevent the occurrence of shadow flicker at properties surrounding the wind farm. The shadow flicker control units will be added to any required turbines and are not cost prohibitive.

[67] *Department of Environment, Heritage and Local Government, 2010. A Guide to Risk Assessment in Major Emergency Management. Available at: https://assets.gov.ie/117528/e06a7ca8-a634-4f70-a9a7-b405ee08429a.pdf*

A shadow flicker control unit allows a wind farm's turbines to be programmed and controlled using the wind farm's SCADA control system to change a particular turbine's operating mode during certain conditions or times or even turn the turbine off if necessary.

All predicted incidents of shadow flicker can be pre-programmed into the wind farm's control software. The wind farm's SCADA control system can be programmed to shut down any particular turbine at any particular time on any given day to ensure that shadow flickers occurrences at properties which are not naturally screened or cannot be screened with measures outlined above. Where such wind turbine control measures are to be utilised, they need only be implemented when the specific combined circumstances occur that are necessary to give rise to the shadow flicker effect in the first instance. Therefore, if the sun is not shining on a particular day that shadow flicker was predicted to occur at a nearby property, there would be no need to shut down the relevant turbines that would have given rise to the shadow flicker at the property. Similarly, if the wind speed was below the cut-in speed that caused the turbine rotor to rotate and give rise to a shadow flicker effect at a nearby property, there would be no need to shut down the relevant turbines that otherwise would have caused shadow flicker.

The atmospheric variables that determine whether shadow flicker will occur or not are continuously monitored at the wind farm site and the data fed into the wind farm's SCADA control system. The strength of direct sunlight is measured by way of photocells, and if the sunlight is of sufficient strength to cast a shadow, the shadow flicker control mechanisms come into effect. Wind speed and direction are measured by anemometers and wind vanes on each turbine and on the wind farm's met mast, and similarly, and if wind speed and direction is such that a shadow will be cast, the shadow flicker control mechanisms come into effect. The moving blades of the turbine will require a short period of time to cease rotating and as such there may be a very short period (less than 3 to 5 minutes) during which the blades are slowed to a complete halt. The turbines giving rise to shadow flicker may be turned off on different days to prevent excessive wear and tear on any single turbine.

To ensure that the model and SCADA system is accurate and working well a site visit will be carried out to verify the system. The shadow flicker prediction data will be used to select dates on which a shadow flicker event could be observed at one or multiple affected properties and the following process will be adhered to.

1. *Recording the weather conditions at the time of the site visit, including wind speeds and direction (i.e., blue sky, intermittent clouds, overcast, moderate breeze, light breeze, still, etc.).*
2. *Recording the house number, time and duration of site visit and the observation point GPS coordinates.*
3. *Recording the nature of the sensitive receptor, its orientation, windows, landscaping in the vicinity, any elements of the built environment in the vicinity, vegetation.*
4. *In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded.*
5. *The data will then be sent to the wind farm operational team to confirm that the model and SCADA system are working.*
6. *Following 12 months of full operation of the Proposed Project a report can be prepared for the Local Authority describing the shadow flicker mitigation measures used at the wind farm and confirming the implementation and successful operation of the system.*

This method of shadow flicker mitigation has been technically well-proven at wind farms in Ireland and in areas outside Ireland that experience significantly longer periods of direct sunlight. In order to demonstrate how the SCADA control system can be applied to switch off particular turbines at the relevant times and dates, Table 5-10 below lists the 58 no. sensitive receptors at which a shadow flicker mitigation strategy may be necessary to ensure the DoEHLG 2006 Guidelines 30-minute per day shadow flicker threshold is not exceeded. In this case, the relevant turbine(s) would be programmed to switch off for the time required to reduce daily shadow flicker to below the guideline limit of 30 minutes. The SCADA control system would be utilised to control shadow flicker in the absence of being able to agree alternative mitigation measures with the relevant property owner. The mitigation

strategy outlined in Table 5-10 below is based on the theoretical precautionary scenario. The details presented in Table 5-10 list the days per year and the turbines that could be programmed to switch off at specific times, in order to reduce daily shadow flicker to a maximum of 28 minutes, which is below the DoEHLG 2006 Guidelines limit of 30 minutes.

This measure will be utilised at the Proposed Wind Farm to prevent incidences of shadow flicker at any house if required. Therefore, the Proposed Wind Farm could be brought in line with the requirements of the Draft DoHPLG 2019 Guidelines should they come into force during the planning application process for this development.

Should a complaint be received within 12 months of commissioning of the Proposed Wind Farm, field investigation/monitoring will be carried out by the wind farm operator at the affected property. Notwithstanding the approach set out above should shadow flicker associated with the permitted development be perceived to cause a nuisance at any home, the affected homeowner is invited to engage with the Applicant. The homeowner will be asked to log the date, time and duration of shadow flicker events occurring on at least five different days. The provided log will be compared with the predicted occurrence of shadow flicker at the residence, and if necessary, a field investigation will be carried out.

Screening Measures

In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at residential receptor locations, mitigation options will be discussed with the affected homeowner, including:

- Installation of appropriate window blinds in the affected rooms of the residence;
- Planting of screening vegetation;
- Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation.

If agreement can be reached with the homeowner, then it would be arranged for the required mitigation to be implemented in cooperation with the affected party as soon as practically possible and for the full costs to be borne by the wind farm operator.

Table 5-10 Shadow Flicker Mitigation Strategy for Daily Shadow Flicker Exceedance – Turbine Numbers and Days

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
3	31	T10	74-88, 257-272	15th-29th March, 14th-29th September	00:28:00
2	58	T05	123-151, 194-222	3rd-31st May, 13th July-10th August	00:28:00
4	38	T14	107-125,220-238	17th April-5th May, 8th-26th August	00:28:00
5	57	T01, T02	81-84, 122-146, 199-224, 262, 263	22nd-25th March, 2nd-26th May, 18th July-12th August, 19th-20th September	00:28:00
6	64	T07, T08	1-7, 79-93, 253-267, 339-365	1st-7th January, 20th March-3rd April, 10th-24th September, 5th-31st December	00:28:00
7	86	T05	130-215	10th May-3rd August	00:28:00
9	67	T08, T10	1-7, 101-116, 229-244, 339-365	1st-7th January, 11th-26th April, 17th August-2nd September, 5th-31st December	00:28:00
8	57	T10	1-19, 328-265	1st-19th January, 24th November-31st December	00:28:00
1243	11	T14	78-82, 263-268	19th-23rd March, 20th-25th September	00:28:00
10	38	T01	114-132, 213-231	24th April-12th May, 1st-19th August	00:28:00

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
1207	18	T14	84-91, 254-263	25th March-1st April, 11th-20th September	00:28:00
13	34	T14, T15	157-188, 269, 270	6th June-7th July, 26th-27th September	00:28:00
12	37	T05	117-134, 211-229	27th April-14th May, 30th July-17th August	00:28:00
11	67	T11	1-24, 323-265	1st-24th January, 19th November-31st December	00:28:00
17	36	T01	117-134, 211-228	27th April-1st May, 20th July-16th August	00:28:00
14	64	T04	141-204	21st May-23rd July	00:28:00
15	64	T05	132-213	12th May-1st August	00:28:00
19	66	T05	140-205	20th May-24th July	00:28:00
25	31	T01	114-128, 217-232	24th April-8th May, 8th-20th August	00:28:00
24	22	T10	85-95, 251-261	26th March-5th April, 8th-18th September	00:28:00
23	19	T04	131-140, 206-214	11th-20th May, 25th July-2nd August	00:28:00
29	32	T01	119-134, 211-226	29th April-14th May, 1st July-14th August	00:28:00

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
30	31	T05	123-138, 207-222	3rd-18th May, 26th July-10th August	00:28:00
31	9	T04	130, 132-135, 210, 212-214	10th May, 12th-15th May, 29th July, 31st July-2nd August	00:28:00
32	56	T01	1-27, 320-365	1st-27th January, 26th November-31st December	00:28:00
35	35	T04	139-155, 190-207	19th May-4th June, 9th-16th July	00:28:00
37	47	T01	5-17, 319-341	5th-17th January, 15th November-7th December	00:28:00
42	23	T15	108-118, 227-238	18th-28th April, 15th-26th August	00:28:00
40	53	T11	1-17, 330-365	1st-17th January, 26th November-31st December	00:28:00
41	36	T05	128-146, 200-216	8th-26th May, 19th July-4th August	00:28:00
43	24	T15	115-126, 219-230	25th April-6th May, 7th-18th August	00:28:00
45	29	T08, T10	1-5, 96-104, 242-250, 340-365	1st-5th January, 6th-14th April, 30th August-7th September, 6th-31st December	00:28:00
47	26	T15	122-134, 212-224	2nd-14th May, 31st July-12th August	00:28:00

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
48	22	T15	113-123, 222-232	23rd April-3rd May, 10th-20th August	00:28:00
49	39	T05	134-152, 193-212	14th May-1st June, 12th-31st July	00:28:00
51	16	T10	66-73, 273-280	7th-14th March, 30th September-1st October	00:28:00
56	10	T10	72-76, 270-274	13th-17th March, 27th September-1st October	00:28:00
59	12	T10	69-72, 274-279	8th-13th March, 1st-6th October	00:28:00
58	42	T11	1-11, 335-365	1st-11th January, 1st-31st December	00:28:00
60	16	T10	43-50, 297-304	13th-19th February, 24th-31st October	00:28:00
61	9	T10	62-65, 281-285	3rd-6th March, 8th-12th October	00:28:00
64	48	T05	149-196	29th May-15th July	00:28:00
66	17	T02	121-129, 216-223	1st-9th May, 4th-11th August	00:28:00
65	28	T11	1-5, 343-365	1st-5th January, 9th-31st December	00:28:00
69	14	T02	122-127, 218-225	2nd-7th May, 6th-13th August	00:28:00

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
70	16	T05	139-146, 199-207	19th-26th May, 18th-26th July	00:28:00
1453	8	T02	45-47, 300-303	14th-16th February, 27th-30th October	00:28:00
73	27	T11	1-4, 343-365	1st-4th January, 9th-31st December	00:28:00
75	19	T03	132-140, 205-214	12th-20th May, 24th July-2nd August	00:28:00
76	28	T05	142-155, 190-203	22nd May-4th June, 9th-22nd July	00:28:00
77	15	T03	129-136, 209-215	9th-16th May, 29th July-3rd August	00:28:00
27	2	T04	129, 215	9th May, 3rd August	00:28:00
28	37	T08	29-43, 128, 128, 130, 214, 216, 217, 219, 303-317	29th January-12th February, 7th-8th May, 10th May, 2nd August, 4th-5th August, 7th August, 30th-31st October, 1st-13th November	00:28:00
67	8	T10	70-73, 273-276	11th-14th March, 30th September-3rd October	00:28:00
74	7	T02	122-126, 221, 222	2nd-6th May, 9th-10th August	00:28:00

Property No.	No. of Days 30min/day Threshold is Exceeded	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Day Nos) *	Days of Year When Mitigation May be Required (Dates)	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)
84	8	T08	30-33, 314-317	30th January-2nd February, 10th-13th November	00:28:00
90	2	T03	211, 213	30th July, 1st August	00:28:00
101	12	T15	2, 346, 348, 350, 352-354, 358-360, 362, 364	2nd January, 12th December, 14th December, 16th December, 18th-20th December, 24th-26th December, 29th December, 30th December	00:28:00

Residual Effects

Following the implementation of the above suite of mitigation measures, the DoEHLG 2006 Guidelines limit of 30 mins per day or 30 hours per year will not be exceeded and this will result in a negative, imperceptible, long-term, residual effect from shadow flicker on human health.

Significance of Effects

The effect on human health from shadow flicker due to the operation of the Proposed Project is Not Significant.

5.8.3.2.9 *Interference with Telecommunication Systems and EMF*

Pre-Mitigation Impact

Proposed Project

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The alternating current, electrical generating and transformer equipment associated with wind turbines, like all electrical equipment, also generates its own electromagnetic fields, and this can interfere with broadcast communications.

EMF is often colloquially considered to have a negative effect on human health. However, as stated in Section 5.4.4 above, the EMF and ELF of electricity cables are in compliance with EU guidelines for the exposure of EMF to humans. As such, there is no potential for negative health effects on the local population due to EMF or ELF produced by any of the proposed infrastructure.

The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path. This interference can be overcome by the installation of deflectors or repeaters.

As part of the scoping and consultation exercise undertaken by MKO, the national and regional broadcasters and fixed and mobile phone operators were contacted regarding potential interference from the Proposed Project. Full details are provided in of Chapter 2: Background to the Proposed Project and Section 15.2 (Telecommunications and Aviation) of Chapter 15: Material Assets. Copies of the scoping responses received are presented in Appendix 2-1 of the EIAR. No impacts were identified to telecommunications from the Proposed Project.

Mitigation Measures

Following the scoping and consultation exercise undertaken by MKO, further consultation with required telecommunication providers was held by Ai Bridges. While no mitigation measures are required to prevent significant effects, it is standard practice of 2RN to produce a protocol document for wind farm developments, which will be signed by the developer prior to construction. The Protocol Document is further detailed in Section 15.2.4 of Chapter 15 and in Appendix 15-6 Telecommunications Impact Assessment.

Residual Effects

Following the implementation of the mitigation measures above, there will be no residual effect from the Proposed Project on communication systems.

Significance of Effects

The effect on communications and effect on human health from EMF due to the operation of the Proposed Project is Not Significant.

5.8.4 Decommissioning Phase

The wind turbines proposed as part of the Proposed Project are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the site may be decommissioned fully. The substation will remain in place as it will be under the ownership of ESB/EirGrid.

The works required during the decommissioning phase are described in Section 4.13 in Chapter 4: Description of the Proposed Project. Any impact and consequential effect that occurs during the decommissioning phase will be similar to that which occurs during the construction phase, however to a lesser extent and lesser duration, and the mitigation measures outlined above will be implemented during the decommissioning phase also. A Decommissioning Plan has been prepared as part of this EIAR and is included as Appendix 4-8. This Decommissioning Plan follows the most up to date NatureScot guidance. By its nature, the Decommissioning Plan is a working document and, in accordance with the NatureScot guidance, an updated Decommissioning Plan will be agreed with the local authorities three months prior to decommissioning the Proposed Project. The principles that will inform the final decommissioning plan are contained in the CEMP in Appendix 4-4.

5.8.5 Cumulative Effects

For the assessment of cumulative impacts, any other existing, permitted or proposed developments (wind energy or otherwise) have been considered. Further information on projects considered as part of the cumulative assessment, including the Draft Rehabilitation Plan and Midlands Trail Network are given in Chapter 2: Background to the Proposed Project. This cumulative list also includes the proposed Bellair Wind Farm, located 2.7 km north of the Proposed Wind Farm at its closest point. The impacts with the potential to have cumulative effects on human beings are discussed below and in more detail in the relevant chapters: Chapter 10: Air Quality, Chapter 12: Noise and Vibration, Chapter 14: Landscape and Visual, and Chapter 15: Material Assets. A summary is detailed below.

As part of the IPC licence rehabilitation requirements, BnM is required to produce cutaway bog decommissioning and rehabilitation plans, please see Appendix 2-4 to view the Draft Rehabilitation Plan for the site. These plans have considered the Proposed Project footprint and demonstrate that both peatland rehabilitation and renewable energy can coexist harmoniously onsite. Irrespective of any further development on the site, BnM's statutory duties to discharge the conditions of its IPC Licence will remain ongoing.

The Peatland Climate Action Scheme (PCAS) which comprises enhanced peatland rehabilitation (above and beyond IPC licence requirements). This scheme is in addition to the IPC licence requirements and therefore does not form part of the Proposed Wind Farm application but has been cumulatively assessed.

5.8.5.1 Construction Phase

5.8.5.1.1 *Population*

Population Levels

The assessment above in Section 5.8.2.1.1 demonstrated that there will be no significant effect on population levels from the Proposed Project during the construction phase. As the Proposed Project will

not cause to changes to trends, population density, household size or age structure, it is therefore considered there can be no cumulative effects with other proposed or consented projects and plans that may be constructed in parallel with the Proposed Project.

Employment and Investment

The assessment above in Section 5.8.2.1.2 demonstrated that there will be a positive, significant, short-term, direct effect on employment levels during the construction phase (estimated to be 24 months) and a positive, slight, short-term effect on investment and employment in the local and wider regions due to the contributions paid to the Offaly County Council at the commencement of the construction phase.

It is therefore considered that there will be a positive, significant, short-term cumulative effect on employment should the Proposed Project be constructed in parallel with other proposed, planning and permitted projects and plans as identified in Section 2.10 in Chapter 2, and a positive, slight, long term cumulative effect on investment in local and regional infrastructure and communities due to additional commercial rates paid to the local authorities by other proposed or consented projects and plans.

Land Use Patterns and Activities

Due to the small footprint of the Proposed Project infrastructure on a site scale and a local scale, and the continuation of land use and activities onsite and in the wider area, there will be no significant effects on land use and activities during the construction phase. Therefore, it is considered there will be no cumulative effects on land use and activities should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Substitute Consent and EPA Licensed Activities

As identified in Table 2-2 in Chapter 2, an application for substitute consent was submitted to An Coimisiún Pleanála (Case Ref: SU19.323676) on 12th September 2025, for peat extraction and ancillary works from July 1988 to the present day that have been carried out within Lemanaghan Bog. A Remedial Natura Impact Statement (rNIS) and Remedial Environmental Impact Assessment Report (rEIAR) was submitted with this application. Impacts on land use within the substitute consent application during identified activities to be carried out on Lemanaghan Bog in the future were determined to be long term, significant, and positive, which is Significant, due to the provisions outlined in the Draft Rehabilitation Plan.

The implementation of the Draft Rehabilitation Plan in conjunction with the construction, operation and decommissioning of the Proposed Project as well as proposed, permitted and operational plans and projects listed in Chapter 2 of its EIAR is considered. The overall footprint of the Proposed Project will be less than 3% of the total area of the site and therefore will not impact or change the overall goals and outcomes of the Draft Rehabilitation Plan. As such, it is the intention of the BnM to integrate the peatland remedial measures proposed as part of the substitute consent project with the Proposed Project. Overall, there are no significant negative cumulative effects when considering the future works associated with the Lemanaghan Bog (i.e., the Draft Rehabilitation Plan) and the Proposed Project.

Peatland Climate Action Scheme

In 2023 the Peatland Climate Action Scheme (PCAS) selected Ballaghurt and Glebe Bogs located approximately 4.4km west of the Proposed Wind Farm at its closest point (i.e., T01). In 2024, PCAS has selected Curraghalassa Bog and Derrynagun bog which are adjacent to the Proposed Project site. These two areas are on the southern side of the R436 road which connects Ferbane, Co. Offaly to Ballycumber, Co. Offaly. The two sections include an area of drained high bog, Curraghalassa Bog, located 65m south of the site and a larger section of cutaway bog, Derrynagun Bog, located 105m south of the site. Please note, the Curraghlassa Bog and Derrynagun Bog discharge to the same watercourses as Lemanaghan Bog and there is the potential for cumulative effects. The PCAS measures in the

Derrynagun and Curraghalassa bogs will provide greater surface water attenuation and surface water quality benefits in and downstream of the restoration areas. These PCAS measures will have a positive effect on bog hydrogeology.

There is therefore no potential for significant cumulative effects to occur between the Proposed Project and PCAS works ongoing in nearby bogs during construction, operation or decommissioning.

Property Values

The assessment above in Section 5.8.2.1.4 concludes that there is the uncertain potential for a short-term negative imperceptible residual effects which are Not Significant, due to the construction phase of Proposed Project. There are no other cumulative turbines located within 2 km of the proposed turbines and so this area within 1 km, where there is potential for impacts on property values, will not overlap with any other cumulative turbines. On that basis it is concluded that there is no potential for cumulative effects on property values to arise.

Tourism

The assessment above in Section 5.8.2.1.5 concludes that there will negative, imperceptible, short term, residual effect, which are Not Significant on tourism in the wider landscape due to the construction phase of Proposed Project.

It is not considered that the Proposed Project together with other projects in the area will negatively affect cumulatively any tourism infrastructure in the wider area. As also noted in Section 5.3 above, the conclusions from available research indicate there is a generally positive disposition among tourists towards wind development in Ireland. Considered cumulatively with the proposed MTN, it is considered that the Proposed Project will support the development of the wider area, attracting local and new visitors to the area which could be uncovered as part of a wider regional strategy.

It is on this basis that it can be concluded that there would be a long-term imperceptible cumulative effect from the Proposed Project and other developments in the area.

Residential Amenity

Development can cause effects on one or more components of residential amenity such as of noise, dust, vibration, shadow flicker, and visual amenity. These factors are assessed within this EIAR, and summaries are presented in this chapter and their respective chapters. The assessments of noise and vibration, dust and other emissions to air, water quality and visual amenity conclude that there are no significant effects during the construction phase of the Proposed Project. Therefore, there will be no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

5.8.5.1.2 *Health*

Health and Safety

The assessment above in Section 5.8.5.1.2 concludes that there will negative, slight, short-term effect, which are Not Significant, during the construction phase of the Proposed Project. There is no credible scientific evidence to link wind turbines with adverse health effects. All other existing, permitted or proposed projects (wind energy or otherwise) would be expected to follow all relevant Health and Safety Legislation during the construction, operation and decommissioning phases of the development. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented. Therefore, it is considered there will be no cumulative effects on Health and Safety

should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Air Quality: Dust and Exhaust Emissions

The assessment above in Section 5.8.2.2.2 concludes that there will short-term, imperceptible, negative, which are Not Significant from dust and other emissions to air due to the construction phase of Proposed Project. A Cumulative Assessment has been conducted in Chapter 10: Air Quality, which concludes that there will be no measurable cumulative effects on air quality should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Climate

The assessment above in Section 5.8.2.2.3 concludes that there will be negative, imperceptible, permanent, which are Not Significant on climate due to the construction phase of Proposed Project. A Cumulative Assessment has been conducted in Chapter 11: Climate, which concludes that there will be a permanent imperceptible negative cumulative effect on climate resulting from greenhouse gas emissions, and a long-term, slight negative cumulative effect on loss of carbon sequestration potential, should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Water Quality

The assessment above in Section 5.8.2.2.4 concludes that there will be negative, imperceptible, long term, indirect effects, which are Not Significant, on water quality due to the construction phase of Proposed Project. A Cumulative Assessment has been conducted in Chapter 9: Water, which concludes that there will be no cumulative effects on water quality should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project. Please see Section 5.8.5.1.1 'Land Use Patterns and Activities' for further detail on the cumulative assessment associated with PCAS.

Noise & Vibration

The assessment above in Section 5.8.2.2.5 concludes that there will be a negative, not significant, short-term effect, which is Not Significant, from noise and vibration emissions due to the construction phase of the Proposed Project. A Cumulative Assessment has been conducted in Chapter 12: Noise and Vibration, which concludes that there will be no cumulative effects relating to noise and vibration should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Traffic and Transport

The assessment above in Section 5.8.2.2.6 concludes that there will be a slight, temporary, negative effect, which is Not Significant on traffic and transport due to the construction phase of the Proposed Project. A Cumulative Assessment for Traffic and Transport has been conducted in Chapter 15: Material Assets, which concludes that there will be no cumulative effects on local road users should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Major Accidents and Natural Disasters

Chapter 16 assesses the potential for impacts from Major Accidents and Natural Disasters to/from the Proposed Project during its construction phase. Chapter 16 assesses nine risks: flooding, major road traffic accident, contamination event, major fire, bog fire, civil disorder at large events, adverse weather conditions, loss of critical infrastructure, peat instability and concludes that there will be no significant effects to/from the construction of Proposed Project by such risks. A Cumulative Assessment has been conducted in Chapter 16: Major Accidents and Natural Disasters, which concludes that there will no increase in the vulnerability of the Proposed Project or adjacent areas to major accidents and/or natural disasters, should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Shadow Flicker

Shadow Flicker only has the potential to occur from operational wind turbines. Therefore, there can be no cumulative effects during the construction phase of the Proposed Project.

Interference with Telecommunication Systems

As there will be no impacts on telecommunication systems during the construction phase, there will be no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

5.8.5.2 Operational Phase

5.8.5.2.1 *Population*

Population Levels

The assessment above in Section 5.8.3.1.1 demonstrated that will be no impact on population levels from the Proposed Project during the operational phase. As the Proposed Project will not cause to changes to trends, population density, household size or age structure, it is therefore considered there can be no cumulative effects with other proposed or consented projects and plans within the Cumulative Assessment Boundary that may be operational alongside the Proposed Project.

Employment and Investment

The assessment above in Section 5.8.3.1.2 demonstrated that will be a positive, slight, long-term effect on employment and investment, which is Not Significant from the Proposed Project during its operational phase. It is therefore considered that there will be a positive, slight, long-term cumulative effect on employment and investment should the Proposed Project be operational in parallel with other proposed, planning and permitted projects and plans as identified in Section 2.10 in Chapter 2.

Land Use Pattern and Activities

The small footprint of the Proposed Project relative to the site and local scale, and the continuation of land use and activities onsite and in the wider area, there will be a neutral, indirect, not significant, long-term effect, which is Not Significant on land use and activities during the operational phase. Therefore, it is considered there will be no cumulative effects on land use and activities should other proposed or consented plans and projects within the Cumulative Assessment Boundary be operational alongside the Proposed Project.

Please see Section 5.8.5.1.1 above for detail on cumulative effects associated with substitute consent, EPA licenced activities, and PCAS.

Property Values

The assessment above in Section 5.8.3.1.4 concludes that there is the uncertain potential for negative, imperceptible, short-term effects which are Not Significant, due to the operational phase of Proposed Project. There are no other cumulative turbines located within 2 km of the proposed turbines and so this area within 1 km, where there is potential for impacts on property values, will not overlap with any other cumulative turbines. Furthermore, no correlation between the presence of grid infrastructure and property values has been demonstrated. On that basis it is concluded that there is no potential for cumulative effects on property values to arise.

Tourism

The assessment above in Section 5.8.3.1.5 concludes that there will negative, imperceptible, short term, residual effect of visitor experience to attractions in the wider landscape. It also concludes the Proposed Project will have a positive, slight, long-term impact on tourism due to the social and recreational benefits associated with the recreational amenity walkways/ paths. Both of these effects are considered Not Significant.

As noted in Section 5.3 above, the conclusions from available research indicate there is a generally positive disposition among tourists towards wind development in Ireland.

When considered cumulatively with the granted Offaly West MTN, which directly interacts with the associated amenity tracks of the Proposed Wind Farm at 2 no. locations, , it is considered that the Proposed Project and MTN will support the development of the wider area, attracting local and new visitors to the area which could be uncovered as part of a wider regional strategy.

It is on this basis that it can be concluded that there would be a long-term slight positive cumulative effect from the Proposed Project and the MTN.

Residential Amenity

The assessment above in Section 5.8.3.1.6 concludes that there will be a negative, imperceptible, long-term, which is Not Significant, on residential amenity due to the operation of the Proposed Project. Operation can cause effects on one or more components of residential amenity such as of noise, dust, vibration, shadow flicker, and visual amenity. Cumulative Assessments within the relevant chapters and sections (Chapter 10, Chapter 12, Chapter 14, and Shadow Flicker in Section 5.8.5.2.2 below) conclude that there will be no cumulative effects. Therefore, no cumulative effects to residential amenity are considered should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

5.8.5.2.2 *Health*

Health and Safety

The assessment above in Section 5.8.3.2.1 concludes that there will negative, slight, long-term effect, which are Not Significant, during the operational phase of the Proposed Project. There is no credible scientific evidence to link wind turbines with adverse health effects. All other existing, permitted or proposed projects (wind energy or otherwise) would be expected to follow all relevant Health and Safety Legislation during the construction, operation and decommissioning phases of the development. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented. Therefore, it is considered there will be no cumulative effects on Health and Safety

should other proposed or consented plans and projects within the Cumulative Assessment Boundary be operational in parallel with the Proposed Project.

Air Quality: Dust and Exhaust Emissions

The assessment above in Section 5.8.3.2.2 concludes that there will long-term, imperceptible, negative effects, which are Not Significant, from dust and other emissions to air due to the operational phase of Proposed Project. A Cumulative Assessment has been conducted in Chapter 10: Air Quality, which concludes that there will be a long-term, moderate, positive impact on air quality should other proposed or consented plans and projects within the Cumulative Assessment Boundary be operational in parallel with the Proposed Project.

Climate

The assessment above in Section 5.8.3.2.3 concludes that there will be positive, moderate, long-term effect, which is Not Significant, on CO_2 emissions and energy targets, due to the operational phase of Proposed Project. A Cumulative Assessment has been conducted in Chapter 11: Climate, which concludes that there will be a no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Water Quality

The assessment above in Section 5.8.3.2.4 concludes that there will be negative, imperceptible, long term, indirect effects, which are Not Significant, on health from a potential water quality impact due to the operational phase of the Proposed Project. A Cumulative Assessment has been conducted in Chapter 9: Water, which concludes that there will be a no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Noise & Vibration

The assessment above in Section 5.8.3.2.5 concludes that there will be negative, not significant, short-term effects on health from noise and vibration emissions due to the operational phase of the Proposed Project, which is Not Significant. A Cumulative Assessment has been conducted in Chapter 12: Noise and Vibration, which concludes that there will be a no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Traffic and Transport

The assessment above in Section 5.8.3.2.6 concludes that there will be a negative, imperceptible, long-term, which is Not Significant, on traffic and transport due to the operational phase of the Proposed Project. A Cumulative Assessment for traffic and transport has been conducted in Chapter 15, which concludes that there will be a no cumulative effects should other proposed or consented plans and projects within the Cumulative Assessment Boundary be constructed in parallel with the Proposed Project.

Major Accidents and Natural Disasters

Chapter 16 concludes that there will be no significant effects to/from major accidents and natural disasters due to the operation of the Proposed Project. Therefore, it is considered there will be no

cumulative effects from major accidents and natural disasters to/from other proposed or consented plans and projects in the Study Area.

Chapter 16 assesses the potential for impacts from Major Accidents and Natural Disasters to/from the Proposed Project during its operational phase. Chapter 16 assesses nine risks: flooding, major road traffic accident, contamination event, major fire, bog fire, civil disorder at large events, adverse weather conditions, loss of critical infrastructure, peat instability and concludes that there will be no significant effects to/from the construction of Proposed Project by such risks. A Cumulative Assessment has been conducted in Chapter 16: Major Accidents and Natural Disasters, which concludes that there will no increase in the vulnerability of the Proposed Project or adjacent areas to major accidents and/or natural disasters, should other proposed or consented plans and projects within the Cumulative Assessment Boundary be operational in parallel with the Proposed Project.

Shadow Flicker

The cumulative assessment of shadow flicker arising from the Proposed Wind Farm and other wind farms was carried out based on the methodology, assumptions and criteria outlined in Section 5.2.3. For the assessment of cumulative shadow flicker, any other existing, permitted or proposed wind farms are considered where the project's ten times rotor diameter shadow flicker study area are located within the Shadow Flicker Study Area of ten times the rotor diameter for the Proposed Wind Farm. In this case, the closest wind farm is the proposed Bellair Wind Farm located 2.7 km north of the Proposed Wind Farm at its closest point, and as such the ten times rotor diameter shadow flicker study for this proposed project would not overlap with that of the Proposed Project ten times rotor diameter Shadow Flicker Study Area. At this distance, any potential properties that would be considered within the proposed Bellair shadow flicker study area are excluded from the Proposed Wind Farm's Shadow Flicker Study Area and therefore are beyond the range for potential cumulative shadow flicker impacts. Therefore, there is no potential for shadow flicker in combination with the Proposed Wind Farm and therefore no cumulative shadow flicker assessment is required.

Interference with Telecommunication Systems and EMF

The assessment above in Section 5.8.3.2.9 concludes that there will be no impact on telecommunication systems, or on health due to EMF, due to the operational phase of the Proposed Project. Therefore, it is considered there will be no cumulative effects on health from noise and vibration emissions should other proposed or consented plans and projects within the Cumulative Assessment Boundary be operational in parallel with the Proposed Project.

5.8.6 Summary

Chapter 8: Land, Soils and Geology, Chapter 9: Water, Chapter 10: Air Quality, Chapter 11: Climate, Chapter 12: Noise and Vibration, Chapter 13: Cultural Heritage, Chapter 14: Landscape and Visual and Chapter 15: Material Assets (Traffic and Transport, Telecommunications and Aviation sections) provide an assessment of the effects of the Proposed Project on these areas of consideration. Chapter 16: Major Accidents and Natural Disasters assesses the vulnerability of the Proposed Project to and from major accidents and natural disasters. There is potential for positive effects to populations as a result of employment and investment in the locality. There is the potential for negative effects on human health during the Proposed Project construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions. The assessments in the chapters listed show that the residual effects are not significant and will not lead to significant effects on any environmental media with the potential to lead to health effects for humans. On this basis, the potential for negative health effects associated with the Proposed Project is slight to imperceptible. Furthermore, the Proposed Wind Farm is capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage the Proposed Wind Farm will have a long term, moderate positive effect on air quality as set out in

Chapter 10 which will contribute to positive effects on human health and assist in Ireland reaching its emissions targets and renewable energy goals.

5.9 EIA Classification Summary

Please see the below table for a summary of all identified impacts for the Proposed Project relating to population and human health.

Table 5-11 Impact Assessment Classification Summary

Topic	Pre-Mitigation Effect	Mitigation Section Reference	Residual Effect	Significance
Construction Phase				
Population Levels	No identified impacts	Section 5.8.2.1.1 – No mitigation required	No identified impacts	Not Significant
Employment and Investment	Short-term, Moderate, Positive	Section 5.8.2.1.2	Short-term, Moderate, Positive	Not Significant
Land Use Patterns & Activities	Short-Term, Slight, Negative	Section 5.8.2.1.3 – No mitigation required	Short-Term, Slight, Negative	Not Significant
Property Values	Short-Term, Slight, Negative	Section 5.8.2.1.4	Short-Term, Imperceptible, Negative	Not Significant
Tourism	Short-Term, Slight, Negative	Section 5.8.2.1.5	Short-Term, Imperceptible, Negative	Not Significant
Residential Amenity	Short-Term, Moderate, Negative	Section 5.8.2.1.6	Short-Term, Slight, Negative	Not Significant
Health & Safety	Short-term, Significant, Negative	Section 5.8.2.2.1	Short-Term, Slight, Negative	Not Significant
Air Quality: Dust and Exhaust Emissions	Short-Term, Slight, Negative	Section 5.8.2.2.2	Short-Term, Imperceptible, Negative	Not Significant
Climate	Short-Term, Slight, Negative	Section 5.8.2.2.3	Permanent, Imperceptible, Negative	Not Significant
Water Quality	Long-Term, Significant, Negative	Section 5.8.2.2.4	Long-Term, Imperceptible, Negative	Not Significant

Noise and Vibration	Short-Term, Not Significant, Negative	Section 5.8.2.2.5	Short-Term, Not Significant, Negative	Not Significant
Traffic and Transport	Temporary, Slight, Negative	Section 5.8.2.2.6	Temporary, Slight, Negative	Not Significant
Major Accidents and Natural Disasters	Temporary, Moderate, Negative	Section 5.8.2.2.7	Temporary, Slight, Negative	Not Significant
Shadow Flicker	N/A	N/A	N/A	N/A
Interference with Telecommunication Systems and EMF	N/A	N/A	N/A	N/A
Operational Phase				
Population Levels	No identified impacts	Section 5.8.3.1.1 – No mitigation required	No identified impacts	Not Significant
Employment and Investment	Long-Term, Slight, Positive	Section 5.8.3.1.2 – No mitigation required	Long-Term, Slight, Positive	Not Significant
Land Use Patterns and Activities	Permanent, Slight, Negative	Section 5.8.3.1.3 – No mitigation required	Permanent, Slight, Negative	Not Significant
Property Values	Short-Term, Slight, Negative	Section 5.8.3.1.4	Short-Term, Imperceptible, Negative	Not Significant
Tourism	Long-term, Slight, Negative	Section 5.8.3.1.5	Long-Term, Imperceptible, Negative	Not Significant
Residential Amenity	**Air Quality:** Long-Term, Imperceptible, Negative **Noise and Vibration:** Long-term, Not Significant, Negative **Visual:** Long-Term, Moderate, Negative	Section 5.8.3.1.6	Long-Term, Slight, Negative	Not Significant

Health and Safety	Long-term, Slight, Negative	Section 5.8.3.2.1	Long-Term, Imperceptible, Negative	Not Significant
Air Quality; Dust and Exhaust Emissions	Long-Term, Slight, Negative	Section 5.8.3.2.2	Long-Term, Imperceptible, Negative	Not Significant
Climate	Long-Term, Moderate, Positive	Section 5.8.3.2.3	Long-term, Moderate, Positive	Not Significant
Water Quality	Temporary, Slight, Negative	Section 5.8.3.2.4	Temporary, Imperceptible, Negative	Not Significant
Noise and Vibration	Long-Term, Not Significant, Negative	Section 5.8.3.2.5	Long-Term, Not Significant, Negative	Not Significant
Traffic and Transport	Long-Term, Imperceptible, Negative	Section 5.8.3.2.6 – No mitigation required	Long-Term, Imperceptible, Negative	Not Significant
Major Accidents and Natural Disasters	Temporary, Moderate, Negative	Section 5.8.3.2.7	Temporary, Slight, Negative	Not Significant
Shadow Flicker	Long-Term, Slight, Negative	Section 5.8.3.2.8	Long-Term, Imperceptible, Negative	Not Significant
Interference with Communication Systems and EMF	No identified impacts	Section 5.8.3.2.9	No identified impacts	Not Significant
Decommissioning Phase				
Population and Human Health	Any impact and consequential effect that occurs during the decommissioning phase will be similar to that which occurs during the construction phase, however to a lesser extent and lesser duration, and the mitigation measures outlined in Section 5.8.2 will be implemented during the	Section 5.8.2	N/A	N/A

	decommissioning phase also			