5. POPULATION & HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses the potential effects of the Proposed Development on population and human health and has been completed in accordance with the Environmental Impact Assessment (EIA) guidance and legislation set out in Chapter 1 (Introduction). The full description of the Proposed Development 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 Development', 'proposed turbines', the 'Site', the ' 2020 Application' and the 'Kealkill Wind Farm'. Please see Section 1.1.1 of this EIAR for further details. A detailed description of the Proposed Development is provided in Chapter 4 (Description of the Proposed Development) of this EIAR.

One of the principal concerns during the development process is that human beings, as individuals or communities, should experience no significant diminution of their quality of life from the direct, indirect or cumulative effects arising from the construction, operation and decommissioning of a development. Ultimately, all the effects of a development impinge on human beings, 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 (including visual amenity, shadow flicker and noise), community facilities and services, tourism, property values, traffic and health and safety.

5.1.1 Statement of Authority

This section of the EIAR has been written by Ciarán Fitzgerald, supported by Natasha Morley, and reviewed by Sean Creedon, all of MKO. Ciarán Fitzgerald is an Environmental Scientist who has been working with MKO since June 2024. Ciarán holds a B.Sc. (Honours) in Marine Science from the National University of Ireland Galway and a First-Class Honours PG. Dip in Geographic Information Systems from University College Cork. Ciarán works as part of the Environmental Renewables team as well as a larger multidisciplinary team. Ciarán's role involves undertaking tasks such as report writing, EIAR chapter writing, and QGIS mapping. Prior to joining MKO, Ciarán spent time aboard the research vessel "Celtic Explorer", working as part of a team undertaking chemical water data, pelagic species abundance and sorting, bathymetric GIS mapping, data collection, and report writing. Ciarán's key strengths lie in GIS mapping and communication. Since joining the company, Ciarán has been involved in a range of projects, including onshore wind, offshore wind, and solar, contributing by reviewing EIAR chapters and assisting with project development. Ciarán holds a membership from the Institute of Sustainability and Environmental Professionals (ISEP).

Natasha is an Environmental Scientist with MKO since September 2024. Natasha holds BA (Hons) in Geography & English and a PG. Dip in Environmental Sustainability Implementation. Natasha has specialist knowledge in environmental science, sustainability, and renewables. Natasha's key strengths and areas of expertise are in environmental surveying, report writing and environmental mapping. Within MKO Natasha is a member of the MKO Environmental Renewables Team working as part of a large multi-disciplinary team writing and reviewing EIAR chapters and assisting with project development to produce extensive Environmental Impact Assessment Reports for large-scale onshore and offshore wind energy developments.

Sean is an Associate Director in the Environment Team at MKO. He oversees a team of highly skilled environmental professionals working on EIAR for large-and medium scale Renewable Energy infrastructure. Sean has directed and overseen multiple renewable energy projects across wind, solar, battery and hydrogen as well as a range of thermal and other energy related developments. He is a member of the MKO senior management team responsible for developing the business, mentoring team members, fostering a positive culture and promoting continuous employee professional development. Sean has over 22 years' experience in

program and project development, holds an MSc from NUI Galway and a Diploma in Project Management from Institute of Project Management Ireland.

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 (Introduction) 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:

- Department of Health – Health in Ireland: Key Trends 2024[1];
- Environmental Impact Assessment of National Road Schemes- A practical Guide, National Roads Authority/ Transport Infrastructure Ireland, Revision 1, November 2008;[2]
- Fáilte Ireland EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects, July 2023[3];
- Health Impact Assessment Resource and Tool Compilation, United States Environmental Protection Agency 2016[4];
- Health Impact Assessment Guidance, Institute of Public Health Ireland. 2021[5];
- Framework for Human Health Risk Assessment to Inform Decision Making developed by the United States Environmental Protection Agency (US EPA) 2014[6];
- Institute for Environmental Management and Assessment (2022) Health In Environmental Impact Assessment: A Primer for a Proportionate Assessment[7];
- Institute for Environmental Management and Assessment (2022) Determining Significance for Human Health in Environmental Impact Assessment[8];
- Central Statistics Office (CSO): Census of Ireland 2016; Census of Ireland 2022; Census of Agriculture 2020[9];
- Cork County Development Plan 2022-2028[10]; and
- The World Health Organisation (WHO) Environmental Noise Guidelines for the European Region (WHO, 2022 Update)[11] https://www.who.int/

[1] *Department of Health – Health in Ireland: Key Trends. Available at: https://www.gov.ie/en/press-release/8168c-minister-for-health-publishes-health-in-ireland-key-trends-2024/#:~:text=the%20number%20of%20people%20in,perceived%20good%20health%20in%202022 [Accessed on 06.03.2025]*

[2] *National Roads Authority - Environmental Impact Assessment of National Road Schemes – A Practical Guide https://www.tii.ie/media/oodvduf/environmental-impact-assessment-of-national-road-schemes-practical-guide.pdf*

[3] *Failte Ireland - EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects - https://www.failteireland.ie/*

[4] *United States Environmental Protection Agency- The Health Impact Assessment (HIA) Resource and Tool Compilation - https://www.epa.gov/sites/default/files/2017-07/documents/hia_resource_and_tool_compilation.pdf.*

[5] *Health Impact Assessment Guidance, Institute of Public Health Ireland. Available at: https://www.publichealth.ie/sites/default/files/resources/HIA%20Guidance%20A%20Manual_0.pdf [Accessed on 06.03.2025]*

[6] *United States Environmental Protection Agency -Framework for Human Health Risk Assessment to Inform Decision Making - https://www.epa.gov/sites/default/files/2014-12/documents/hhra-framework-final-2014.pdf*

[7] *IEMA Health In Environmental Impact Assessment: A Primer for a Proportionate Assessment. Available at: https://www.researchgate.net/publication/358589092_Health_in_Environmental_Impact_Assessment_A_Primer_for_a_Proportionate_Approach [Accessed on 06.03.2025]*

[8] *Institute of Environmental Management and Assessment (IEMA) Guide to – Effective Scoping of Human Health in Environmnetal Impact Assessment- https://www.iema.net/media/s35fughe/iema-eia-guide-to-effective-scoping-of-human-health-nov-2022.pdf*

[9] *Central Statistics Office – Census - https://www.cso.ie/en/census/*

[10] *Cork County Council – Cork County Development Plan 2022-2028 - https://www.corkcoco.ie/en/resident/planning-and-development/cork-county-development-plan-2022-2028*

[11] *World Health Organization -Environmental Noise Guidelines for the European Region - https://iris.who.int/bitstream/handle/10665/279952/9789289053563-eng.pdf?sequence=1*

5.1.3 Scoping

Chapter 2 (Background to the Proposed Development) of this EIAR describes the scoping and consultation exercise undertaken for the Proposed Development. Relevant to this chapter, responses were received from the Department of Defence, the Department of Climate, Energy and the Environment (Formally the Department of the Environment, Climate and Communications), Fáilte Ireland, Broadcast Authority Ireland, and Transport Infrastructure Ireland (TII). Summaries of the scoping responses and reference locations are presented in table 5.1 below.

Table 5-1 Scoping Consultation Responses

Consultee	Date Received	Scoping Response
Health Service Executive	19th March 2025	A scoping response was received from the Health Service Executive (HSE) on the 19th March 2025. The HSE requested a shadow flicker assessment be undertaken to identify any sensitive receptors which may be impacted by shadow flicker and noted that the environmental impact assessment must include all proposed mitigation measures, including air quality due to the nature of the proposed construction works generation of airborne dust has the potential to have significant impacts on "*sensitive receptors*". The response stated that a Construction Environmental Management Plan (CEMP) should be included in the EIAR which details dust control and mitigation measures. The HSE further stated that the EIAR should examine all likely significant impacts and provide the following information for each: › Description of the receiving environment; › The nature and scale of the impact; › An assessment of the significance of the impact; › Proposed mitigation measures; › Residual impacts. Directive 2014/52/EU has an enhanced requirement to assess likely significant impacts on Population and Human Health. It is the experience of the Environmental Health Service (EHS) that impacts on human health are often inadequately assessed in EIAs in Ireland. It is recommended that the wider determinants of health and wellbeing are considered in a proportionate manner when considering the EIA. Guidance on wider determinants of health can be found at www.publichealth.ie The HSE advised that in addition to any likely significant negative impacts from the Proposed Development, any positive likely significant impacts should also be assessed. The Environmental Health Service (EHS) recommends that the following matters are included and assessed in the EIAR: › Public Consultation › Population and Human Health including Opportunity for Health Gain › Climate Change › Siting and location of proposed turbines › Noise & Vibration › Shadow Flicker › Air Quality › Surface and Groundwater Quality

Consultee	Date Received	Scoping Response
		› Geological Impacts › Ancillary facilities › Cumulative impacts Impacts from shadow flicker are assessed in Section 5.9 and 5.10.3.2.7. An assessment of effects on human health as a result of impacts to air quality are assessed in Section 5.10 and in more detail within Chapter 10 (Air Quality). An assessment of effects on human health as a result of impacts to water quality are assessed in Section 5.10 and in more detail within Chapter 9 (Hydrology and Hydrogeology). An assessment of effects on human health as a result of impacts from noise and vibration are assessed in Section 5.10 and in more detail within Chapter 11 (Noise and Vibration).
Fáilte Ireland	4rd March 2025	Population and Human Health (including Tourism), Landscape and Visual, and Cultural Heritage were considered most relevant and important to the consultee. It is highlighted that key tourism amenities, such as walking/hiking trails, and tourism attractions, and their proximity to the Proposed Development should be considered. Particular attention needs to be given to effects on views from existing tourism facilities. Scale and sighting of individual and cumulative developments must also be taken into consideration. Emphasis to avoid any effects that may negatively impact local attractions and experiences is also highlighted. Impacts on tourism are assessed in section 5.4, 5.10.2.1.5 and 5.10.3.1.5
Waterways Ireland	21st February 2025	Waterways Ireland confirmed that the Proposed Development is not within any Zone of Influence (ZoI) of relevant waterways, thus will not be commenting.

5.2 Assessment Methodology

5.2.1 Population

A desk-based assessment using sources and guidelines referenced in 5.2.2 below was undertaken to examine relevant information pertaining to the population impact assessment. 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 (2023) *EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects* was also considered in this assessment. See Section 5.3 below.

In order to assess the population in the vicinity of the Proposed Development, the Population Study Area for this population assessment focuses on the EDs within which the Site is within and adjacent to, namely Douce and Bealanageary but it also refers to county and national statistics.

5.2.2 Human Health

This human health analysis section was assessed using guidelines set out in section 5.1.2 above.

The World Health Organisation's (WHO) defines health as:

> *"A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".*[4]

5.2.2.1 National Guidance

The EIAR Guidelines advise 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.*" (EPA, 2022). Environmental Impacts from the Proposed Development 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 Soil & Geology), Chapter 9 (Hydrology & Hydrogeology), Chapter 10 (Air Quality), Chapter 11 (Climate), Chapter 12 (Noise & Vibration), Chapter 13 (Landscape & Visual), Chapter 15 (Material Assets (including Traffic and Transport and Telecommunications and Aviation)).

As referenced in the Department of Housing, Planning and Local Government (2018) *Guidelines for Planning Authorities and An Coimisiún Pleanála*, (taken from the European Commission's Environmental Impact Assessment of Projects: Guidance on the Preparation of the Environmental Impact Assessment Report (2017), 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.'*

The EIAR Guidance (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 EIAR Guidance (EPA, 2022) state 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*'. The EIAR Guidelines (EPA, 2022) note 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 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 IEMA Guidance 2017

The Institute of Sustainability and Environmental Professionals (ISEP) formally known as the Institute for Environmental Management and Assessment (IEMA) published '*Health in Environmental Impact Assessment: A Primer for a Proportionate Assessment'* in 2017 examining what a proportionate assessment of the impacts on health should be in Environmental Impact Assessments. 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 maybe 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 report refers to the WHO 2014 which provides an 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. Therefore, given that this human health assessment is part of the EIAR; there is no stand-alone HIA.

5.2.2.3 EIA Significance Matrix for Human Health, IEMA Guidance 2022

The IEMA Working Group 2022 published *Determining Significance For Human Health In Environmental Impact Assessment* in response to gaps and inconsistencies across existing guidance documents as to how health is assessed in EIA, particularly with regard to significance. The aim of this report is to assist and streamline discussions for consultants producing the assessments and for the decision makers who are reviewing the assessments. The report states that an EIA must identify, describe and assess the direct and indirect significant effects in an appropriate manner 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, taking into account current knowledge and methods of assessment.

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. In this context, and aligned with the above noted IEMA 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 IEMA Guidance, which might be required for an assessment of effects on human health arising from a type of development with a 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 shadows over a window in 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 a window of an enclosed room, and therefore Shadow Flicker assessments are undertaken for the nearby adjacent properties around a Proposed Development.

The frequency of occurrence and the strength of any potential Shadow Flicker effect depends on several factors, each of which is 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 eights (okta) of the sky covered. Irish skies are completely covered by cloud (8 oktas) for over 50% of the time. The mean cloud amount for each hour is between five and six okta. 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 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. (*Source: Met Éireann,* www.met.ie)

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.

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 500m 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 Guidelines (DoEHLG,2006) iterates that at distances greater than ten rotor diameters from a turbine, the potential for Shadow Flicker is very low.

Figure 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.

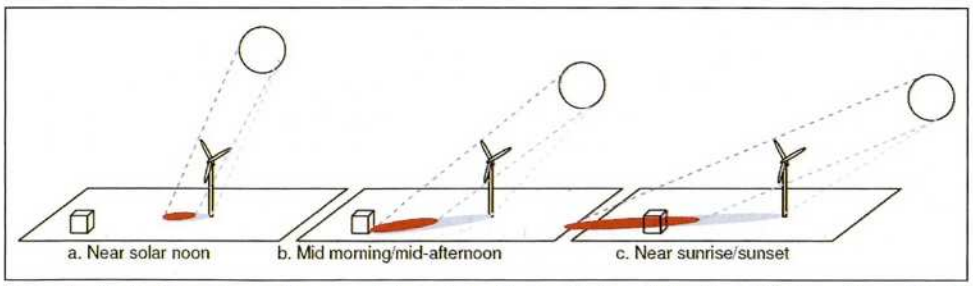


Figure 5-1 Shadow-Prone Area as Function of Time of Day (Source: Shadow Flicker Report, Helimax Energy, Dec 2008)

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 effect.

At a distance, the turbine blades do not cover the sun but only partly mask it, substantially weakening the shadow. This impact 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. (Source: Update of Shadow Flicker Evidence Base, UK Department of Energy and Climate Change, 2010).

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 worst-case assessment as detailed in Section 5.7.4.3 below.

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. In order 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 Figure 5-2 below.

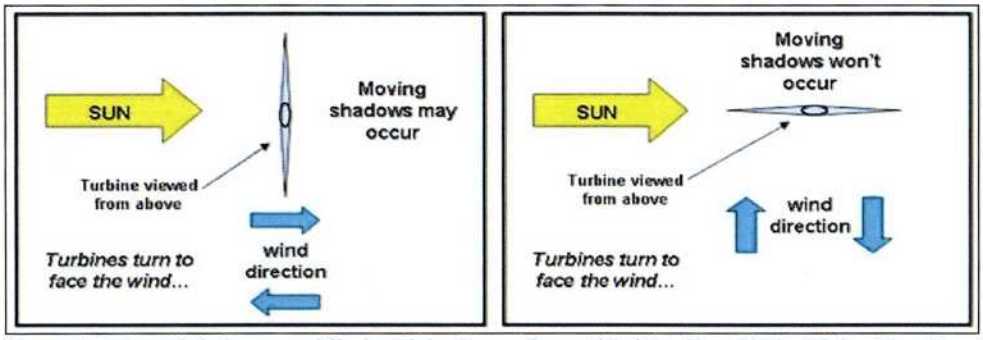


Figure 5-2 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC)

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 produces a net power output, and they 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, then no Shadow Flicker will occur.

5.2.3.2 Guidance

The current guidance for Shadow Flicker in Ireland is derived from the '*Wind Energy Development Guidelines for Planning Authorities 2006*' (DoEHLG, 2006), and the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (Irish Wind Energy Association, 2012).

The Guidelines (DoEHLG, 2006) set out a threshold of 30 hours per year or 30 minutes per day of Shadow Flicker at dwellings within 500 metres of a proposed turbine location. As detailed in the Guidelines (DoEHLG, 2006), there is a low probability of any Shadow Flicker effects occurring beyond 10 rotor diameters. Therefore, a study area of 10 rotor diameters was selected based on the low probability of effects beyond 10 rotor diameters as outlined in the Guidelines (DoEHLG, 2006). In this case, the maximum potential rotor diameter proposed for this project is 133m. As such, the Shadow Flicker study area is 1.33km (10 x 133m = 1.33km). A significant minimum separation distance of 1km from third-party dwellings has been achieved with the project design. There are 8 no. properties located within the Shadow Flicker study area.

The Guidelines (DoEHLG, 2006) state that the Shadow Flicker lasts for only a short period of time and occurs only during certain specific combined circumstances, as follows:

- the sun is shining and is 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.

The Guidelines (DoEHLG, 2006) are currently under review. The DoHPLG released the '*Draft Revised Wind Energy Development Guidelines'* in December 2019 (DoHPLG, 2019), which was released for public consultation. The Draft Guidelines (DoHPLG, 2019) 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 Guidelines are currently under review. the DoEHLG's released the '*Draft Revised Wind Energy Development Guidelines'* for public consultation in December 2019. The consultation period closed February 2020; however, no update or final guidelines was released. The draft 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 draft Guidelines are based on the recommendations set out in the '*Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review'* (December 2013) and the '*Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach*' (June 2017)[12].

The Climate Action Plan 2024 (CAP24) published in December 2023 states that final guidelines will be adopted in 2024. The Climate Action Plan 2025 (CAP25) was published in April 2025; however it does not provide an update on the commitments published in CAP24 relating to the publication timeline of the Draft DoEHLG 2019 Guidelines. The shadow flicker methodology and assessment within this chapter are based on compliance with the Guidelines, which remain to be the current adopted guidelines. However, it should also be noted the proposed turbines can be brought in line with the requirements of the draft Guidelines through the stricter implementation of the mitigation measures outlined in Section 5.10.3.2.7.

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 short-lived. The Guidelines (DoEHLG,2006) 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 in the design of the Proposed Development. Proper siting of wind turbines is key in eliminating 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) or AWS OpenWind. 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.

[12]*Proposed Revisions to Wind Energy Development Guidelines 2006 – Targeted Review' (December 2013) and the 'Review of the Wind Energy Development Guidelines 2006 – Preferred Draft Approach' (June 2017). Available at: https://ie.rwe.com/-/media/RWE/RWE-Ireland/downloads/lyre/preferred-draft-approach-to-wind-energy-guidelines.pdf*

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 when it might occur. 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.

For the purposes of this Shadow Flicker assessment, the software package WindPRO: Shadow – Version 4.0.552 has been used to predict the level of Shadow Flicker associated with the Proposed Development development. WindPRO is a commercially available software tool that enables developers to analyse, design and optimise Proposed Developments. It allows proposed turbine layouts to be optimised for maximum energy yield whilst taking account of environmental, planning and engineering constraints.

5.2.3.4 Shadow Flicker Assessment Criteria

5.2.3.4.1 *Proposed turbine Dimensions*

Planning permission is being sought for a turbine of the following dimensions:

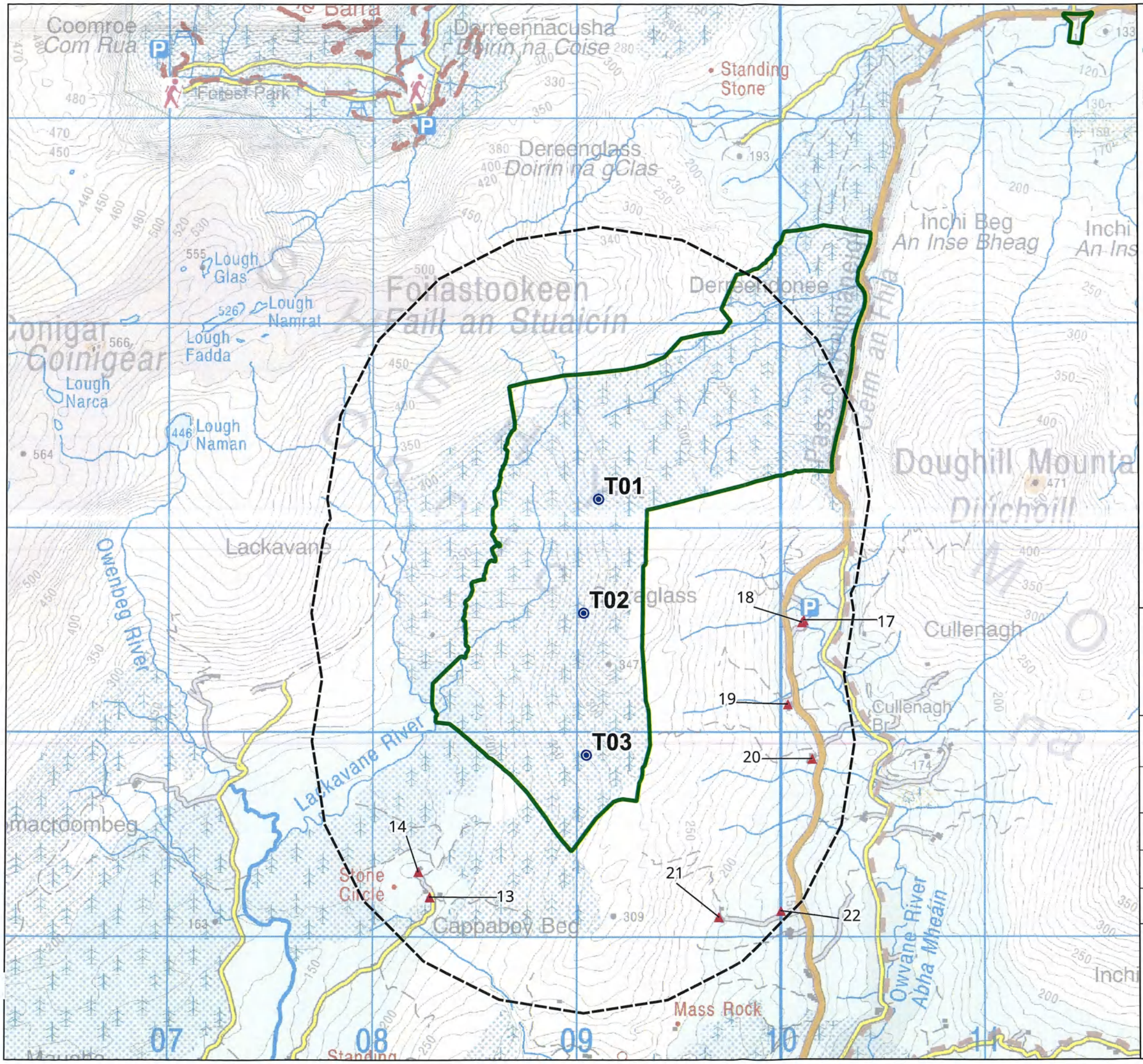
- Tip Height: 156.5 metres
- Hub Height: 90 metres
- Rotor Diameter: 133 metres

5.2.3.4.2 *Shadow Flicker Study Area*

At the outset of the Proposed Development, 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 EIAR Site Boundary 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.

The Shadow Flicker Study Area for the Shadow Flicker assessment is ten times rotor diameter (133m rotor diameter x 10 = 1.33km). The Guidelines (DoEHLG,2006) note 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 1.33km from the proposed turbines. All inhabitable dwellings within 1.33km of the Proposed turbines have been considered as part of the following Shadow Flicker assessment. There are 8 no. properties located within 1.33km of the proposed turbine locations. Of these, no property is theoretically predicted to experience Shadow Flicker.

The Shadow Flicker Study Area is shown in Figure 5-3



Map Legend

- EIAR Site Boundary
- Proposed Turbine Locations
- Proposed Project Shadow Flicker Study Area - 1.33km (10x133m Rotor Diameter)
- Sensitive Receptors

REG. No. _____
PLANNING (WEST) DEPT
06 NOV 2025
CORK COUNTY COUNCIL
NORTON HOUSE, SKIBBEREEN, Co. CORK

REG. No. _____
PLANNING (WEST) DEPT
15 SEP 2025
CORK COUNTY COUNCIL
NORTON HOUSE, SKIBBEREEN, Co. CORK

Drawing Title
Shadow Flicker Study Area

Project Title
Curraglass Wind Farm, Co. Cork

Drawn By	Checked By
EM	EC
Project No. 240614	Drawing No. Figure 5-3
Scale 1:18,000	Date 2025-08-18

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5.2.3.4.3 Assumptions and Limitations

A precautionary approach has been taken in relation to the orientation of each individual property in relation to the location of the proposed 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.

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 5.10.3.2.7.

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[1]. As such properties located outside of this potential Shadow Flicker zone (50 degrees either side of south) will not be impacted.

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, referred to as the 'worst-case impact', 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 33.40% of the daylight hours per year. This percentage is based on Met Éireann data recorded at Cork Airport over the 30-year period from 1981 to 2010 (www.met.ie). The actual sunshine hours at the Site and therefore the percentage of time Shadow Flicker could actually occur is 33.40%of daylight hours. Where the annual Shadow Flicker is calculated for each property, it is corrected for the regional average of 33.40%sunshine, to give an accurate annual average Shadow Flicker prediction. Tables 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.

5.3 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 area. 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 Cork County Development Plan 2022-2028, Fáilte Ireland and any other literature pertinent to the area. The study included an examination of the population and employment characteristics of the area. This information was sourced from the Census of Ireland 2022, which is the most recent census for which a complete dataset is available, also the Census of Ireland 2016, the Census of Agriculture 2010 and from the CSO website (www.cso.ie). Census information is divided into State, Provincial, County, Major Town, Electoral Division (ED) level.

The Site is located within a rural, agricultural setting in southwest Cork, approximately 6.8km northeast of Kealkill Village and 3.8km southwest of the village of Ballingeary. The approximate location for the centre of the Site is E508999, N562646. The Site covers an area of approximately 270 hectares in total, the majority of which is planted with mixed forestry and existing wind farm infrastructure. The Site ranges in elevation from 111 metres above ordnance datum (m OD), in the turbine component turning area of the Site, to 347m OD in the north of the Site. The Site location context is shown on Figure 1-1. The EIAR Site boundary is presented in Figure 2-1.

Current land use comprises of commercial forestry, agricultural land and unutilised existing wind farm infrastructure.

In order to assess the population in the vicinity of the Proposed Development, the 'Population Study Area' for this EIAR was defined in terms of Electoral Divisions (EDs). The Site lies within two (2) No. EDs: Douce and Bealanageary as shown in Figure 5-4. These EDs will collectively be referred to hereafter as the Population Study Area for this chapter. The Population Study Area has a population of 821 persons as of 2022, with the populations of each electoral division as follows:

- Douce (260 persons)
- Bealanageary (561 persons)

The total land area of the Population Study Area totals 71.15km^2 and comprises Douce 37.25km^2 and Bealanageary 33.9km^2.

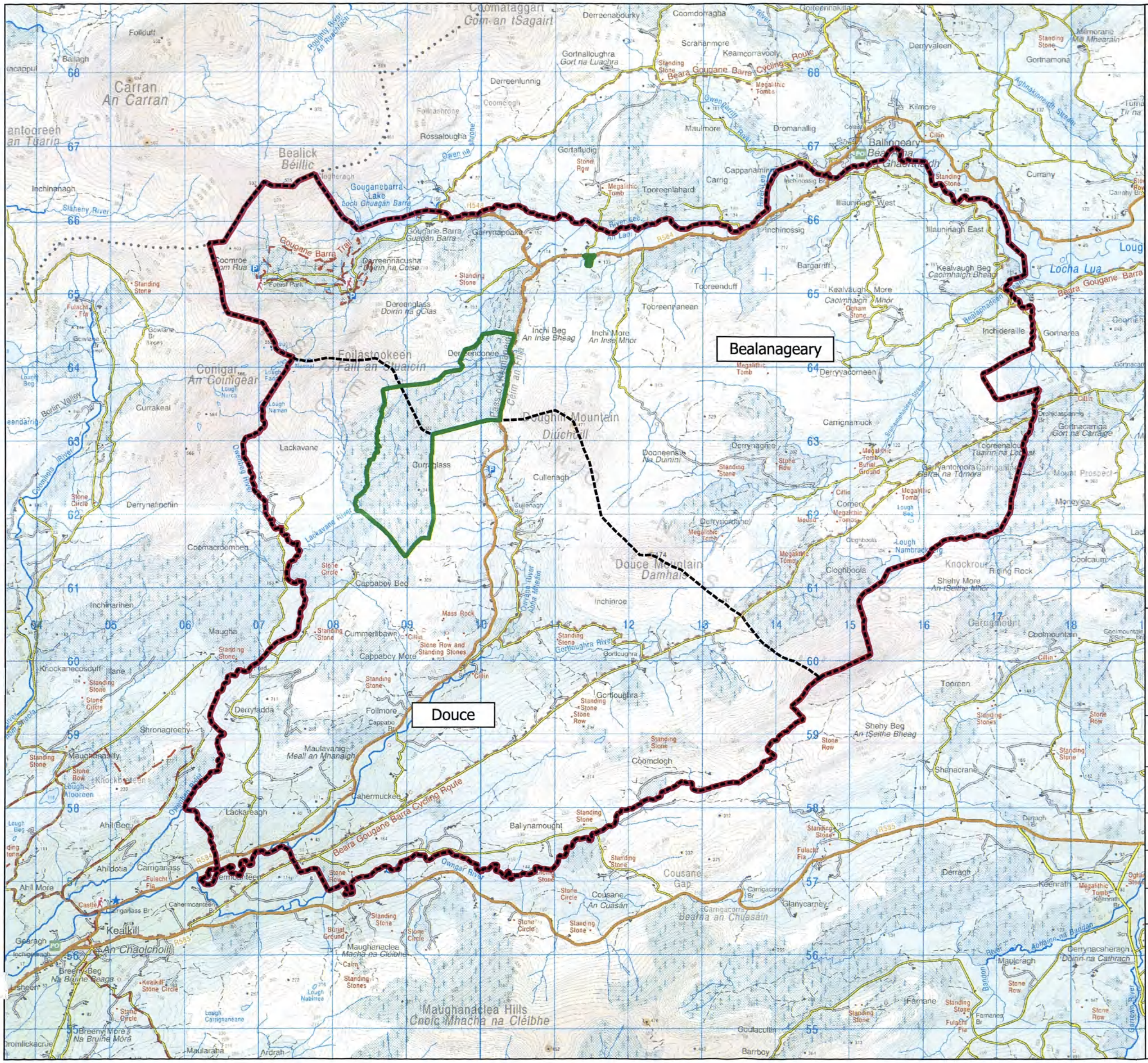
The Population Study Area is compared to the state and the County below using data sourced from the Central Statistics Office (CSO) Census data 2016 and 2022. The County refers to the extent of the Cork County Council Area, rather than the entire County. The extent of the Cork City Council Area was excluded as results of the effects on those living in the County would be skewed by high density population of Cork City. It should also be noted that the extent of the Cork County Council Area decreased between the 2016 Census and the 2022 Census due to the expansion of Cork City. The table below outlines the extents of each area.

Table 5-2 extent(km2) of study areas

	Area (km2)		Area (km^2) Change
	2016	2022	2016-2022
State	70,273	70,273	0
Cork County Council	19,451	19,246	205

Population Study Area	96.57	96.57	0

The nearest sensitive receptor is approximately 1km from the nearest proposed turbine (T3).



Map Legend

- EIAR Site Boundary
- Population Study Area
- Curraglass EDs: Douce and Bealanageary

N

Drawing Title	Population Study Area
Project Title	Curraglass Wind Farm, Co. Cork
Drawn By: EM	Checked By: SC
Project No.: 240614	Drawing No.: Figure 5-3
Scale: 1:50,000	Date: 2025-07-21

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5.3.2 Population Trends

In the period between the 2016 and the 2022 Census, the population of Ireland increased by 8.1%. During this time the population of Co. Cork decreased by 13.7%. Population statistics for the State, County Cork and the Population Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5-2 below.

Table 5-3 Population 2016 - 2022 (Source: CSO)

Area	Population Change		Percentage Population Change
	2016	2022	2016– 2022
State	4,761,865	5,149,139	8.1%
County Cork	417,211	360,152	-13.7%
Population Study Area	759	821	8.2%

In the same period, the population of the Study Area grew by 8.2%. When this is examined in closer detail, can be seen that the population of both EDs grew in the period between the 2016 and 2022 Census'. Douce grew in population size by the largest amount, seeing a population growth of 15.6%, with Bealanageary growing by 5.1%.

5.3.3 Population Density

The population densities recorded within the State, County Cork and the Population Study Area during the 2016 and 2022 Census are shown in Table 5-3.

Table 5-4 Population Density in 2016 and 2022 (Source CSO)

Area	Population Density (Persons per square kilometre)	
	2016	2022
State	67.8	73.3
Co Cork	21.7	18.7
Population Study Area	12.2	12.9

In the same period, the population density of the study area grew from 12.2 persons per square kilometre, to 12.9 persons per square kilometre. When these figures are examined on a closer level, it can be seen that the population density of Douce rose from 2.4 to 2.5 persons per square kilometre, while the population density of Bealanageary rose from 2.6 to2.7 persons per square kilometre.

5.3.4 Household Statistics

The number of households and average household size recorded within the State, County Cork and the Population Study Area during the 2016 and 2022 Censuses are shown in Table 5-4.

Table 5-4 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	2.7	1,841,152	2.7
County Cork	146,442	2.8	127,971	2.8
Population Study Area	299	2.6	319	2.6

The figures in Table 5-4 show that the number of households within the State and the Eds have increased and the number of households in the County have decreased. However, the average number of people per household remained the same due to the proportionate increase in population during this period. Average household size recorded within the Population Study Area during the 2016 and 2022 Censuses is the same or slightly below those observed at State and County level during the same time period. The average household size recorded in the Population Study Area increased by 0.1% for both EDs. Douce ED recorded 2.5 persons per household recorded in 2022, while Bealanageary recorded 2.7 persons per household in 2022.

5.3.5 Age Structure

Table 5-5 presents the population percentages of the State, County Cork and Population Study Area within different age groups as defined by the Central Statistics Office during the 2022 Census. This data is also displayed in 5-5.

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

Area	Age Category				
	2022				
	0 - 14	15 – 24	25 - 44	45 - 64	65 +
State	19.7%	12.5%	27.6%	25.1%	15.1%
County Cork	21.3%	11.7%	24.8%	26.6%	15.6%
Population Study Area	21.7%	8.3%	22.5%	28.0%	19.5%

County Cork's population in April 2022 was comprised of 360,152. The average age of Cork's population in April 2022 was 39.1 years, compared with 37.5 years in April 2016. Nationally, the average age of the population was 38.8, up from 37.4 in April 2016. The number of people aged 65 and over continues to grow. This age group increased by 3.76% to 56,189 in Cork, and by 19.63% to 776,315 at a national level since 2016. The proportion of the Population Study Area population within each age category is similar to those recorded at national and county level for most categories. The population age 65+ is slightly higher in the Population Study Area, while the population age 15-24 is slightly lower in comparison to national and county records. For the Study Area, the highest population percentage occurs within the 45-64 age category.

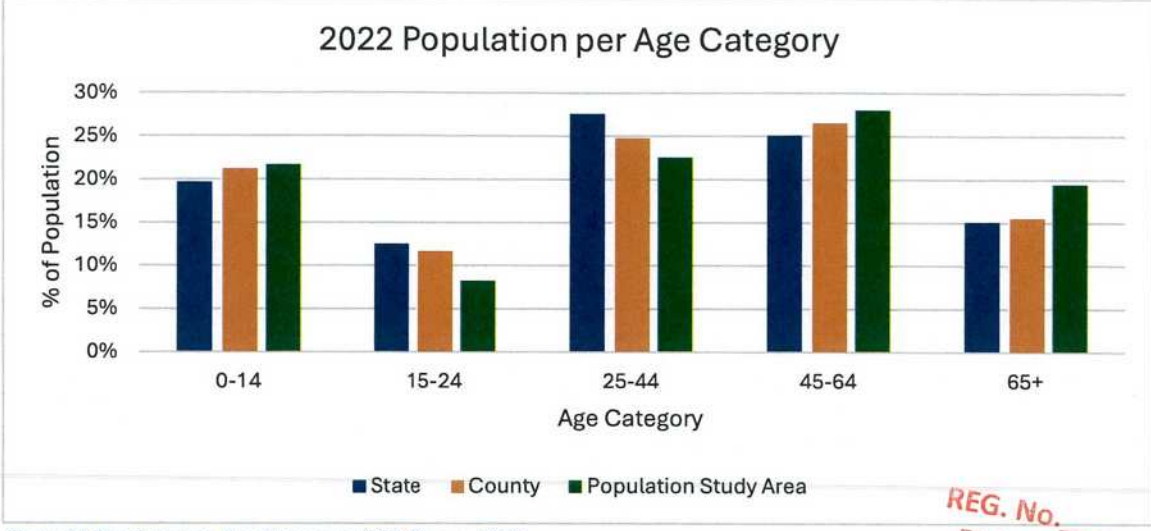

Figure 5-5 Population per Age Category in 2022 (Source: CSO)

5.3.6 Employment and Economic Activity

5.3.6.1 Economic Status of the Population Study Area

The labour force consists of those who are able to work, i.e. those who are aged 15+, out of full-time education and not performing duties that prevent them from working. In 2022, there were 2,531,099 persons in the labour force in the State. Table 5-6 shows the percentage of the total population aged 15+ who were in the labour force in the State during the 2022 Census. This figure is further broken down into the percentages that were at work 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. In Census 2022, for the first time, two categories of unemployment detail were included, Long-term Unemployment and Short-term Unemployment, for the purpose of this assessment, both categories have been grouped into one Unemployment group.

Table 5-6 Economic Status of the Total Population Aged 15+ in 2022 (Source: CSO)

Status		Republic of Ireland	County	Population Study Area
% of population aged 15+ who are in the labour force		**61.2%**	**60.5%**	**58.81%**
% of which are:	At work	91.7%	93.9%	96.19%
	First time job seeker	1.4%	1.00%	0.82%
	Unemployed	7.0%	5.1%	6.5%
% of population aged 15+ who are not in the labour force		**38.8%**	**39.5%**	**41.19%**
% of which are:	Student	28.6%	27.7%	15.95%
	Home duties	17.0%	18.7%	23.35%
	Retired	41.0%	40.64%	46.30%
	Unable to work	11.8%	11.2%	11.67%

	Other	1.7%	1.7%	2.72%

Overall, the principal economic status of those within the labour force living in Population Study Area is higher than that recorded at State and County level. During the 2022 Census, the percentage of people over the age of 15 who were in the labour force was similar at both state and county level, but slightly lower in the Population Study Area at 58.81%of the population. Of those who were not in the labour force during the 2022 Census, the highest percentage of the population in the Population Study Area was in the 'Retired' category, which is the same as figures recorded at State and County level that 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 *Background*

A report entitled '*Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy*' 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, a report published in 2014 by Siemens entitled '*An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland*', also in conjunction with the Irish Wind Energy Association (IWEA), 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
- Investor activity
- Electricity Grid Network Employment
- Potential Wind Turbine Manufacturing Employment

The Sustainable Energy Authority of Ireland[13] demonstrates in their '*Wind Energy Roadmap 2011-2050*', 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 (CAP25) was launched in April 2025. Following on from Climate Action Plans 2019, 2021, and 2023, CAP25 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.* CAP25 sets out indicative ranges of emissions reductions for each sector of the economy.

[13] *SEAI (2019), https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*

Further information on energy and climate change targets is detailed in Section 1.5 of Chapter 1 (Introduction), Sections 2.2 to 2.4 of Chapter 2 (Background to the Proposed Development) and Chapter 11 (Climate) of this EIAR.

5.3.6.2.3 Employment Potential

The 2014 report *"An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland"* published by the Irish Wind Energy Association (IWEA) predicted that the wind energy sector in Ireland would result in 6,659 direct jobs in a scenario where 4GW capacity is achieved by 2020. This figure of 6,659 is broken down further; 5,596 of these jobs are associated directly with the construction and installation of windfarms, while the remaining 1,063 jobs are associated with the national grid. Under this scenario this contributes 1.66 direct jobs per Megawatt (MW) of wind capacity throughout the various stages of installation. According to Wind Energy Ireland, the installed wind capacity in Ireland is over 4.3GW as of February 2021, which would support employment during the last decade. Ireland needs to achieve a total of 9GW of onshore wind by 2030 which will further support further employment.

The Sustainable Energy Authority of Ireland[14] estimates, in their '*Wind Energy Roadmap 2011-2050*', note that '*Onshore and offshore wind could create 20,000 direct installation and O&M jobs by 2040*'. Furthermore, '*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*'.

The 2014 report '*The Value of Wind Energy to Ireland*', published by Pöyry, 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 instead chooses to not develop any more wind, then by 2030 the country will be reliant on natural gas for most of our electricity generation, at a cost of €671 million per annum in fuel import costs.

Internationally, a report issued by WindEurope in September 2017, entitled '*Wind energy in Europe: Scenarios for 2030*' 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 new report published by MaREI, the SFI Research Centre for Energy, Climate and Marine, hosted by University College Cork[15] (March 2021) details that in order to meet the government target of net-zero carbon emissions by 2050, at least 25,000 jobs will be created in the development of onshore and offshore wind to meet our zero carbon targets.

A more recent report which was issued by WindEurope in February 2022, titled '*Wind Energy in Europe: 2021 Statistics and the Outlook for 2022-2026*' details various scenarios in Europe in respect to the EU target for renewable energy. According to WindEurope's 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 continued on to state that '*We expect Europe to install 116 GW of new wind farms over the period from 2022-2026. Three quarters of these new capacity additions will be onshore wind.*' The report also states that '*The European Commission modelling shows that we need at least 79 GW offshore wind but National Government have pledged to build at least 92 GW offshore wind capacity by 2030.*'

As of the end of 2024, there were 6,321 Megawatts (MW) of wind energy capacity installed on the island of Ireland[16]. Of this, 4,934 MW was installed in the Republic of Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Kerry (746MW), Cork (705MW), Donegal (455MW), Mayo

[14] *SEAI (2019), https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*
[15] *https://www.marei.ie/our-climate-neutral-future-zeroby50/*
[16] *Eirgrid, https://www.eirgrid.ie/grid/system-and-renewable-data-reports*

(358MW), Galway (326MW) and Tipperary (422MW)[17], 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*', has 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) will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), 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 corresponds with the Deloitte report which indicates that more wind energy feeding into the national grid will result in lower and more stable energy costs for consumers.

Furthermore, in May 2020, IWEA released its 70by30 Implementation Plan Reports which further details 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, then 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 Development 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 current land use comprises of commercial forestry, agricultural land and unutilised existing wind farm infrastructure. The total area of farmland within the EDs around the Site measures approximately 4,249 hectares, comprising approximately 60% of the Population Study Area land mass, according to the CSO Census of Agriculture 2020. There are 99 no. farms located within the Population Study Area, with an average farm size of 43.6 hectares.

Table 5-7 Farm Size and Classification within the Population Study Area in 2020 (Source: CSO)

DED	No of holdings	Average size (hectares)	Median age of holder	Livestock units	Average farmed (hectares)
Douce	56	38.2	57	1,332	2,137
Bealanageary	43	49.1	58	1,166	2,112
Total	99	43.6 (average)	57.5 (average)	2,498	2,121.2 (average)
Size of both EDs			7,110 hectares		
Total Area Farmed within both EDs			4,249.4 hectares		
Farmland as % of EDs			60%		

[17] *Wind Energy Ireland* https://windenergyireland.com/about-wind/wind-energy-by-county

5.3.8 Services

The Site is located approximately 6.8km northeast of Kealkill, and The Site is located approximately 3.8km southwest of the village of Ballingeary. Other settlement areas in the wider region include Bantry (approximately 15.6km to the southwest of the Site) and Dunmanway (approximately 16.2km southeast of the Site. Settlements provide retail, recreational, educational, and religious services.

5.3.8.1 Education

The nearest primary school is Cappabue National School in Cappabue, Kealkill, approximately 1.7km south of the Site. The nearest secondary school is Scoil Mhuire in Ballingeary, approximately 5.2km northeast of the Site. The closest Third-Level institution to the Proposed Development is Munster Technological University (Bishopstown Campus) which is located approximately 53km east of the Proposed Development at its closest point.

5.3.8.2 Access and Public Transport

The Site is currently accessible via the existing entrance off the R584 regional road to the east of the Site. There is no public transport access to the Site. The nearest public transport access (public bus stop) is in Ballingeary, located approximately 5.4km by road from the Site.

5.3.8.3 Amenities and Community Facilities

There are no amenity or community facilities located within or adjacent to the Site, however there are several in the surrounding area. Located near Kealkill Village is the Bay Rovers A.F.C, approximately 8.8km from the Site boundary, and St Colums GAA Club, also approximately 8.8km from the Site boundary. Ballingeary GAA Club is located 5.4km northwest of Site boundary. Amenities and community facilities, including other sports clubs, youth clubs, and recreational areas are located in Bantry and Dunmanway.

Community Benefit proposals, which would provide the opportunity to enhance local amenities and community facilities are described in Chapter 4 (Description of the Proposed Development).

5.4 Tourism

For the purposes of this section, the Proposed Development is considered solely in relation to the tourism baseline assessment set out below in Section 5.4.1 – 5.4.3. A standalone Tourism Impact Assessment of the Proposed Development has also been completed and included in Appendix 5-4 of this EIAR.

5.4.1 Tourism and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. *Key Tourism Facts 2023*, pertaining to domestic and international tourism volumes for Ireland, was published by Failte Ireland in 2024 for the year 2023. In 2023, out-of-state (Overseas and Northern Ireland) tourist expenditure amounted to 5,980.1 million euro. Domestic tourism trips amounted to 3,121 million Central Statistics Office's official count of direct employment in 'Accommodation and food service activities', a category which includes hotels, restaurants, bars, canteens and catering, was 204,600 in Q4 2023 and rises to 206,900 when including seasonal and casual employment in the industry[18].

18 Failte Ireland Key Tourism Facts 2023, October 2024. Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/FI_Key-Tourism-Facts-2023_v1-October-1.pdf?ext=.pdf

Key Tourism Facts 2023, published in 2024 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 22 employees in tourism industries."

The Republic of Ireland is divided into seven tourism regions. Table 5-8 shows the total revenue and breakdown of overseas tourist numbers to each region in Ireland during 2023 ('*Key Tourism Facts 2023*, Fáilte Ireland, October 2024).

Table 5-8 Overseas Tourists Revenue and Numbers 2023 (source Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Non-Domestic Tourists (000s)
Dublin	2,289	3,870
Mid-East/Midlands	502	755
South-East	283	521
South-West	962	1,321
Mid-West	487	724
West	723	1,112
Border	337	462
Total	**5,583**	**8,765**

The South-West Region, in which the Site is located, comprises Counties Cork and Kerry. This Region benefited from approximately 21% of the total number of overseas tourists to the country and approximately 23% of the total tourism income generated in Ireland in 2022[19].

Table 5-9 presents the county-by-county breakdown of overseas tourist numbers and revenue to the South-West Region during 2023 (Fáilte Ireland, 2023). As can be observed, Cork had a tourism revenue of €1,035 million.

Table 5-9 Overseas Tourism to Border Region during 2023 (Source: Fáilte Ireland)

County	Revenue Generated by Overseas and Domestic Tourists (€m)	No. of Overseas Tourists (000s)
Cork	1,035	891,000
Kerry	762	628,000

5.4.2 Tourist Attractions

The nearest identified tourist attraction is the Gougane Barra which is located approx. 2.7km to the north of the nearest proposed turbine (T1). Set on a glacial lake surrounded by mountains, the surrounding walks and St Finbarr's Oratory offer a popular tourist attraction to West Cork. Gougane Barra Forest Park consists of six

19 Failte Ireland *Key Tourism Facts 2023*, October 2023. *Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/Publications/2022-key-tourism-facts.pdf?ext=.pdf*

different walking trails that are available as well as a 318km cycle route which starts in Cork City and finishes in Gougane Barra.

An in-depth assessment of the potential effect that the Proposed Development could potentially have on tourism in the area is included in Appendix 5-4 of this EIAR. This Tourism Impact Assessment (TIA) includes an extensive desk-study review, with a focus on the potential impacts due to the presence of the Proposed Development on tourism within the Zone of Influence(ZoI).

Carriganass Castle, a restored 16th century tower house, is located approximately 6.3km to the southwest of the Site in the village of Kealkill. Kealkill Stone Circle and Breeny More Stone Circle are two megalithic archaeological sites also located within the village of Kealkill. A number of walking routes are located within the village of Kealkill.

A number of amenities and tourist attractions can be found in the nearby town of Bantry, located approximately 15.6km south of the Proposed Development, including Bantry Bay Golf Club.

According to the TIA, both Ballingeary and Kealkill act as trailheads with supporting parking and a number of shorter looped walks, e.g. the Ballingeary Loops.

Mehigan's Island, a tree-covered crannóg in Lough Allua, Ballingeary, which is also used as a kayak/canoe destination by outdoor activity operator, Outdoor Discovery Adventure based in Inchigeelagh.

Local amenity/picnic areas, e.g. at Ballingeary and Kealkill. These are unlikely to have any tourism appeal, other than as a stop-off point if passing.

The TIA also suggests that Múscraí Gaeltacht could be considered to be a tourism asset, due to its culturally significant. However, it is not promoted as such and there is evidence that it has no tourism recognition.

Archaeological sites and monuments are part of Irish national heritage and are recognised tourist attractions across the country. National Monuments within 10km of the nearest proposed turbine are listed below. It should be known that not all of these National Monuments are publicly accessible. Please see Chapter 14 (Archaeological, Architectural & Cultural Heritage) for further details.

- Breeny More Stone Circle & boulder burials.
- Breeny More Stone Circle -Multiple Stone
- Derryarkane Stone Circle & Standing Stone.
- Maughanasilly Stone Row.
- Kealkill Stone circle - five-stone.
- Derryarkane Stone Circle & Standing Stone

5.4.3 Tourist Attitudes to Wind Farms

5.4.3.1 Scottish Tourism Study 2021

BiGGAR Economics undertook an independent study in 2021, entitled '*Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms*' to understand the relationship, if any, that exists between the development of onshore wind and the sustainable tourism sector in Scotland. In recent years, the onshore wind sector and sustainable tourism sector 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 during the years since 2009, an overall increase of 20%.

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 to 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 15km 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. The study found no relationship between tourism employment and wind farm development, at the level of the Scottish economy, across local authority areas, not in the locality of the wind farm sites.

5.4.3.2 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'.

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:

- 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 landscapes 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. Overall 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 Development throughout the design and assessment processes. Reference has been made to the '*Planning Guidelines on Wind Energy Development 2006*' herby referred to as the Guidelines (DoEHLG, 2006) and the '*Draft Revised Wind Energy Development Guidelines December 2019*' herby referred to as the Draft Guidelines (DoHPLG, 2019), 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'. 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 5.5 below.

5.4.3.3 Curraglass Tourism Impact Assessment

The Tourism Impact Assessment (TIA) for Curraglass assesses tourism based on the supply and distribution of accommodation, visitor demand levels, and visitor attractions provide further methods of quantifying tourism activity in an area in order to assess significance.

According to the TIA, there is one registered tourist accommodation premises (the Gougane Barra Hotel) and an additional 8 no. Airbnb premises within 5 km of the Site. This suggests that the immediate area is not highly significant in tourism terms, although it does indicate that there is a certain level of tourism. In the wider Bantry/Ballylickey/Glengarriff area, approximately 20kms away from the Site, is the closest hub of tourism activity as gauged by the clustering of tourist accommodation. It can be noted that a significant proportion of accommodation in this area is accounted for by caravan and camping, suggesting a thriving domestic family market that is more interested in coast and sea than in inland touring.

A review of visitor attractions across County Cork (excluding the City) identifies that the top attractions are located at a considerable distance from the Site, with Blarney, Carrigtwohill, and Doneraile listed as the most visited. According to the desk study undertaken by the TIA, recognised sources - Fáilte Ireland, the Association of Visitor Experiences and Attractions (AVEA) and the Office of Public Works (OPW) - does not identify any visitor attraction in the immediate vicinity of the Proposed Development. Therefore, the absence of any visitor attraction in the immediate area identifiable through official data sources indicates that the area is not of high tourism significance.

However, the TIA also recognises the importance of considering the existence of other potential tourism assets that may not be captured through official sources of accommodation and visitor attractions data, including St. Fin Barre's Oratory & Gougane Barra Forest Park. It was found that while there is no visitor number data

available for St. Fin Barre's Oratory, most recent data for the Forest Park, which is over ten years old, indicates approx. 63,000 visitors to the Park (Fáilte Ireland, 2010). This makes it a relatively significant tourism asset.

The Beara Breifne Way is also an identified tourist attraction in the TIA. Although, it is noted that, due to the strenuous nature of the trail, it is more likely that experienced walkers utilise these trails, which would not be considered part of a mainstream tourism market. The vast majority of walkers (85%) prefer short walks of 1km-5kms.

In addition to the two recognised tourism assets, a number of scenic routes are also identified in the TIA which may also be taken into consideration. One of which passes by the entrance to the Site: this is the R584 between Ballingeary and Kealkill, passing through the Pass of Keimaneigh. A second route also needs to be considered, which is the R548, north of the Site to Gougane Barra. A third scenic route along the R585, further away to the south east, may also be taken into consideration

The TIA observes that, upon review of the immediate development area through the Government's Historic Environment Viewer, it does not identify any significant heritage assets on or near the Site other than those at Gougane Barra.

The TIA assess the potential impacts of the Proposed Development through a review of datasets on whether tourists' experiences are affected by the nature of the development – wind farms and turbines. With regard to higher end tourism, the assessment of the tourism character and significance of the Proposed Development location is considered to be of low tourism significance. The closest tourism hub is Bantry is over 20kms away and beyond the range of potential impact.

The TIA also assess the potential impacts of the Proposed Development on a small number of tourism assets identified in the immediate area, namely Gougane Barra, the Beara Breifne Way, and the scenic routes. The TIA concludes it is not considered that the Proposed Development will have an impact on the Gougane Barra Site (including hotel, café, oratory, lake and forest park). As a result, it can be considered to also have no impact on its tourism value.

According to the TIA it is considered that the Proposed Development will have a negative impact on the local section of the Beara Breifne Way. However, as the impact is not expected to be significant due to the low visitor numbers using the trail and the lack of evidence that wind farms are perceived as negative by tourists, the impact on the tourism value of the trail is considered not to be significant.

Finally, it is not considered that the Proposed Development will have an impact on the two scenic routes identified in the area: the R584 between Ballingeary and Kealkill which passes through the Pass of Keimaneigh, and the R548 north of the Site that connects to Gougane Barra. As a result, their value as tourism assets will not be impacted. The TIA states the proposed turbines will have some impact on the scenic route along R585. However, as the impact is not expected to be significant due to the route's distance from the Site, as well as the low level of tourism in the area and the lack of evidence that wind farms are perceived as negative by tourists, the impact on the tourism value of the route is considered not to be significant.

The TIA address a number of concerns and oppositions raised in relation to previous planning applications for the Site. Conclusions from the assessment are summarised as follows:

- The impact on key visitor attractions: The potential impact has been assessed as imperceptible in the case of Gougane Barra and not significant in the case of the Beara Breifne Way.
- Erosion of visual quality: The overall impact on the tourism value of this particular tourism asset is considered to be not significant given the low volume of visitors on the route and the evidence that wind farms are not perceived negatively by the majority of tourists.
- Undermining of Gougane Barra and Bantry: See above point re. Gougane Barra. The TIA considers Bantry to be beyond any potential impact of the Proposed Development as it is over 20kms away.
- Cumulative impact: Following the assessment of cumulative impacts within the EIAR and of the scenic routes assessed within the TIA, it is concluded that there is unlikely to be a cumulative negative impact as a result of the Proposed Development.

- Impact on scenic routes: The potential impact of the Proposed Development on the routes has been assessed as imperceptible or not significant.

The TIA concludes that the Proposed Development as described will not have any significant negative impact on tourism in the area nor on the value of tourism asset.

See the full TIA is contained in Appendix 5-3.

5.5 Public Perception of Wind Energy

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

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

5.5.1.1.1 *Background*

In May 2023 the Sustainable Energy Authority of Ireland (SEAI) published a report on the national survey they commissioned of people's opinions of new commercial solar or wind farm projects in Ireland.[20] 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 5km of a new commercial wind or solar project sites, of which 219 live within 1km of a project site.

2023 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 1km 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 1km 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 publics support for Irelands energy transition.

5.5.2 Sustainable Energy Authority of Ireland Survey 2003 (updated in 2017)

5.5.2.1 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 2024 there are almost 400 wind farms on the island of Ireland. Since 1992 wind farms have

[20] *SEAI Irish national survey of households near new commercial wind and solar farms. Available at: <https://www.seai.ie/publications/SEAI-RESS-National-Survey.pdf>*

elicited a range of reactions from the Irish people.[21] In response, the SEAI (formerly SEI) commissioned a survey aimed at identifying public attitudes to renewable energy and to wind energy in Ireland[22]. The results of a national survey entitled '*Attitudes Towards the Development of Wind Farms in Ireland*'[23] were published by the Sustainable Energy Authority of Ireland (SEAI) in 2003 and updated in 2017. A catchment area survey was also carried out by SEAI (formerly SEI) in order to focus specifically on people living with a wind farm in their locality or in areas where wind farms are planned.

5.5.2.2 2003 Findings

The SEAI survey published in 2003, found that the overall attitude to wind farms is very positive, with 84% of respondents rating it positively or very positively. One percent rates it 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 effect 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 effect on the landscape is not a major concern for those living near an existing wind farm.

With regards to the economic and environmental effects 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 some experience of the structures 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 effect 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.

[21] *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*

[22] *SEAI Irish national survey of households near new commercial wind and solar farms. Available at: https://www.seai.ie/publications/SEAI-RESS-National-Survey.pdf*

[23] *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*

5.5.2.3 Survey Update 2017

Additionally, a survey carried out by Interactions in October 2017, published by the SEAI[24], show 47% of Irish adults polled said they 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.

The SEAI survey found that the overall attitude to wind farms is very positive, with 84% of respondents in favour of the use 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 selected good for the environment and reduced Carbon Dioxide emissions while fewer people, just over two in three, cited cheaper electricity.

5.5.2.4 Conclusions

Th main findings of the SEAI Surveys from 2003, 2017, and 2023 show consistently strong public support for wind energy in Ireland. In 2003, 84% of respondents viewed wind energy positively, with 67% open to having a wind farm nearby and concerns mainly limited to visual impact. The 2017 SEAI survey reported a similar 84% favourability, with 70% preferring renewable energy for their homes and 45% supporting local wind farm development, citing environmental and cost benefits. By 2023, support remained high, with 67% overall and 73% of those living near RESS-supported projects holding positive views, suggesting that proximity and direct experience with wind farms continue to reinforce favourable attitudes. These studies highlights that two-thirds of Irish adults are generally favourable to having a wind farm built in their locality, with little evidence of a "Not In My Back Yard" (NIMBY) effect.

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

5.5.3.1 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*', Journal of Environmental Planning and Management, November 2005). 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.

5.5.3.2 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 had two wind farms in proximity to each other.

5.5.3.3 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.

[24] *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*

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 Developments 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 opposition to a reliance on fossil fuels and nuclear power. Problems that are often cited as negative effects 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 effect 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.

5.5.3.4 Conclusions

The overall conclusions drawn from the survey findings and from the authors' review of previous studies show that local people become more favourable towards wind farms after construction, that the degree of acceptance increases with proximity to them, and that the NIMBY effect does not adequately explain variations in public attitudes due to the degree of subjectivity involved.

5.5.4 Wind Energy Ireland Interactions Opinion Poll on Wind Energy

Published in January 2020, Irish Wind Energy Ireland (IWEA) undertook a national opinion poll on Wind Energy November 2019 with the objective to "*measure and track public perceptions and attitudes around wind energy amongst Irish adults.*" Between November 20th – 30th 2019, a nationally represented sample of 1,019 adults and a booster sample of 200 rural residents participated in an online survey. The 2019 results indicate that

79% of both the nationally represented sample and rural sample strongly favour or favour wind power while 16% of both samples neither favour or oppose it. Amongst those in favour of wind power, the majority cited environmental and climate concerns as their main reasons for supporting such developments. Other reasons cited for supporting wind energy developments include: "economic benefits," "reliable/efficient," "positive experience with wind energy" and recognise it as a "safe resource." When questioned about wind developments in their local area, 55% of nationally represented sample favour or tend to favour such proposals and 51% of the rural population reported the same. Reasons cited for supporting wind developments in their local area include: "good for the environment," "social responsibility," "create jobs," "good for the community."

The IWEA November 2019 survey follows previous national opinion polls on wind energy undertaken in October 2017 and November 2018. The 2019 survey results are consistent with the 2017 and 2018 figures and thus indicate that approximately 4 out of 5 Irish adults have continued to support for wind energy in recent years.

5.5.4.1 Wind Energy Ireland Public Attitudes Monitor 2022

Published in December 2022, IWEA undertook a national opinion poll on Wind Energy in Q4 of 2022 with the objective '*to measures & track the perceptions and attitudes around wind energy amongst Irish adults.* Between November 23rd and December 8th 2022, a nationally represented sample of 1,017 and a booster sample of 201 rural dwellers participated in the survey. The 2022 results indicate that 80% of the nationally representative sample and 85% of the rural sample strongly favour or favour wind power. Almost half (45%) of those surveyed ranked cheaper electricity as the top wind energy benefit. Amongst rural residents, the percentage of people producing negative feedback is reducing year on year. Nationally, 58% of people said that they would be in favour of a wind farm in their area, which is the highest number in favour since tracking began. Amongst rural residents, just 1 in 10 people registered being opposed to having a wind farm in their local area.

The IWEA December 2022 survey follows previous national opinion polls on wind energy undertaken by IWEA in November 2019 and November 2018. The 2022 survey results are consistent with the 2019 and 2018 figures and thus indicate that 4 out of 5 Irish adults have continued to support wind energy in recent years.

5.5.4.2 WEI Interactions Opinion Poll on Wind Energy 2023

In early 2023, Wind Energy Ireland (WEI) published the results of their most recent nationwide annual poll on attitudes to wind energy, the Public Attitudes Monitor.[25] The objective of the poll was to '*measure and track public perceptions and attitudes around wind energy amongst Irish adults.*'

Between 23rd November and 8th December 2022, a nationally representative sample of 1,017 Irish adults together with a booster sample of 201 rural residents participated in the survey. The 2022 results reported that 4 in 5 (80%) are now in favour of wind power which is a 6% increase on the 2021 results (54% of those in favour were 'strongly in favour'). Amongst rural residents, 4 in 5 (85%) 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 an increase in those in favour from the rural population (from 79% to 85%).

Amongst those in favour of wind power, the majority cited the fact that Ireland was a windy country with a readily available renewable resource and environmental and climate concerns as their main reasons for supporting such developments. Other reasons cited for supporting wind energy developments include: 'free/cheap/costs less', 'reliable/efficient', 'economy/jobs', and view that it as a 'safe resource'.

When questioned about wind energy developments in their local area, 58% of the nationally representative sample either 'favour' or 'tend to favour' such proposals compared to 56% of the rural population reporting the same.

[25] https://windenergyireland.com/about-wind/more-resources/annual-wind-survey

The Wind Energy Ireland 2023 survey follows the structure of previous national opinion polls on wind energy undertaken since 2017. The 2023 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.

5.5.4.3 Wind Energy Ireland Public Attitudes Monitor 2024

In late 2024, WEI published the results of their most recent nationwide annual poll on attitudes to wind energy, the Public Attitudes Monitor[26]. The objective of the poll was to "*measure and track public perceptions and attitudes around wind energy across ROI*".

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.

The Wind Energy Ireland 2024 survey follows the structure of previous national opinion polls on wind energy undertaken since 2017. 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.

5.5.4.4 Conclusion

The WEI national opinion polls from 2019 to 2024 consistently demonstrate strong and sustained public support for wind energy among Irish adults. Across all years, approximately 80% of respondents nationally, and increasingly among rural residents, expressed favourable attitudes towards wind energy. Support is driven primarily by environmental concerns, the perception of wind as a safe and reliable resource, and its potential to lower electricity costs. Notably, acceptance of local wind energy developments has also grown, with 62% of the national sample supporting such projects in 2025, the highest level recorded to date. These findings highlight a stable and positive public attitude towards wind energy in Ireland, reinforcing its role in the country's renewable energy strategy.

5.6 Health Effects of Wind Farms

5.6.1 Introduction

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 Development. The vast majority of those within the Population Study Area marked their general health as being 'very good' across both EDs. It is not anticipated that the general health of the population of the Population Study Area be altered due to the Proposed Development.

[26] *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

5.6.2 Health Impact Studies

While there are anecdotal reports of negative health effects on people who live very close to wind turbines, peer-reviewed research has 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*

This expert panel 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.
- 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*

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 following the publication of 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 WTD are wrong; and
- Noise from Wind Turbines cannot contribute to the symptoms reported by Dr. Pierpont'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. ***'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, New South Wales Australia*

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 of them 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 Wind Turbine Syndrome.
- This study suggests that the infrasound component of Wind Turbine Syndrome is unlikely to be a cause of any ill-health or sleep disruption, although this observation should be independently replicated.

4. ***'A Rapid Review of the Evidence'***, *Australian Government National Health and Medical Research Council (NHMRC) Wind Turbines & Health, July 2010*

The purpose of this paper was to review evidence from current literature on the issue of wind turbines and potential effects on human health and to validate the finding of the 'Wind Turbine Sound and Health Effects - An Expert Panel Review' (see 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."

5. ***'Position Statement on Health and Wind Turbines'***, *Climate and Health Alliance, February 2012*

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 effects of fossil fuel energy generation.

6. ***'Wind Turbine Health Impact Study -Report of Independent Expert Panel'*** *– Massachusetts Departments of Environmental Protection and Public Health (2012)*

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 effects 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."*
>
> *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."*

7. ***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)*

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.

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 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'* critically discusses why certain health effects might often be incorrectly attributed to wind turbines.

8. ***Position Paper on Wind Turbines and Public Health:*** *HSE Public Health Medicine Environment and Health Group, February 2017*

The Health Service Executive (HSE) position paper on wind turbines and public health was published in February 2017 to address the rise in wind farm development and concerns regarding potential effects on public health. The paper discusses previous observations and case studies which describe a broad range of health effects that are associated with wind turbine noise, Shadow Flicker and electromagnetic radiation.

A number of comprehensive reviews conducted in recent years to examine whether these health effects are proven has highlighted the lack of published and high-quality scientific evidence to support adverse effects of wind turbines on health.

The HSE position paper determines that current scientific evidence on adverse effects of wind farms on health is weak or absent. Further research and investigative processes are required at a larger scale in order to be more informative for identifying potential health effects of exposure to wind turbine effects. They advise developers on making use of the Guidelines, as a means of setting noise limits and set back distances from the nearest dwellings.

9. ***Environmental Noise Guidelines for the European Region:*** *World Health Organisation Regional Office for Europe, 2018.*

The WHO Environmental Noise Guidelines provide recommendations for protecting human health from exposure to environmental noise originating from various sources such as transportation noise, 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 increase 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. Furthermore, public perception towards wind turbines are hard to differentiate from reported effects related to noise and the two may be inextricably linked. 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 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, however, it states that no evidence is available to facilitate the recommendation of one type of intervention over another.

10. ***Infrasound Does Not Explain Symptoms Related to Wind Turbines:*** *Finnish Government's Analysis, Assessment and Research Activities (VN TEAS), 2020*

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 was 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 (12 miles) of the generators.

The report notes:

> *'...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'.

11. ***Impact of Wind turbines on Human Health and Safety:*** *Proceedings of Socratic Lectures, University of Ljubljana, 2025*

The purpose of this paper was to review evidence from current literature with regards to effects on noise emissions, infrasound, ice throw and visual impacts. The paper shows that these effects are either negligible or effectively mitigated by modern technologies and safety standards. It was noted that misinformation and psychological factors such as nocebo effects (psychological phenomenon in which negative expectations of a particular stimulus or situation lead to the perception of negative effects, even if there is no direct physical cause)

The paper concluded that the health benefits of wind energy such as reduction of air pollution and associated diseases, along with benefits such as energy security, job creation, and climate change mitigation outweigh the potential risks.

The paper looks to promote informed public dialogue so that the potential of wind energy can be fully realised in line with global efforts to combats climate change and protect public health.

5.6.3 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The Guidelines (DoEHLG,2006) and the Draft Guidelines (DoHPLG,2019) 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 Guidelines (DoEHLG,2006) and the Draft Guidelines (DoHPLG,2019) 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; therefore, danger is 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" provides guidelines and requirements for the design of wind turbines, including considerations for environmental conditions[3]. 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.[4] As such, the Proposed Development, 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 Development 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.

5.6.4 Electromagnetic Interference

The provision of underground electric cables 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.

The ESB document 'EMF & You' (ESB, 2017)[27] provides further practical information on EMF.

Further details on the potential effects of electromagnetic interference to telecommunications and aviation are presented in Chapter 15 (Material Assets).

5.6.5 Assessment of 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*' 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 & Human Health (including Shadow Flicker)), Chapter 8 (Land, Soils & Geology), Chapter 9 (Hydrology & Hydrogeology), Chapter 10 (Air Quality), Chapter 11 (Climate), Chapter 12 (Noise & Vibration), and Chapter 15 (Material Assets (including Traffic and Transport, Telecommunications and Aviation)) provide an assessment of the effects of the Proposed Development 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 Development design and mitigation measures outlined in Chapter 8 and Chapter 9 ensures that the potential for effects on the water environment are not significant. No effects on local water supplies are anticipated.

As set out in Chapter 9, potential health effects are associated with negative effects on public and private water supplies and potential flooding. The Proposed Development overlies the Beara Sneem Groundwater body (GWB) (IE_SW_G_019) and the Ballinhassig West (IE_SW_G_005) GWB. According to the Water Frameworks Directive, both the Loughgrea and Clarbinbride GWB's are classified as 'Good Status, not at Risk'. Proposed Infrastructure is located within areas of 'Extreme' aquifer vulnerability according to Geological Survey Ireland (GSI) (www.gsi.ie), however, due to low permeability nature of the bedrock aquifer underlying the Site, groundwater flow paths are likely short, with recharge emerging close by at seeps and surface streams. Chapter 9 (Hydrology & Hydrogeology) assess 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 Development contributing to 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 Development 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 Development will have a long term, significant, positive effect on air quality as set out in Chapter 10 which will contribute to positive effects on human health.

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

[27] *EMF & You: Information about Electric & Magnetic Fields and the electricity network in Ireland Available at: https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0.*

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 Development. 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 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 Development is imperceptible.

5.6.6 Vulnerability of the Proposed Development to Natural Disasters and Major Accidents

As outlined in Section 5.6.5 above, 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 the construction, operational and decommissioning phases, are limited. 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.

In the context of the Proposed Development, there is limited potential for significant natural disasters to occur. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat instability, flooding and fire. The risk of flooding and potential for contamination of groundwater and drinking water due to the construction of the Proposed Development is addressed in Chapter 9 (Hydrology & Hydrogeology), with the risk being limited due to the proposed mitigation measures and site drainage plan, meaning there is limited risk to human health. It is considered that the risk of significant fire occurring, affecting the Proposed Development and causing the wind farm to have significant environmental effects is limited and therefore a significant effect on human health is similarly limited.

The risk of peat instability and failure (landslide) occurring on the Site is addressed in the Geotechnical and Peat Stability Report included in Appendix 8-1 of this EIAR. It is concluded that the Site has an acceptable margin of safety and is suitable for wind farm development.

As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for effects on human health. The issue of turbine safety is addressed in Section 5.6.3.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on and off the Site of the accident. The Site is not regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO sites and so there are no potential effects from this source. A Major Accidents and Natural Disasters assessment is included as Chapter 16 (Major Accidents and Natural Disasters).

5.7 Property Values

5.7.1 Property Values and Wind Farms

In the absence of any Irish studies on the effect of wind farms on property values, this section summarises the largest and most recent studies from the UK and the United States and also provides a summary of an Irish working paper by 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'*.[28] 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 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 0-1km 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 1km band were not persistent and diminished over the operational lifetime of the turbines. Considering that this is a working paper, based on a small sample size where local conditions have the potential to disproportionately impact on the local housing market, further research is required before relying on its findings.

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', December 2009, was carried out by 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 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", in August 2013. 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 10 miles of the wind energy facilities - about 1,100 homes were within 1 mile, with 331 within half a mile. The report is therefore based on a very large sample 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. Therefore, although there have been claims of significant property value effects near operating wind turbines that regularly surface in the press or in local communities, strong evidence to support those claims has failed to materialise in all the major U.S. studies conducted thus far.

[28] *Centre for Economic Research on Inclusivity and Sustainability (2023) Wind Turbines and House Prices Along the West of Ireland: A Hedonic Pricing Approach. <https://www.universityofgalway.ie/media/researchsites/ceris/files/WP-2023-01.pdf>*

In September 2023, the Energy Policy Journal published 'Commercial wind turbines and residential home values: new evidence from the universe of land-based wind projects in the United States.'[29] 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 1 mile of a proposed wind energy project experience a decrease in value of 11% relative to homes located within 3-5 miles of the Proposed Development. 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.

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'* and its main conclusions 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 five-kilometre radius of the Sites.

A study issued in October 2016 'Impact of wind Turbines on House Prices in Scotland' (2016) 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 (p.3) 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 2km or 3km 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 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 Development.

[29] *Energy Policy (2023) Commercial wind turbines and residential home values: new evidence from the universe of land-based wind projects in the United States. Available at: https://www.sciencedirect.com/science/article/pii/S0301421523004226*

5.8 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.

When considering the amenity of residents in the context of a Proposed Development, 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 impact assessments have been completed as part of this EIAR (Section 5.9 refers to Shadow Flicker, Chapter 12 addresses noise and vibration). A comprehensive landscape and visual impact assessment have also been carried out, as presented in Chapter 13 (Landscape and Visual) of this EIAR. Impacts on the local population during the construction, operational and decommissioning phases of the Proposed Development is assessed in relation to each of these key topics and other environmental factors such as noise, traffic, and dust; see impacts in Section 5.10 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, telecommunications, dust and general disturbance.

The closest sensitive receptor is located 1 kilometre from proposed turbine location T3. Therefore, all sensitive receptors are located beyond the minimum of 626m from any proposed turbine, i.e., 4 times the tip height of 156.5m (specifically set out in the Draft Guidelines (DoHPLG,2019) for the purposes of protecting visual amenity). The proposed turbine locations adhere to the Guidelines (DoEHLG,2006) and the Draft Guidelines (DoHPLG,2019) in relation to turbine setback, a minimum 500m set back from sensitive receptors and a minimum setback of four times the tip height of the proposed turbines with a reduced setback of a minimum of 500m for sensitive receptors involved with the Proposed Development.

On the 21st of December 2023, the Department of the Environment, Climate and Communications published the 'Climate Action Plan 2024' (CAP24) which states as a key action to publish revised wind energy development guidelines for onshore wind in 2024. At time of writing, the draft Guidelines have not yet been adopted, and the relevant guidelines for the purposes of section 28 of the Planning and Development Act 2000, as amended, remain to be the Guidelines. Notwithstanding this, however, due to the timelines associated with the planning process for renewable energy projects and the commitment within the CAP24 to publish new draft guidelines, it is possible that the draft Guidelines may be adopted during the consideration period for the current planning application. Please note, the Climate Action Plan 2025 (CAP25) was published in April 2025, however it does not provide an update on the commitments published in CAP24 relating to the publication timeline of the Draft DoEHLG 2019 Guidelines. Without benefit of the revised wind energy development guidelines for onshore wind, it is considered that since noise emissions and shadow flicker are controllable via inbuilt technologies, the Proposed Development is capable of compliance with any future guideline limits in this regard. Furthermore, it is considered that 4 times turbine tip height set back from non-involved sensitive receptors has become an industry established accepted separation distance for visual amenity purposes.

5.9 Shadow Flicker Assessment Results

5.9.1 Daily and Annual Shadow Flicker

The WindPRO Shadow – Version 4.0.552 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 maximum Shadow Flicker model assumes that daylight hours consist of 100% sunshine. This is a conservative assumption which represents a worst-case scenario. Following the detail provided above on sunshine hours, a sunshine factor of 33.40% 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 5-10.

The predicted maximum daily and annual Shadow Flicker levels are then considered in the context of the Guidelines (DoEHLG,2006) 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 Guidelines (DoEHLG,2006) recommend that Shadow Flicker at dwellings within 500 metres of a proposed turbine location should not exceed a total of 30 minutes per day or 30 hours per year. As detailed in Section 5.5.1 there are no sensitive receptors less than 500 metres of the proposed turbine locations.

The predicted Shadow Flicker levels have been modelled for all 8 no. sensitive receptors located within the Shadow Flicker Study Area. The predicted Shadow Flicker model results indicate:

- 8 sensitive receptors are theoretically predicted to experience zero Shadow Flicker;
- 0 sensitive receptors are theoretically predicted to experience some Shadow Flicker;
    - Of the 8 sensitive receptors, none of the sensitive receptor is theoretically predicted to experience Shadow Flicker that exceeds the Guideline thresholds for daily and/or annual Shadow Flicker. Please see Table 5-10 below for details.
- The annual threshold of over 30 hours for Shadow Flicker (Guidelines (DoEHLG,2006)) is predicted to be exceeded at none of the sensitive receptors once the regional sunshine average factor of 33.40% % has been considered. It should be noted that none of the sensitive receptors are involved landowners.

Figure 5-3 illustrates the houses that are potentially impacted by Shadow Flicker exceedances from the Proposed Development.

It is worth noting that the predicted max daily shadow flicker and the max annual Shadow Flicker listed in Table 5-10 is 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 onto the wind turbines.
- At distances, greater than 500-1000m '*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*' (Danish Wind Industry Association, 2003).

While none of the receptors exceed the exceedances set out in the Guidelines (DoEHLG,2006). It is noted that the Proposed Development can be brought in line with the requirements of the Draft Guidelines (DoHPLG,2019), should they be adopted while this application is in the planning system, through the implementation of the mitigation measures outlined below.

5.9.2 Cumulative Shadow Flicker

The only existing, permitted, or Proposed Development within 5km of the nearest turbine of the Proposed Development is the proposed Maughanaclea Wind Farm, located approximately 3.6km southeast of the Proposed Development. The rotor diameter for the Proposed Maughanaclea wind turbines is 133m with a corresponding Shadow Flicker study area for these turbines of 1330m (10-x rotor diameter). This area does not overlap with the Shadow Flicker Study Area for the Proposed Development and so there is no potential for cumulative Shadow Flicker effects in this instance. Due to the separation distance between the proposed turbines and all surrounding proposed, permitted, or operational wind farms, there is no potential for cumulative Shadow Flicker effects.

Table 5-10 Maximum Potential Daily & Annual Shadow Flicker – Proposed Curraglass Wind Farm, Co. Cork.

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	508250	561256	Dwelling	1033	T3	00:00:00	0:00:00	0:00:00	N/A	No	No
14	508193	561379	Dwelling	1001	T3	00:00:00	0:00:00	0:00:00	N/A	No	No
17	510082	562611	Dwelling	1079	T2	00:28:00	25:36:00	8:33:04	N/A	No	No
18	510073	562601	Dwelling	1079	T2	00:29:00	26:02:00	8:41:45	N/A	No	No
19	510004	562199	Dwelling	1018	T3	00:30:00	32:46:00	10:56:42	N/A	No	No
20	510123	561933	Dwelling	1107	T3	00:28:00	13:17:00	4:26:13	N/A	No	No
21	509664	561160	Dwelling	1021	T3	00:00:00	0:00:00	0:00:00	N/A	No	No
22	509971	561187	Dwelling	1221	T3	00:00:00	0:00:00	0:00:00	N/A	No	No

5.10 Likely Significant Effects and Associated Mitigation Measures

5.10.1 'Do Nothing' Scenario

If the Proposed Development were not to proceed, the Site will continue to function as it does at present, with no changes made to the current land-use and potential for impacts on population and human health through the construction, operation and decommissioning of the Proposed Development would not occur.

If the Proposed Development were not to proceed, the opportunity to capture part of Cork'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 by 2030 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. Furthermore, the opportunity to utilise existing on-site infrastructure and the existing 38kV overhead line would also be lost.

5.10.2 Construction Phase

Within this section, the impact will consider the construction phase of the Proposed Development.

5.10.2.1 Population

Pre-Mitigation Impacts

Those working on the construction phase of the Proposed Development 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 and is not significant.

5.10.2.1.2 *Employment and Investment*

Pre-Mitigation Impacts

The design, construction, operation and decommissioning of the Proposed Development will provide employment for technical consultants, contractors and maintenance staff. As discussed, it is proposed to construct the Proposed Development which would require approximately 40 employees in total, with an estimated 40 jobs focussing on the construction phase. The construction phase of the wind farm will last between 9-12 months.

The Proposed Development 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 effect 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 long-term slight positive indirect effect. Wind Energy Ireland 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 the Climate Action Plan accelerates.

Residual Impact

The injection of money in the form of salaries and wages to those employed during the construction phase of the Proposed Development 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 short-term positive effect on their cash flow. This will have a short-term slight positive indirect effect and is not significant.

Significance of Effects

The significance of effects on employment levels and local investment during the construction phase will be slight and not significant.

5.10.2.1.3 *Land Use Patterns & Activities*

Pre-Mitigation Impacts

Current land use comprises of commercial forestry, agricultural land and unutilised existing wind farm infrastructure. In addition to forestry and wind energy, other land-uses in the surrounding area include agriculture, and residential/commercial activities.

There is no potential for impact on residential and commercial land use in the area.

Mitigation and Monitoring Measures

The identified 8.8 ha of commercial forestry that will be permanently felled for the Proposed Development will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that will be issued in respect of the Proposed Development felling (Section 4.4.3.1.2 of Chapter 4 (Description of the Proposed Development) of this EIAR).

Residual Impact

Due to the small footprint of the above ground elements of the Proposed Development infrastructure, on a site scale and even more so on a local scale, the residual effect is considered negative, direct, slight, permanent impact on land use and a negative, direct, slight short-term impact on activities.

Significance of Effects

The effect on land use/activities due to the construction phase the Proposed Development infrastructure is Slight and not significant.

5.10.2.1.4 *Property Values*

Pre-Mitigation Impacts

As noted in Section 5.7.1 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 Development. The impact assessment on property values outlined below takes a precautionary approach and assumes that based on the inconclusive evidence summarised above in Section 5.7, there is the potential for short-term slight impacts on property values located within 1km of the proposed turbines during the construction phase of the Proposed Development. However, there are no sensitive receptors located within 1km of the Site.

Mitigation and Monitoring Measures

- All mitigation relevant to property values, outlined above and the corresponding chapters: Chapter 10 (Air Quality), Chapter 12 (Noise & Vibration), Chapter 13 (Landscape & Visual), and Chapter 15 (Material Assets), will be implemented in order to reduce potential impacts

on property values at properties located in the vicinity of Proposed Development construction works. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.

- The Proposed Development has been designed in accordance with the parameters set out in the Guidelines (DoEHLG,2006) and with cognisance of the Draft Guidelines (DoHPLG,2019), 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.

Residual Impact

It is on this basis that it can be concluded that there is the uncertain potential for a short term negative not significant impact on property values from the construction phase of the Proposed Development.

Significance of Effects

The effect on property values due to the construction of the Proposed Development is not significant.

5.10.2.1.5 *Tourism*

Pre-Mitigation Impact

Given that there are currently no tourism attractions or amenity walkways located within the Site itself, there are no impacts on tourism associated with the construction phase of the Proposed Development. It is considered that the Proposed Development would not have an adverse impact on tourism infrastructure in the vicinity. Renewable energy developments are an existing feature in the surrounding landscape, which will assist in the assimilation of the Proposed Development into this environment.

With regard to tourist attractions and amenity use surrounding the Proposed Development, described in Section 5.4, traffic management safety measures will be in place, where required. Please see below for Traffic impact mitigation measures and Chapter 15 (Material Assets) for mitigation measures relating to the Site.

Mitigation and Monitoring Measures

Section 5.10.2.2.5 below outlines the mitigation measures proposed in relation to traffic management.

Residual Impact

Based on the above it is concluded that there would be a short term, negative imperceptible impact on tourism in the wider landscape due to the construction phase the Proposed Development. Appendix 5-4: Tourism Impact Assessment provides further evidence that there will be no significant negative tourism effects due to the Proposed Development.

Significance of Effects

The effect on tourism in the wider landscape due to construction phase the Proposed Development is Slight and not significant.

5.10.2.1.6 *Residential Amenity*

Pre-Mitigation Impact

The potential for impacts on residential amenity is discussed in Section 5.8 above. There is the potential for impacts on residential amenity during the construction phase of the Proposed Development due to air, traffic, noise and vibration emissions due to the presence of additional traffic and plant machinery.

Mitigation and Monitoring Measures

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

Residual Impact

Based on the above it is concluded that there would be a short-term, negative, slight impact on residential amenity due to the construction phase of the Proposed Development and not significant

Significance of Effects

The effect on residential amenity due to construction phase the Proposed Development is slight and not significant.

5.10.2.2 Health

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

5.10.2.2.1 *Health and Safety*

Pre-Mitigation Impacts

Construction of the Proposed Development will necessitate the presence of a construction site and travel on the local public road network to and from the construction 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 short-term potential significant negative impact on health and safety.

Mitigation and Monitoring Measures

The Proposed Development will be constructed 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 (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

The following measures below are also detailed in Chapter 18 (Schedule of Monitoring & 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.
- Goal posts will be established, where necessary, under overhead electricity lines for the entirety of the construction phase of the Proposed Development.
- 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 the Site. All staff will be trained to be aware of the risks associated with overhead lines. All contractors that may visit the Sites 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, 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 on Site.
- 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 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 necessitates 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'*. 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
- 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 Safe Pass 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 Impact

With consideration of the implementation of the detailed mitigation measures, there will be a short-term direct, slight negative residual effect on health and safety during the construction phase of the Proposed Development.

Significance of Effects

Based on the assessment above the effects on health and safety during the construction phase of the Proposed Development are considered to be slight and not significant.

5.10.2.2.2 *Air Quality: Dust and Exhaust Emissions*

Pre-Mitigation Impacts

Potential dust and exhaust emission sources during the construction phase of the Proposed Development include upgrading of existing and construction of new access tracks, turbine and meteorological mast foundations, temporary construction compound, borrow pit construction, and peat and soil management.

An increase in dust and exhaust emissions has the potential to cause a nuisance to sensitive receptors in the immediate vicinity of the Site. The entry and exit of construction vehicles from the Proposed Development 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 volumes of stone to be transported into the 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. The potential dust impacts that may occur during the construction phase of the Proposed Development are further described in Chapter 10 (Air Quality).

Mitigation and Monitoring Measures

All mitigation as outlined in Chapter 10 (Air Quality) will be implemented in order to reduce impacts on air quality in the vicinity of Proposed Development construction works. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.

Residual Impacts

With the implementation of the above measures for this construction phase, residual impacts on air quality from dust and exhaust emissions associated with construction activities and machinery are considered to be a short-term direct, slight negative effect on air quality.

Significance of Effects

The effects on air quality from dust and exhaust emissions during the construction phase of the Proposed Development are considered to be slight and not significant.

5.10.2.2.3 *Water Quality*

Pre-Mitigation Impacts

The construction phase ground works and use of plant on site may give rise to the potential release of suspended solids and hydrocarbons into surface and groundwaters. There are a number of tributaries of two EPA surface watercourses within the Site boundary. The Owenbeg (Owvane)_010 (IE_SW_21O030200) to the south and west, and the Lee (Cork)_010 (IE_SW_19L030040) to the north and east. There are also several fresh water drains present onsite. There are no underground water or sewerage networks in proximity to the proposed infrastructure locations. Chapter 9 (Hydrology & Hydrogeology) assesses the potential for impact on group water schemes and other public water supplies during the construction phase. The pre-mitigation impact on water quality is assessed as Indirect, negative, moderate, temporary, likely effect.

Mitigation and Monitoring Measures

A bespoke drainage design which includes but is not limited to interceptor drains, check dams, swales and ponds will be implemented on the Site. Chapter 9 (Hydrology & Hydrogeology) of this EIAR details all best practice and mitigation measures to minimise the potential for entrainment of suspended sediment or potential hydrocarbon leak. Please see Chapter 9 (Hydrology & Hydrogeology) for details and Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of mitigation and monitoring measures for the Proposed Development.

Residual Impacts

With the implementation of the drainage design and all mitigation measures listed in Chapter 9 (Hydrology & Hydrogeology) (separation distances, prevailing geology, topography and groundwater flow directions), it is considered that the residual effects are to be short-term, imperceptible, negative effect on water quality.

Significance of Effects

The effects on water quality during the construction phase of the Proposed Development are considered to be imperceptible and not significant.

5.10.2.2.4 *Noise and Vibration*

Pre-Mitigation Impacts

There will be an increase in noise levels in the vicinity of the Site during the construction phase, as a result of heavy machinery and construction work which has the potential to cause a nuisance to sensitive receptors located closest to the Site. These effects will be short-term in duration. The noisiest construction activities associated with wind farm development are excavation and concrete pouring of the turbine bases. Excavation of a turbine base can typically be completed in five days however, and the main concrete pour is usually conducted within one day.

Construction noise at any given noise sensitive location will be variable throughout the construction phase, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the Proposed Development are further described in Chapter 12 (Noise & Vibration). The predicted pre-mitigation noise

impacts during the construction of the Proposed Development are assessed as negative, not significant and short-term.

Mitigation and Monitoring Measures

Best practice measures for noise control will be adhered to on-site during the construction phase of the Proposed Development to impacts associated with this phase of the development. Please refer to Chapter 12 (Noise & Vibration) and Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.

- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, Local Authority and residents;
- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- Selection of plant with low inherent potential for generation of noise and/ or vibration where practical;
- Placing of noise generating / vibratory plant as far away from sensitive properties as practical within the site constraints, and;
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, turbine component deliveries) it could occasionally be necessary to work out of these hours.

Residual Impact

With the implementation of the above mitigation measures, there will be a short-term, slight impact on health due to an increase in noise levels during the construction phase of the Proposed Development.

Significance of Effects

For the reasons outlined above, the effects on human health due to noise emissions from the Proposed Development during construction will be slight and not significant.

5.10.2.2.5 *Traffic and Transport*

Pre-Mitigation Impact

It is proposed that the large wind turbine components will be delivered to the Proposed Development from the Port of Cork. For the purposes of assessment, the turbine components and other abnormal loads will be transported, from Ringaskiddy Port, west on the N22, before turning southwest along the R585 Regional Road via Crookstown to the junction with the R584 Regional Road at the village of Kealkill. From Kealkill, the turbine delivery route will continue along the R584 to Ballylickey, where a reversing manoeuvre occurs at Ballylickey bridge. Once the manoeuvre is complete, the turbines will travel northeast back along the R584, through Kealkill towards Ballingeary. The turbines will travel past the Site entrance, performing a reversing manoeuvre further along the R584, before travelling back south along the same road and accessing the Site from the north via the existing Coillte entrance. This is the preferred route for turbine delivery.

The proposed turbine component turning area along the R584, with the reversing manoeuvre shown on Figure 4-20, will require removal of fencing and temporary placement of hardcore, so the area can be used during the delivery of large turbine components. Once the turbines have been delivered, this area will be returned to its original state.

This will have a temporary slight negative effect on traffic users on the delivery routes.

Mitigation and Monitoring Measures

A complete Traffic and Transport Assessment (TTA) of the Proposed Development has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Chapter 15 (Material Assets). The Plan will be developed and implemented to ensure any effect is short term in duration and imperceptible in significance during the construction of the Proposed Development. A Traffic Management Plan has also been developed in order to minimise any potential effect on the local population during the construction phase of the Proposed Development 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 in order to ensure that disruption will be kept to a minimum. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.

Residual Effects

Once the Traffic Management Plan is implemented for the construction phase of the Proposed Development, there will be a short-term direct slight negative residual effect on local road users.

Significance of Effects

Based on the assessment above, the effects on traffic from the Proposed Development during construction will be slight and not significant.

5.10.2.2.6 Major Accidents and Natural Disasters

Pre-Mitigation Impacts

A risk register has been developed which contains all potentially relevant risks identified during the construction phase of the Proposed Development. eight risks (Critical Infrastructure Emergencies, Severe Weather, Flooding, Peat Stability, Traffic Incident, Contamination, Fire/ Explosion and Collapse/ damage to structure) specific to the construction phase have been identified and are presented in Chapter 16 (Major Accidents & Natural Disasters). As outlined in 16.4.1 of this EIAR, the scenario with the highest risk score in terms of the occurrence of major accident and/or disaster during the construction is identified as 'Peat Stability, Contamination' of the Site and risk of 'Fire/Explosion' during construction.

Residual Impact

The impact assessment concludes that the risk of a major accident and/or disaster during the construction phase of the Proposed Development is considered 'low' in accordance with the '*Guide to Risk Assessment in Major Emergency Management*' (DoEHLG, 2010).

Significance of Effects

Based on the risk assessment in Chapter 16 (Major Accidents & Natural Disasters), the effects to/from Major Accidents and Natural Disasters during the construction phase of the Proposed Development is not significant.

5.10.2.2.7 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 of this chapter, can only occur during the operational phase of a wind

energy development. There are therefore no Shadow Flicker impacts associated with the construction phase of the Proposed Development. Any Shadow Flicker effects that occur in the commissioning phase of the proposed turbines will be short in duration and is dealt with under Section 5.10.3.2.7 below.

5.10.3 Operational Phase

5.10.3.1 Population

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

5.10.3.1.1 *Population Levels*

Pre-Mitigation Impacts

The operational phase of the Proposed Development will have no impact on the population of the area with regard to changes to trends, population density, household size or age structure.

Residual Impact

No residual impacts

Significance of Effects

Not significant and No significance of effects.

5.10.3.1.2 *Employment and Investment*

Pre-Mitigation Impacts

The operational phase will present an opportunity for mechanical-electrical contractors and craftspeople to become involved with the maintenance and operation of the Proposed Development. On a long-term scale, the Proposed Development will create approximately 1-2 jobs during the operational phase relating to the maintenance and control of the Proposed Development, having a long-term slight positive effect.

The injection of money in the form of Community Gain income and landowner payments to the landowners who are participating in the Proposed Development, where a rental agreement 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 long-term positive impact on their cash flow. This will have a long-term slight positive indirect effect. Further details on the proposed Community Benefit Fund proposals are presented in Appendix 2-1 and Section 4.9.3 of Chapter 4 (Description of the Proposed Development) of this EIAR.

Rates payments for the Proposed Development will contribute significant funds to Cork County Council, which will be redirected to the provision of public services within the county. These services include provisions such as road upkeep fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives. This will have a long-term slight positive indirect effect.

Residual Effects

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

Significance of Effects

Based on the assessment above, the effects on employment and investment from the Proposed Development during operation will be slight and not significant

5.10.3.1.3 *Land Use Patterns and Activities*

Pre-Mitigation Impacts

The Site covers an area of approximately 270 hectares in total. The permanent footprint of the Proposed Development will occupy only a small percentage of the Site; 4.7 hectares, 1.7% of the overall 270-hectare site.

As such, its small-scale relative to the Site and Population Study Area combined with its ability to coexist with ongoing site activities and activities within the landscape indicate that the Proposed Development will not impact significantly on other land uses within the Site and the wider area.

Residual Impact

Due to the small footprint of the Proposed Development infrastructure on a Site scale and even more so on a local scale, the residual effect is considered negative, direct, not significant, permanent effect on land use and activities during the operational phase.

Significance of Effects

The effect on land use/activities due to the operational phase of the Proposed Development will be slight and not significant.

5.10.3.1.4 *Property Values*

Pre-Mitigation Impacts

As noted in Section 5.7.1 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 Development. The impact assessment on property values outlined below takes a precautionary approach and assumes that based on the inconclusive evidence summarised above in Section 5.7. However, there are no dwelling situated or planned within 1km of the Proposed Development. There is the potential for short-term slight impacts on property values located within 1km of the proposed turbines during the early operational phase of the Proposed Development.

Mitigation and Monitoring Measures

- All mitigation relevant to property values, outlined above and the corresponding chapters; Chapter 10 (Air), Chapter 12 (Noise & Vibration), Chapter 14 (Landscape & Visual), and Chapter 15 (Material Assets), will be implemented in order to reduce potential impacts on property values at properties located in the vicinity of Proposed Development construction works. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.
- The Proposed Development has been designed in accordance with the parameters set out in the Guidelines (DoEHLG,2006) and with cognisance of the Draft Guidelines (DoHPLG,2019), 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.

- 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 Impact

It can be concluded that there is the potential for a short term negative not significant impact on property values from the operational phase of the Proposed Development.

Significance of Effects

The effect on property values due to the Proposed Development is not significant.

5.10.3.1.5 *Tourism*

Pre-Mitigation Effect

There are no tourism attractions within or adjacent to the Site that could be affected by the operation of the Proposed Development. The nearest notable tourist attraction is the Gouganne Barra oratory, located approx. 2km north of the Proposed Development. There will be no visibility of the Proposed Development from the oratory. There will be no theoretical or actual visibility of the Proposed Development from the oratory location, as outlined in Chapter 13 (Landscape & Visual).

Based on the literature review in Section 5.4.3 the majority of studies indicate that wind farm developments do not deter visitors to tourist attractions or scenic landscapes where turbines are visually evident. There are no significant impacts determined to arise.

Residual Effects

It is considered that the Proposed Development will have a long-term imperceptible negative impact of visitor experience to attractions in the wider landscape.

Significance of Effects

The effect on tourism in the wider landscape due to the operational phase of the Proposed Development will be imperceptible and not significant.

5.10.3.1.6 *Residential Amenity*

Pre-Mitigation Effects

Potential impacts on residential amenity during the operational phase of the Proposed Development 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 Development will be capable of meeting all required guideline limits in relation to noise and the Shadow Flicker set out in the Guidelines (DoEHLG,2006) or the Draft Guidelines (DoHPLG,2019) if adopted. The noise and vibration assessment is detailed in Chapter 12 (Noise & Vibration). It should be noted that the Proposed Development will be brought in line with the noise thresholds imposed on the development by the consenting authority should permission be granted for the Proposed Development. The visual impact of the Proposed Development is addressed in Chapter 13 (Landscape & Visual). The turbine locations have been designed to maximise turbine separation distances to dwellings in the area, with no turbines located less than 1km of non-involved sensitive receptors, achieving the recommended four times turbine setback, set out in the Draft Guidelines (DoHPLG,2019) specifically for protecting visual amenity.

Mitigation and Monitoring Measures

- There are no turbines proposed within 626m (4 x tip height) of any third-party sensitive receptors.
- All mitigation measures outlined in Chapter 12 (Noise & Vibration), Shadow Flicker (Section 5.9 of this EIAR chapter) and visual (Chapter 13 (Landscape & Visual)) in this EIAR will be implemented in order to reduce impacts on residential amenity at properties located within the in the vicinity of the Proposed Development.

Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of measures.

Residual Effects

The residual effect is considered to be a negative, moderate, long-term impact on residential amenity during the operational phase.

Significance of Effects

Based on the assessment above the effects on residential amenity during the operational life of the Proposed Development will be not significant.

5.10.3.2 Health

5.10.3.2.1 *Health and Safety*

Pre-Mitigation Effect

Rigorous safety checks and continued maintenance are conducted on the turbines and ancillary infrastructure during operational phase to ensure there are no health and safety risks posed by the Proposed Development. This will have a potential long-term, slight impact on health and safety during the operation phase. Any waste generated at the Site will be managed in accordance the Waste Management Act 1996 and under the relevant EU legislation.

Mitigation and Monitoring Measures

The following mitigation measures will be implemented during the operation of the Proposed Development to ensure that the risks posed to staff and landowners remain imperceptible throughout the operational life of the Proposed Development. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of mitigation and monitoring measures for the Proposed Development.

- 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.
- 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 50m (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 existing onsite 38kV substation, operated by ESBN will be locked and fenced off from public access. The existing onsite 38kV 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 existing onsite 38kV 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 and daily 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.

The components of a wind turbine are designed to last up to 35 years and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the 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 Effect

With the implementation of the above mitigation measures, there will be a long-term, imperceptible effect on health and safety during the operational life of the Proposed Development.

Significance of Effects

Based on the assessment above the effects on health and safety during the operational life of the Proposed Development will be imperceptible and not significant

5.10.3.2.2 *Noise and Vibration*

Pre-Mitigation Effect

An assessment of the operational wind turbine noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Chapter 12 (Noise & Vibration). The predicted noise levels associated with the Proposed Development will be within best practice noise criteria curves recommended in the Guidelines (DoEHLG,2006), therefore, it is not considered that a significant effect is associated with the Proposed Development.

Mitigation and Monitoring Measures

Please see Chapter 12 (Noise & Vibration), Section 12.6 for noise and vibration mitigation and monitoring proposals for the Proposed Development. Please refer to Chapter 18 (Schedule of Mitigation & Monitoring Measures) for a full list of mitigation and monitoring measures for the Proposed Development.

Residual Effects

The predicted residual operational turbine noise effects at the closest noise sensitive locations range from not significant to imperceptible. Please see Chapter 12 (Noise & Vibration) for details.

Significance of Effects

As stated in the noise assessment in Chapter 12 (Noise & Vibration), it has been demonstrated that the relevant national guidance in relation to noise associated with proposed wind turbines can be satisfied. The effects are considered not significant.

5.10.3.2.3 *Air Quality: Dust and Exhaust Emissions*

Pre-Mitigation Effect

The Proposed Development will require daily visits of maintenance staff in LGVs and will produce dust and other emissions. The Proposed Development will generate electricity from a renewable source, contributing to a positive impact on air quality. Over the envisaged 35-year lifespan of the Proposed Development it is expected to effectively reduce carbon dioxide emissions that would have occurred if the same energy were generated by traditional fossil fuel plants. This is a long-term moderate positive effect on Air Quality.

Mitigation and Monitoring Measures

Please see Chapter 10 (Air Quality), Section 10.3.3 for air quality mitigation and monitoring proposals for the Proposed Development. Please refer to Chapter 18: (Schedule of Mitigation & Monitoring Measures) for a full list of mitigation and monitoring measures for the Proposed Development.

Residual Effects

Impacts from dust and other emissions to air from the maintenance of the Proposed Development on sensitive receptors during the operational phase of the Proposed Development is considered to be a momentary and imperceptible effect. Overall, considering offsetting of dust and greenhouse gas emissions from fossil fuels as a result of the Proposed Development, there will be a long-term overall moderate positive effect on Air Quality.

Significance of Effects

Through the offsetting of dust and greenhouse gas emissions from fossil fuels, the Proposed Development is considered have a moderate effect on air quality and not significant.

5.10.3.2.4 *Water Quality*

Pre-Mitigation Impact

During the operational phase, 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 and hardstand areas. These works would be of a very minor scale and would be very infrequent. During such maintenance works there is a small risk associated with the 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. There will be a long-term imperceptible impact on human health due to water quality.

Mitigation and Monitoring Measures

The mitigation measures detailed in Chapter 9 (Hydrology & Hydrogeology) will ensure all surface water runoff from upgraded roads and new road surfaces (including hardstand and turbine base areas) will be captured and treated prior to discharge/release. Settlement ponds, checks dams and buffered outfalls will prevent roads acting as preferential flowpaths by providing attenuation and water quality treatment. Please see Chapter 9 (Hydrology & Hydrogeology) for details. The full list of mitigation and monitoring measures for the Proposed Development are detailed in Chapter 18 (Schedule of Mitigation & Monitoring Measures).

Residual Effects

With the implementation of the Proposed Development drainage design and mitigation measures the residual effects are considered to be long term imperceptible impact on human health due to water quality.

Significance of Effects

Based on the assessment above, the effects on Human Health due to water quality will be imperceptible and not significant.

5.10.3.2.5 *Traffic and Transport*

Pre-Mitigation Effect

Major component failures are considered unlikely and therefore the presence of abnormal load vehicles and HGVs at the Site is considered extremely rare. Should a turbine component need replacing, the measures detailed in Section 5.1.10.5 and Chapter 15 (Material Assets) will be implemented.

Mitigation and Monitoring Measures

All site visits for maintenance and inspection purposes for the Proposed Development will be done so via LGVs with one or two LGVs each day.

Residual Effects

Effects on local road users during the operational phase are considered to be a long term negative imperceptible impact.

Significance of Effects

Based on the assessment above, the effects on Human Health due to traffic will be imperceptible and not significant.

5.10.3.2.6 *Major Accidents and Natural Disasters*

Pre-Mitigation Effects

A risk register has been developed which contains all potentially relevant risks identified during the operational phase of the Proposed Development. Seven risks (Critical Infrastructure Emergencies, Severe Weather, Flooding, Utility Emergencies, Traffic Incident, Contamination, and Fire/Gas Explosion) specific to the operational phase have been identified and are presented in Chapter 16 (Major Accidents & Natural Disasters). As outlined in Section 16.4.1, the scenario with the highest risk score in terms of the occurrence of major accident and/or disaster during operation is identified as "Fire/Explosion' during operation.

Mitigation and Monitoring Measures

- The Proposed Development will be designed and built 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.
- The Proposed Development will also be subject to a fire safety risk assessment in accordance with Chapter 19 of the Safety, Health and Welfare at Work Acts 2005 to 2014, which will assist in the identification of any major risks of fire on site, and mitigation of the same during operation.

Residual Effect

The Impact Assessment concludes that the risk of a major accident and/or disaster during the operational phase of the Proposed Development is considered 'low' in accordance with the '*Guide to Risk Assessment in Major Emergency Management*' (DoEHLG, 2010).

Significance of Effects

Based on the above and the risk assessment in Chapter 16 (Major Accidents & Natural Disasters), the effects to/from Major Accidents and Natural Disasters during the operational phase of the Proposed Development are not significant.

5.10.3.2.7 Shadow Flicker

Pre-Mitigation Effect

As stated in Section 5.9, 8 no. properties have been modelled for the shadow flicker assessment. Assuming worst-case conditions, none of the sensitive receptors are predicted to experience daily Shadow Flicker in excess of the Guidelines (DoEHLG,2006) threshold of 30 minutes per day as a result of the Proposed Development. Shadow Flicker limits will not be exceeded at any property. It is noted that the Proposed Development can be brought in line with the requirements of the Draft Guidelines (DoHPLG,2019), should they be adopted while this application is in the planning system, through the implementation of the mitigation measures outlined below.

The Guidelines (DoEHLG,2006) total annual guideline limit of 30 hours is not predicted to be exceeded at any of the sensitive receptors when the regional sunshine average of 33.40% is taken into account. As stated in Section 5.9 there are 8 no. sensitive receptors located within 1.33km of the proposed turbines.

Proposed Mitigation Measures

No daily or annual Shadow Flicker exceedances are predicted at the identified 8 no. sensitive receptors. It is noted that the Proposed Development can be brought in line with the requirements of the Draft Guidelines (DoHPLG,2019), should they be adopted while this application is in the planning system, through the implementation of the mitigation measures outlined below.

A site visit will be undertaken firstly to determine the presence of existing screening and window orientation at each potentially affected property. 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 at the potentially affected property, the following measures will be employed.

Screening Measures

In the event of an occurrence of Shadow Flicker exceeding guideline threshold values 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.

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.

A Shadow Flicker control unit allows a wind turbine to be programmed and controlled using the wind farm's Supervisory Control and Data Acquisition (SCADA) 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 avoid excessive Shadow Flicker 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 Proposed Development 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.

In order 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 Development 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 also 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 5-11 below lists EXAMPLE sensitive receptors at which a Shadow Flicker mitigation strategy may be necessary to ensure the Draft Guidelines (DoHPLG,2019), should they be adopted while this application is in the planning system. 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. 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 5-11 below is based on the theoretical precautionary scenario. The details presented in Table 5-11 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.

Table 5-11 Shadow Flicker Mitigation Strategy EXAMPLE for Shadow Flicker Exceedance – Turbine Numbers and Days

Property No.	Max. Daily shadow Flicker: Pre-Mitigation (hrs:min:sec)	Max. Annual Shadow Flicker Adjusted for Average Regional Sunshine (hrs:min:sec)	Turbine(s) Producing Shadow Flicker Exceedance	No. of Days 30min/day Threshold is Exceeded	Days of Year When Mitigation May be Required (Day No's)*	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)	Post-mitigation Maximum Annual Shadow Flicker (hrs:min:sec)
House A	00:51:00	21:06:27	3	75	129-165, 181-218	≤00:00:00	≤00:00:00
House B	00:47:00	17:20:02	3	66	141-206	≤00:00:00	≤00:00:00
House C	00:39:00	11:27:53	3	38	135-153, 193-211	≤00:00:00	≤00:00:00
House D	01:09:00	12:48:02	1, 3	39	1-10, 338-366	≤00:00:00	≤00:00:00
House E	00:51:00	20:21:27	1	48	54-75, 106-107, 240-241, 272-293	≤00:00:00	≤00:00:00

Overall, the details presented in Table 5-11 demonstrate that using the turbine control system, it will be possible to reduce the level of Shadow Flicker at any affected property to below the daily guideline limit, by programming the relevant turbines to switch off at the required dates and times.

Notwithstanding this, the approach set out above should Shadow Flicker associated with the Proposed Development be perceived to cause nuisance at any home, the affected homeowner is invited to engage with the Wind Farm operator. Should a complaint or query in relation to Shadow Flicker be received within 12 months of commissioning of the Proposed Development, field investigation/monitoring will be carried out by the wind farm operator at the affected property. 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.

Residual Effect

The Guidelines (DoEHLG,2006) limit of 30 mins per day or 30 hours per year will not be exceeded at any of the Sensitive Receptors and therefore this will result in a long-term, imperceptible negative residual effect from Shadow Flicker on human health.

Significance of Effects

Based on the assessment above and the mitigation measures proposed the effects related to Shadow Flicker will be not significant.

5.10.3.3 Interference with Communications Systems and EMF

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 5.6.4 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.

Potential impacts on broadcast signals are discussed in detail in Chapter 15 (Material Assets). The Proposed Development will have no residual impact on the telecommunications signals of any operator, due to distance from or absence of any links in the area and is not significant.

5.10.4 Decommissioning Phase

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 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 Proposed Development may be decommissioned fully.

The works required during the decommissioning phase are described in Section 4.10 in Chapter 4 (Description of the Proposed Development). Any effect 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 the mitigation measures outlined above will be implemented during the decommissioning phase also. A Decommissioning Plan (DP) has been prepared as part of this EIAR and is included as Appendix 4-6. This

Decommissioning Plan follows the most up to date NatureScot guidance[30]. By its nature, the DP 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 Development. The principles that will inform the final decommissioning plan are contained in the Construction and Environmental Management Plan (CEMP) in Appendix 4-3.

5.10.5 Cumulative and In-Combination Effects

For the assessment of cumulative effects, any other existing, permitted or Proposed Developments (wind energy or otherwise) have been considered. The potential cumulative effects of the Proposed Development and other relevant developments has been carried out with the purpose of identifying what influence the Proposed Development will have on the surrounding environment when considered cumulatively.

Further information on projects considered as part of the cumulative assessment are given in Chapter 2 (Background to the Proposed Development). The effects with the potential to have cumulative effects on population and human health are discussed below and in more detail in the relevant chapters: noise (Chapter 12 Noise & Vibration), visual effects (Chapter 13 (Landscape & Visual) and traffic (Chapter 15 Material Assets).

5.10.5.1 Employment and Economic Activity

Cumulative projects within 20 kilometres of the Proposed Development which may be proposed, permitted or operational/existing contribute to short term employment during the construction stages and provide the potential for long-term employment resulting from maintenance operations. This results in a long-term slight positive effect and is not significant

5.10.5.2 Tourism and Amenity

Following EIAR and TIA assessments, it is not considered that the Proposed Development together with other projects in the area will cumulatively affect any tourism infrastructure in the wider area. Wind farms are an existing feature in the surrounding landscape, which will assist in the assimilation of the Proposed Development into this environment.

It is on this basis that it can be concluded that there would be a long-term slight cumulative effect from the Proposed Development and other wind farm developments in the area and is not significant.

5.10.5.3 Traffic

Construction of the Proposed Development at the same time as cumulative projects located in the surrounding area has the potential to give rise to cumulative impacts on traffic. In particular, the proposed Maughanaclea Wind Farm, located approx. 3.6km from the Site. If it occurs at the same time as the Proposed Development has the potential to give rise to cumulative effects on traffic. There is the potential for short-term slight effects to arise as a result of the combination of the construction of the Proposed Development along with nearby cumulative permitted and Proposed Developments. However, the mitigation measures in relation to traffic set out in Section 5.10.2.2.5 above will ensure that any cumulative effects that arise will be short term in duration and imperceptible in significance and not significant.

5.10.5.4 Air (Dust)

The nature of the Proposed Development is such that, once operational, it will have a long-term, moderate, positive effect on the air quality.

[30] *Scottish Nature Heritage -Decommissioning and restoration Plans for wind farms* - https://www.nature.scot/sites/default/files/2019-10/Guidance%20-%20Decommissioning%20and%20restoration%20plans%20for%20wind%20farms%20-%20Feb%202016.pdf

During the construction phase of the Proposed Development and the construction phase of other developments within 20 kilometres of the wind farm site that are yet to be constructed, there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, once the mitigation proposals, as outlined in Section 10.3.2 of Chapter 10 (Air Quality), are implemented during the construction phase of the Proposed Development, there will be no significant cumulative negative effect on air and climate.

The nature of the Proposed Development and other wind energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, moderate, positive effect on the air quality and climate and not significant.

5.10.5.5 Health and Safety

The Proposed Development will have no effects in terms of health and safety. There is no credible scientific evidence to link wind turbines with adverse health effects. All other existing, permitted or Proposed Developments (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.

It is on this basis that it can be concluded that there would be a long-term imperceptible cumulative effect from the Proposed Development and other developments in the area and is not significant.

5.10.5.6 Property Values

As noted in Section 5.10.3.1.4 above, it can be concluded that there is the potential for a short-term negative, not significant, impact on property values within 1km of the proposed turbines of the Proposed Development. There are no other cumulative turbines located within 2km of the proposed turbines and so this area within 1km, 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.

5.10.5.7 Shadow Flicker

As outlined above, no dwellings may be impacted by Shadow Flicker from the Proposed Development in combination with other existing, permitted, or Proposed Developments.

5.10.5.8 Residential Amenity

Pre-Mitigation Effects

In the extremely unlikely event that all permitted and proposed Developments as described in the cumulative assessment in Chapter 2 (Background to the Proposed Development) are constructed at the same time, there is the potential for a resulting short term, moderate, cumulative, negative effects to occur on residential amenity, in relation to noise and vibration, dust, traffic, telecommunications and visual amenity.

Proposed Mitigation Measures

There are no turbines as part of the Proposed Development that will be located within 626 metres of any third-party sensitive receptors (4 times tip height set back distance set out in the Draft Guidelines (DoHPLG,2019). All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and telecommunications in this EIAR will be implemented in order to reduce effects on residential amenity at properties located in the vicinity of the Proposed Development, including along the proposed turbine and construction materials haul route during the construction phase.

It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

Residual Effects

The Proposed Development will have a short-term, slight negative effect on residential amenity during construction works. During the operational phase, noise and Shadow Flicker from the proposed and permitted projects will be limited to below Guideline levels, resulting in a long-term, slight, negative residual impact on residential amenity.

Significance of Effects

Based on the assessment above and the mitigation measures proposed, the Cumulative effects will be not significant during the construction and operational phases of the Proposed Development.

5.11 Summary

Following consideration of the residual effects (post-mitigation) it is noted that the Proposed Development will not result in any significant effects on human beings in the area surrounding the Proposed Development. Following appropriate mitigation the Guidelines (DoEHLG,2006). Shadow Flicker limits will not be exceeded at any property. It is noted that the Proposed Development can be brought in line with the requirements of the Draft Guidelines (DoHPLG,2019), should they be adopted while this application is in the planning system, through the implementation of the mitigation measures outlined.
Provided that the Proposed Development is constructed, operated and decommissioned in accordance with the design, best practice and mitigation that is described within this EIAR, significant effects on population and human health employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values and health and safety are not anticipated at international, national or county scale.