5. POPULATION AND HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses the potential significant effects of the Proposed Project on population and human health and has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA), in particular the '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (EPA, 2022) and Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU and as transposed into Irish Law through Regulations in 2018 (S.I. No. 296 of 2018). The entirety of the project for the purposes of this EIA in accordance with the EIA Directive. The Proposed Project is described in detail in Chapter 4 of this EIAR.

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

Impacts of a proposed development that may impinge on human health, directly and indirectly, positively and negatively have been considered. The key issues examined in this chapter of the EIAR include employment, settlement and land use patterns, population and demographic trends, tourism and amenity, and human health (health and safety and shadow flicker). Vulnerability of the project to risk of major accidents and /or disasters is dealt with separately. Please see Chapter 16 for further details.

5.1.1 Statement of Authority

This section of the EIAR, has been prepared by Evan Connolly and reviewed by Brandon Taylor and Eoin McCarthy, all of MKO.

Evan is an Environmental Scientist with MKO with over one year of private consultancy experience. Evan holds a B.Sc. in Earth and Ocean Science from the University of Galway and an interinstitutional M.Sc. in Sustainable Resource Management: Policy & Practice from University of Galway and University of Limerick. Evan's strengths and areas of expertise are in environmental sustainability, geology, hydrology and oceanography. Since joining MKO Evan has been involved as an Environmental Consultant on a range of wind energy infrastructure projects. Within these projects Evan has been responsible for the drafting and reviewing of EIAR chapters, geological mapping as well as assisting with proposed project fee proposals and scoping on behalf of clients.

Brandon is an Environmental Scientist with over two years of private consultancy experience. Brandon holds a BSc (Hons) in Geography from McGill University, and a MSc (Hons) in Coastal & Marine Environments from the University of Galway. Brandon's key skills include scientific research and report writing, particularly in the context of local communities and their interactions with environmental stressors, and geospatial analysis and the application of GIS and remote sensing tools across the fields of renewable energy development, coastal zone management, and education and scientific communication. Since joining MKO, Brandon has been involved in the design and environmental impact assessment (EIA) of multiple large-scale onshore wind energy developments across Ireland, contributing to and managing the production of EIA reports.

Eoin is a Project Director with MKO. with over 14 years of environmental consultancy experience. Eoin holds B.Sc. (Hons) in Environmental Science from NUI, Galway. Eoin's key strengths and areas of expertise are in project management, environmental impact assessment, wind energy site selection and feasibility assessment. Since joining MKO in 2011, Eoin has been involved as a Graduate, Assistant and

Project Environmental Scientist on a significant range of energy infrastructure, tourism, waste permit, flood relief scheme and quarrying projects. He has overseen some of the largest SID wind energy in Ireland in in that time. In his role as project manager, Eoin works with and co-ordinates large multidisciplinary teams including members from MKO's Environmental, Planning, Ecological and Ornithological departments as well as sub-contractors from various fields in the preparation and production of EIARs. Eoin is also involved in the development of project strategy for the projects that he manages. He has held the role of project manager on over 550MW worth of wind energy projects. Within MKO Eoin plays a large role in the management of and sharing of knowledge with junior members of staff and works as part of a large multi-disciplinary team to produce EIA Reports.

5.1.2 Relevant Guidelines and Data Sources

In addition to the guidelines set out in the EPA 2022 report 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;
- Department of Housing, Planning and Local Government (DoHPLG), Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (2018);
- European Commission (EC), Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (2017);
- Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines (2006);
- Department of the Environment, Heritage and Local Government Draft Wind Energy Development Guidelines (2019);
- Environmental Impact Assessment of National Road Schemes- A practical Guide, National Roads Authority/ Transport Infrastructure Ireland, Revision 1, November 2008;
- Fáilte Ireland EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects, July 2023.
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2022)
- Health Impact Assessment Resource and Tool Compilation, United States Environmental Protection Agency 2016;
- Health Impact Assessment Guidance, Institute of Public Health Ireland. 2009;
- Framework for Human Health Risk Assessment to Inform Decision Making developed by the United States Environmental Protection Agency (US EPA) 2014;
- Institute for Environmental Management and Assessment (2017) Health In Environmental Impact Assessment: A Primer for a Proportionate Assessment;
- Institute for Environmental Management and Assessment (2022) Determining Significance for Human Health in Environmental Impact Assessment;
- Central Statistics Office (CSO): Census of Ireland 2016; Census of Ireland 2022; Census of Agriculture 2020;
- Galway County Development Plan 2022-2028;
- The World Health Organisation (WHO) Environmental Noise Guidelines for the European Region (WHO, 2022 Update) https://www.who.int/
- British Horse Society's 'Advice on Wind Turbines and Horses – Guidance for Planners and Developers' (2015).

5.1.3 Scoping

Chapter 2 (Section 2.7) of this EIAR describes the scoping and consultation exercise undertaken for the Proposed Project. Relevant responses were received from the Health Service Executive (HSE), Uisce Éireann and Fáilte Ireland

Health Service Executive

A scoping response was received from the Health Service Executive (HSE) on 22nd of May 2023. The HSE requested a shadow flicker assessment is undertaken to identify any dwellings and Sensitive Receptors which may be impacted by shadow flicker and noted that the assessment must include all proposed mitigation measures. The HSE also recommended that turbine selection will be based on the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. The HSE also noted that the 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 Effects.

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 Environmental Impact Assessments EIA 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 Project, 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
- Decommissioning
- Siting, Location and details of Turbines/Energy Storage Batteries
- Assessment of Consideration of Alternatives
- Noise & Vibration
- Shadow Flicker
- Air Quality
- Surface and Groundwater Quality
- Geotechnical and Peat Stability Assessment
- Ancillary Facilities
- Cumulative Impacts

A follow up scoping response to the HSE was received on the 28th of August 2025. The contents of which reiterated the observations made in the above.

Uisce Éireann (Irish Water)

A scoping response was received from Uisce Éireann (formally Irish Water) on the 20th of March 2023. outlining the measures for consideration in the scope of an EIA. This includes steps to avoid any adverse effects on Uisce Éireann 's Drinking Water Source(s) during both the construction and operational phases of the development, as well as an assessment of potential impacts on nearby public water supply infrastructure. Impacts on utilities including Uisce Éireann infrastructure are assessed in Chapter 15 Material Assets.

Fáilte Ireland

A scoping response was received from Fáilte Ireland on the 24th of April 2023 and provided the 'Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA', to inform the preparation of the EIAR for the Proposed Project. The report provides guidance for those conducting Environmental Impact Assessment and compiling an EIAR, or those assessing EIARs, where the project involves tourism or may have an impact upon tourism (see Section 5.4 and Section 5.10.3.1.5 for further detail).

5.1.4 Health and Safety

5.1.4.1 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 generally not supported these statements. There is currently no published credible scientific evidence to positively link wind turbines with adverse health effects. The main publications supporting the view that there is no evidence of any direct link between wind turbines and health are summarised below.

1. ***'Wind Turbine 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. Pierpoint's respondents by the mechanisms proposed."

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

2. ***'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."

3. *'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 impacts 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."

4. *'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 impacts of fossil fuel energy generation.

5. *'Wind Turbine Health Impact Study -Report of Independent Expert Panel' – Massachusetts Departments of Environmental Protection and Public Health (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 impacts and risks to human health associated with the design and operation of wind energy turbines. In its final report, the expert panel set out its conclusions under several headings, including noise and shadow flicker.

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

> *"There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a "Wind Turbine Syndrome."*
>
> *The strongest epidemiological study suggests that there is not an association between noise from wind turbines and measures of psychological distress or mental health problems. There were two smaller, weaker, studies: one did note an association, one did not. Therefore, we conclude the weight of the evidence suggests no association between noise from wind turbines and measures of psychological distress or mental health problems.*
>
> *None of the limited epidemiological evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and headache/migraine."*

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

> *"Scientific evidence suggests that shadow flicker does not pose a risk for eliciting seizures as a result of photic stimulation.*
>
> *There is limited scientific evidence of an association between annoyance from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects."*

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

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.

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

The 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 impacts 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 impacts of wind farms on human 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 Draft Wind Energy Development Guidelines (2019), as a means of setting noise limits and set back distances from the nearest dwellings.

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

The World Health Organisation (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 increased risk can impact health. Wind turbine noise above this level is associated with adverse health effects.

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

That being said, the GDG 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. Please see Chapter 12: Noise and Vibration for details.

9. *'The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive Health Adults' Woolcock Institute for Medical Research, New South Wales, Australia*[1]

When considering the effects of health regarding noise sensitivity generated from the Proposed Project, an analysis of a recent study by the 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.

5.1.4.2 Turbine Safety

Turbines pose no threat to the health and safety of the general public. The '*Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government (DOEHLG), 2006 (hereafter referred to as the 2006 DoEHLG Guidelines) and the '*Draft Wind Energy Development Guidelines*' (December 2019) (hereafter referred to as the draft 2019 DoEHLG Guidelines) iterate that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations and should be kept to a minimum. People or animals can safely walk up to the base of the turbines.

The 2006 DoEHLG Guidelines and the draft 2019 DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. Modern turbine blades are composite structures with no bolts or separate components; 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[2], which correlates to a *Low* icing frequency.

Turbine blades are manufactured of glass reinforced plastic 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.

5.1.4.3 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.

[2] *Wind Power Icing Atlas (WIceAtlas) – IEA Ice Class 1 Category for Ireland (map). Available at: https://vtt.maps.arcgis.com/apps/instant/minimalist/index.html?appid=6d93b5e284104d54b4fb6fd36903e742*

The ESB document 'EMF & You' (ESB, 2017)[3] provides further practical information on EMF. Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in Chapter 15: Material Assets.

5.2 Assessment Methodology

5.2.1 Population

A desk-based assessment using sources and guidelines referenced in Section 5.1.2 above 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 2022. Fáilte Ireland's *EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects,* the Galway County Development Plan 2022 – 2028, and any other literature pertinent to the area was also considered in this assessment. See Section 5.3 below.

In order to assess the population in the vicinity of the Proposed Wind Farm, the Population Study Area for this population assessment focuses on the EDs within which the Proposed Wind Farm is located, namely Cooloo, Hillsbrook and Moyne but it also refers to county and national statistics.

In order to assess the population in the vicinity of the Proposed Grid Connection, a review of properties and planning applications in the vicinity of the underground electrical cabling route was carried out (properties within c.100m of the underground cabling route included).

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]

National Guidance

The EPA 2022 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.*" Environmental Impacts from the Proposed Project, which may also have an impact on population and human health are discussed in this chapter but addressed in more detail in the following chapters: Chapter 8 Land Soil and Geology, Chapter 9 Water, Chapter 10 Air Quality, Chapter 11 Climate, Chapter 12 Noise and Vibration, Chapter 14 Landscape and Visual and Chapter 15 Material Assets (including Traffic and Transport).

As referenced in the Department of Housing, Planning and Local Government (2018) *Guidelines for Planning Authorities and An Bord 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:

[3] *ESB 2017 EMF & You'. Available at: https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0)*
[4] *World Health Organisation Constitution Available at: https://www.who.int/about/governance/constitution*

> *'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.'*

In 2022 the Environmental Protect Agency published EIAR Guidelines which state that "*while no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU, the same term was used in 3.3.6 the SEA Directive (2001/42/EC). The Commission's SEA Implementation Guidance states 'The notion of human health should be considered in the context of the other issues mentioned in paragraph (f)'*" of the Directive, where paragraph f lists environmental factors such as soils, water, landscape, air etc. The Guidelines 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 Guidelines 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'.*

IEMA Guidance 2017

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 EIAs. The document. 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 and overview of health in different types of assessment:

"*The health sector, by crafting and promoting HIA, can be regarded as contributing to fragmentation among impact assessments. Health issues can, and need to, be included [in impact assessment] irrespective of levels of integration. At the same time, from a civic society perspective, it would be*

unacceptable for HIA to weaken other impact assessments. A prudent attitude suggests optimizing the coverage of health along all three avenues:

- *better consideration of health in existing impact assessments other than HIA;*
- *dedicated HIA;*
- *and integrated forms of impact assessment."*

As such, the WHO does not support a stand-alone HIA unless it could be demonstrated to be of advantage over an EIAR. Therefore, given that this human health assessment is part of the EIAR; there is no stand-alone HIA.

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.

5.2.3 Shadow Flicker

5.2.3.1 Background

Shadow is an effect that occurs when rotating wind turbine blades cast shadows at a nearby property. Shadow flicker is an indoor phenomenon, which may be experienced by an occupant sitting in an enclosed room when sunlight reaching the window is momentarily interrupted by a shadow of a wind turbine's blade. Outside in the open, light reaches a viewer (person) from a much less focused source than it would through a window of an enclosed room, and therefore shadow flicker assessments are typically undertaken for the nearby adjacent properties around the Proposed Wind Farm site.

Shadow Flicker is only relevant to the Proposed Wind Farm; shadow flicker is not emitted from any infrastructure pertaining to the Proposed Grid Connection.

The frequency of occurrence and the strength of any potential shadow flicker impact depends on several factors, each of which are 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 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 weather stations over a 25-year period showed that the mean cloud amount was at a minimum in April and maximum in July. Cloud amounts were less at night than during the day, with the mean minimum occurring roughly between 2100 and 0100 GMT and the mean maximum occurring between 1000 and 1500 GMT at most stations. (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 current adopted 2006 DoEHLG Guidelines iterate 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.

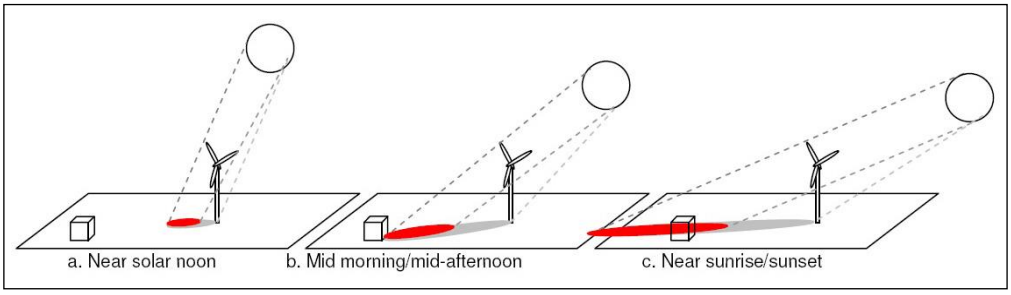

Figure 5-1 Shadow-Prone Area as Function of Time of Day (Source: Shadow Flicker Report, Helimax Energy, Dec 2008)

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 impact.

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

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.

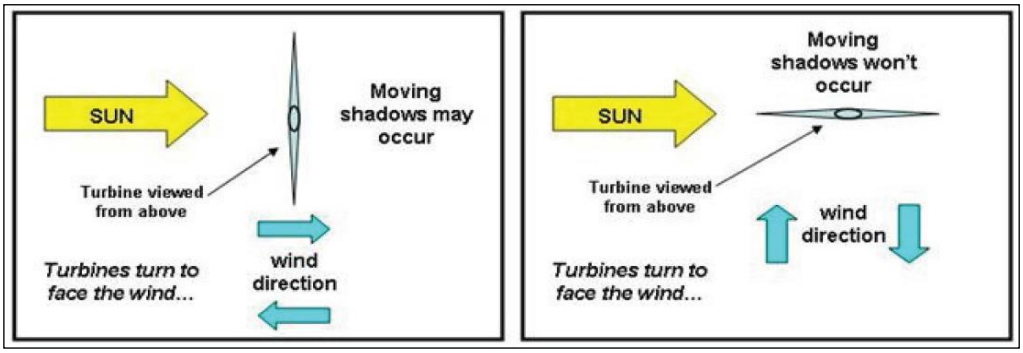

Figure 5-2 Turbine Blade Position and Shadow Flicker Impact (Source: Wind Fact Sheet: Shadow Flicker, Noise Environment Power LLC)

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, no shadow flicker will occur.

All turbines installed on-site will comply with the daily and annual shadow flicker recommended thresholds of 30 minutes and 30 hours, respectively as set out in the 2006 DoEHLG Guidelines. However, the proposed turbines can be brought in line with the 2019 draft DoEHLG Guidelines shadow flicker recommendation through the use of turbine control software, should this draft guidance be brought into effect.

5.2.3.2 Guidance

The current adopted guidance for shadow flicker in Ireland is derived from the 2006 DoEHLG Guidelines and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012). The 2006 DoEHLG Guidelines state that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low. Therefore, the study area adopted for the shadow flicker assessment is10 rotor diameters of the proposed turbine locations (i.e. for the Proposed Project, this is assumed at 1.5 km based on a rotor diameter of 150 metres).

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

Although the 2006 DoEHLG Guidelines threshold applies to properties located within 500 metres of a proposed turbine location, for the purposes of this assessment, the thresholds of 30 hours per year or 30 minutes per day have been applied to all properties located within ten rotor diameters of the proposed turbines (as per IWEA guidelines, 2012).

The 2006 DoEHLG Guidelines are currently under review. The DoEHLG released the 2019 draft Guidelines which were released for public consultation in December 2019. The consultation period closed February 2020; however, no update or final guidelines was released. The 2019 draft DoEHLG

Guidelines recommend local planning authorities and/or An Coimisún 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 2019 draft DoEHLG 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).

In the Annex of Actions[5] for Climate Action Plan 2025 (CAP25), published in April 2025, Action EL/24/5 states that revised wind energy development guidelines for onshore wind will be published in Q1 2025. The shadow flicker assessment in methodology and assessment within this chapter are based on compliance with the current, adopted 2006 DoEHLG Guidelines. However, it should also be noted the proposed turbines can be brought in line with the requirements of the 2019 draft DoEHLG Guidelines through the 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 momentary. The 2006 DoEHLG Guidelines state that careful site selection, design and planning, and good use of relevant software can help avoid the possibility of shadow flicker, all of which have been employed at the site. Proper siting of wind turbines is key in eliminating the impact of shadow flicker.

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

Digital Terrain Modelling (DTM) was used to determine the approximate ground elevation at which the wind turbines and surrounding properties are located for the purpose of running the model. The use of DTM data ensures that realistic elevation variations between the turbines and properties is accounted for.

Any potential impact can be precisely modelled to give the start and end time of any incidence of shadow flicker, at any location, on any day or all days of the year 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 4.0.531 has been used to predict the level of shadow flicker associated with the proposed wind farm development. WindPRO is a commercially available software tool that enables developers to analyse, design and optimise proposed wind farms. It allows proposed turbine layouts to be optimised for maximum energy yield whilst taking account of environmental, planning and engineering constraints.

[5] *Department of the Environment Climate and Communications (2025) CAP25 Annex of Actions. Available at: https://assets.gov.ie/static/documents/Climate_Action_Plan_2025_-_Annex_of_Actions.pdf*

5.2.3.4 Shadow Flicker Assessment Criteria

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

- Turbine Tip Height – 180 metres
- Hub Height – Maximum height 105 metres, Minimum height 99 metres
- Rotor Diameter - Maximum diameter 162 metres, Minimum diameter 150 metres

Planning permission is being sought for a turbine with a tip height of 180m. The potential shadow flicker impacts of the Proposed Wind Farm will give rise no more than that predicted in this assessment using the maximum proposed rotor diameter of 162m. A comparative shadow flicker assessment is detailed in Section 5.9.1 below and presents the modelling results for a median and minimum turbine parameter scenario. With the benefit of the mitigation measures outlined in Section 5.10.3.2.7, any turbine to be installed onsite will be able to comply with the Guidelines (DoEHLG, 2006) thresholds of 30 minutes per day or 30 hours per year, and if necessary with the Draft Guidelines (DoHPLG, 2019) through the use of mitigation measures, including turbine control software where necessary. Any references to the turbine dimensions in this shadow flicker assessment should be considered in the context of the above and should not be construed as pre-determining the dimensions of the wind turbine to be used on the Site.

5.2.3.5 Shadow Flicker Study Area

At the outset of the project, during the constraints mapping process detailed in Chapter 3 of this EIAR, all Sensitive Receptors within 2km of the Proposed Wind Farm site were identified and mapped. In addition, a planning history search to identify properties that may have been granted planning permission, but not yet been constructed, was carried out. These properties were also added to the Sensitive Receptors' dataset.

The Shadow Flicker Study Area for the shadow flicker assessment is ten times rotor diameter (162m rotor diameter x 10 = 1.62km) in accordance with the 2006 DoEHLG Guidelines. There are 218 no. third party properties (hereafter referred to 'Sensitive Receptors') located within 1.62 km of the proposed turbine locations. The Shadow Flicker software modelled 218 no. Sensitive Receptors for potential shadow flicker impact. Of these, a total of 171 no. Sensitive Receptors are theoretically predicted to experience shadow flicker. The Shadow Flicker Study Area and Sensitive Receptors locations are shown in Figure 5-3.

Map Legend

- 1.62km Shadow Flicker Study Area
- Sensitive Receptors
- Proposed Turbines
- EIAR Site Boundary

T1 T2 T3 T4 T5 T6 T7 T8 T9

Drawing Title: Shadow Flicker Study Area

Project Title: Cooloo Wind Farm

Drawn By	Checked By
EC	BT
Project No.	Drawing No.
190723	Figure 5-3
Scale	Date
1:22,500	2025-09-03

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5.2.3.5.1 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 wind turbines through the use of a feature called 'greenhouse mode' within the WindPRO software. This feature assumes shadows can be seen from 360 degrees at a property as opposed to only through windows facing the wind turbines.

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. As such properties located outside of this potential shadow flicker zone (50 degrees either side of south) will not be impacted. However, in taking a precautionary approach for this assessment, all 218 no. properties within 360 degrees of the proposed turbine locations out to 1.62km were assessed for shadow flicker impact.

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 'theoretically precautionary scenario', due to the following limitations:

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

The total annual shadow flicker calculated for the property assumes 100% sunshine during daytime hours, as referred to above. However, weather data for this region shows that the sun shines on average for 24.44% of the daylight hours per year. This percentage is based on Met Éireann data recorded at Claremorris over the 30-year period from 1979 to 2000 (www.met.ie). The actual sunshine hours at the Proposed Wind Farm site and therefore the percentage of time shadow flicker could actually occur is 24.44% of daylight hours. Where the annual shadow flicker is calculated for each property, it is corrected for the regional average of 24.44% sunshine, to give an accurate annual average shadow flicker prediction. Table 5-11 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 Baseline Environment - Population

5.3.1 Baseline Population

Information regarding population and general socio-economic data were sourced from the Central Statistics Office (CSO), the Galway County Development Plan 2022-2028, Fáilte Ireland and the literature and guidelines as listed in Section 5.1.2 above.

The study included an examination of the population and employment characteristics of the area. This information was sourced from the Census of Ireland 2022, the most recent census for which a complete dataset is available, also the Census of Ireland 2016, the Census of Agriculture 2020 and from the CSO website (www.cso.ie). Census information is divided into State, Provincial, County, Major Town, and District Electoral Division (DED) level.

5.3.1.1 Receiving Environment

The Proposed Wind Farm is located within a rural, agricultural setting in east Galway, approximately 12km southeast of Tuam. The village of Brierfield is located approximately 1.3km south of the nearest proposed turbine, and the village of Moylough is located approximately 5.3km east of the nearest proposed turbine. The N63 National Road runs south of the Proposed Wind Farm site in a general northeast-southwest orientation entering the settlement of Abbeyknockmoy and then heading northeast towards Moylough, passing within 1.27km of the nearest proposed turbine.

The Site measures approximately 319 hectares. The Proposed Wind Farm falls within the townlands of Cloondahamper (Blake), Cloonascragh, Elmhill, Cooloo, Lecarrow, Dangan Eighter, Gorteenlahard and Lissavally.

Land use within the Site is predominately agricultural with some adjacent areas in the north of the Proposed Wind Farm occupied by active raised blanket bog. Land-use in the wider landscape comprises a mix of pastoral agriculture, peat bogs and low density residential. The Proposed Wind Farm site is accessed via local roads from the R332 Regional Road which travels in a southeast-northwest direction between Tuam and the N63 National Road, Co. Galway and L6301 Local Road which transverses the Proposed Wind Farm site. The Proposed Wind Farm site itself is served by a number of existing agricultural roads and tracks.

In order to assess the population in the vicinity of the Proposed Wind Farm site, the Population Study Area for the population section of this EIAR was defined in terms of the EDs as outlined in Section 5.2.1 above. The Proposed Wind Farm lies within three (3) No. EDs: Cooloo, Hillsbrook and Moyne 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 1,976 persons as of 2022. This includes Cooloo (580 persons), Hillsbrook (693 persons), and Moyne (703 persons). The total land area of the Study Area totals 71.0km^2 and comprises Cooloo 27.4km^2, Hillsbrook 23.0km^2, and Moyne 20.3km^2.

There are 43 no. Sensitive Receptors located within 1 km of the proposed turbine locations. The closest involved Sensitive Receptors is located over 720.4m from the nearest proposed turbine (T8).

In order to assess the population in the vicinity of the Proposed Grid Connection, a review of properties and planning applications in the vicinity of the underground electrical cabling route was carried out. There are 153 no. Sensitive Receptors within 100m of the Proposed Grid Connection, none of which also fall within 1km of the proposed turbines.

The active construction area for the Proposed Grid Connection underground cable route will be small, ranging from 100 to 150 metres in length at any one time, and it will be transient in nature as it moves

along the route. Should separate crews be used during the construction phase they will generally be separated by one to two kilometres.

For the purposes of the population baseline assessment, the Proposed Wind Farm will be examined primarily from a population perspective due to the reasons outlined above. Where the Proposed Wind Farm and the Proposed Grid Connection are required to be considered separately, this is identified within the baseline assessment.

For the shadow flicker assessment, which is further detailed in Section 5.5 below, the Shadow Flicker Study Area is defined as ten times rotor diameter from each turbine in accordance with the 2006 DoEHLG Guidelines. The Shadow Flicker Study Area for this assessment is 1.62 kilometres based on a maximum rotor diameter of 162 metres and is further detailed in Section 5.6.2.2.13 below. There are 218 no. Sensitive Receptors identified within the 1.62km Shadow Flicker Study Area.

Map Legend

- EIAR Site Boundary
- Population Study Area (3 no. Electoral Divisions)

Drawing Title
Population Study Area

Project Title
Cooloo Wind Farm

Drawn By	Checked By
EC	BT
Project No.	Drawing No.
190723	Figure 5-4
Scale	Date
1:40,000	2025-09-04

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5.3.2 Demographic Trends

The recently published Census of 2022 shows that the population of Galway grew by 7.6% to 277,737 since the 2016 Census. Moreover, the number of people in the county rose by 19,679 between April 2016 and April 2022. Over the same period, Ireland's population grew by 8% from 4,761,865 to 5,149,139. Population statistics for the State, County Galway and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5-1 below.

Table 5-1 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 Galway	258,058	277,737	7.6%
Study Area	1,887	1,976	4.7%

The data presented in **Table 5-1** shows that the population of the Study Area increased by 4.7% between 2016 and 2022. This rate of population growth is less than that recorded at State level and the County Galway level. When the population data is examined in closer detail, it shows that the rate of population increase within the Population Study Area has been unevenly spread through the Electoral Divisions (EDs). The highest increase in the population between 2016 and 2022 occurred in the Cooloo ED, which experienced a 9% population increase. In comparison, the population of Hillsbrook ED increased by 1.2% during the same time period. Of the EDs that make up the Population Study Area for this assessment, the highest population was recorded in Moyne ED, with 703 persons recorded during the 2022 Census. The lowest population was recorded in Cooloo ED, with 580 persons recorded during the 2022 Census.

5.3.3 Population Density

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

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

Area	Population Density (Persons per square kilometre)	
	2016	2022
State	67.77	73.28
County Galway	43.77	47.11
Study Area	26.66	27.92

The population density of the Population Study Area recorded during the 2022 Census was 27.92 persons per km^2. This figure is considerably lower than the national population densities of 73.28 persons per km^2 and lower than the population densities of County Galway, which is recorded at 47.11 persons per $km,^2$ respectively in the 2022 Census.

Similar to the observed population trends, the population density recorded across the Population Study Area varies between EDs. Moyne ED has the highest population density, at 34.56 persons per km^2. Hillsbrook ED has a lower population density of 30.1 persons per km^2. Cooloo ED recorded the lowest population density with a total of 580 persons recorded in the townland with a population density of 21.16 person per km^2.

5.3.4 Household Statistics

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

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

Area	2016		2022	
	No. of Households	Avg. Size (persons)	No. of Households	Avg. Size (persons)
State	1,702,289	2.7	1,841,152	2.7
County Galway	91,899	2.7	98,922	2.7
Study Area	627	3.0	676	2.9

The figures in Table 5-3 show that the number of households within the State and Population Study Area increased, while the number of households in County Galway decreased. Average household size recorded within the Population Study Area during the 2016 and 2022 Censuses are bigger than those observed at State and County level during the same time period. Similar to the trends detailed above, the average household size recorded in the Population Study Area varies only slightly between EDs. Moyne ED had the highest, with 3.08 persons per household recorded in 2016, but decreased to 2.96 in 2022. Hillsbrook ED recorded the lowest with 2.99 persons per household recorded in 2016, while Cooloo ED recorded the lowest average size in 2022 with 2.89 persons per household.

5.3.5 Age Structure

Table 5-4 presents the population percentages of the State, County Galway 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 Figure 5-5.

Table 5-4 Population per Age Category in 2022 (Source: CSO)

Area	Age Category				
	0 - 14	15 – 24	25 - 44	45 - 64	65 +
State	19.7%	12.5%	27.6%	25.1%	15.1%
County Galway	19.3%	13.4%	26.7%	25.1%	15.4%
Study Area	20%	12.0%	23.8%	26.2%	17.9%

County Galway's population in April 2022 was comprised of 193,323. The average age of County Galway's population in April 2022 was 39.7 years, compared to 38.1 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 19% to 32,162 in County Galway, and by 18% to 776,315 at a national level since 2016. The proportion of the ED Population Study Area population within each age category is similar to those recorded at national and county level for most categories. For the Study Area, the highest population percentage occurs within the 45-64 age category.

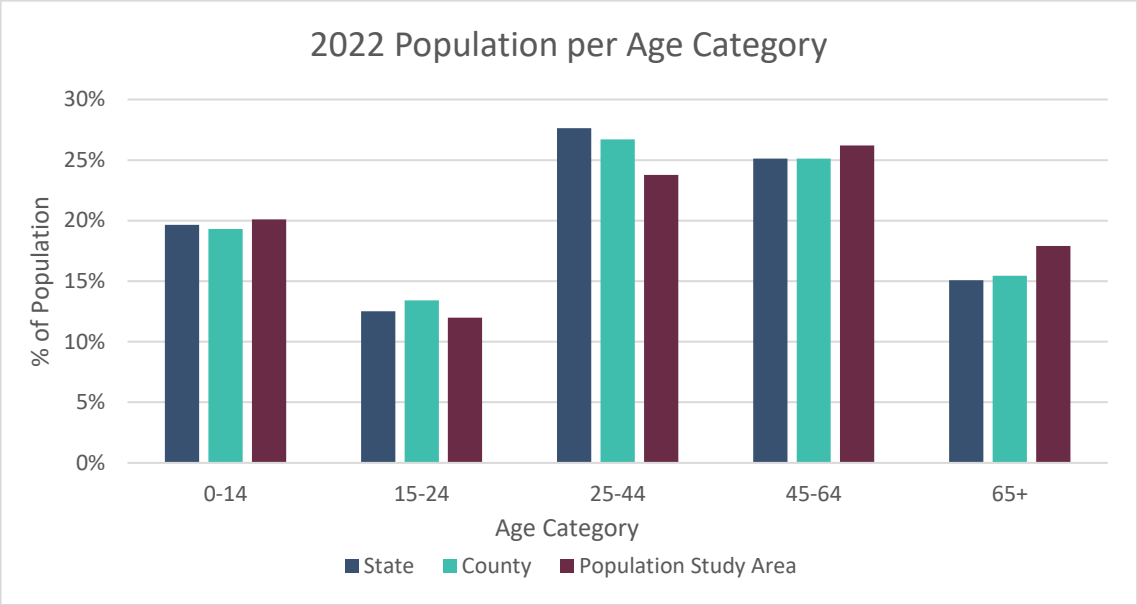

Figure 5-5 Population per Age Category in 2022 (Source: CSO)

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 can work, i.e., those who are aged 15+, out of full-time education and not performing duties that prevent them from working. There were 125,519 people (aged 15 and over) at work in County Galway, an increase of 15,452 people (+14%) between 2016 and 2022. Nationally, there were 313,656 additional people (+15.6%) at work. This figure is further broken down into the percentages that were at work, seeking first time employment or unemployed. It also shows the percentage of the total population aged 15+ who were *not* in the labour force, i.e., those who were students, retired, unable to work or performing home duties. Please see Table 5-5 below for further detail.

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

Status		Republic of Ireland	County Galway	Study Area
% of population aged 15+ who are in the labour force		**61.2%**	**60.8%**	**60.7%**
% of which are:	At work	91.7%	92%	94.9%
	First time job seeker	1.4%	1.2%	1.3%
	Unemployed	7.0%	6.6%	3.8%

Status		Republic of Ireland	County Galway	Study Area
% of population aged 15+ who are not in the labour force		**38.8%**	**39.2%**	**39.3%**
% of which are:	Student	28.6%	32%	28.4%
	Home duties	17%	15.3%	18.1%
	Retired	41%	40.2%	43.6%
	Unable to work	11.8%	10.8%	8.7%
	Other	1.7%	1.8%	1.3%

Overall, the principal economic status of those within the labour force living in Population Study Area is similar to that recorded at State and County level, with between 0 to 4% average difference apparent. 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 national and County level that show 'Retired' as the highest category.

The CSO employment figures grouped by socio-economic status includes the entire population for the Study Area, County and State in their respective categories. As such, the socio-economic category of 'Other' is skewed to include those who are not in the labour force.

5.3.6.2 Employment by Socio-Economic Group

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. The 'Higher Professional' category includes scientists, engineers, solicitors, town planners and psychologists. The 'Lower Professional' category includes teachers, lab technicians, nurses, journalists, actors and driving instructors. Skilled occupations are divided into manual skilled such as bricklayers and building contractors; semi-skilled such as roofers and gardeners; and unskilled, which includes construction labourers, refuse collectors and window cleaners. Figure 5-6 shows the percentages of those employed in each socio-economic group in the State, County Galway, and the Population Study Area during 2022.

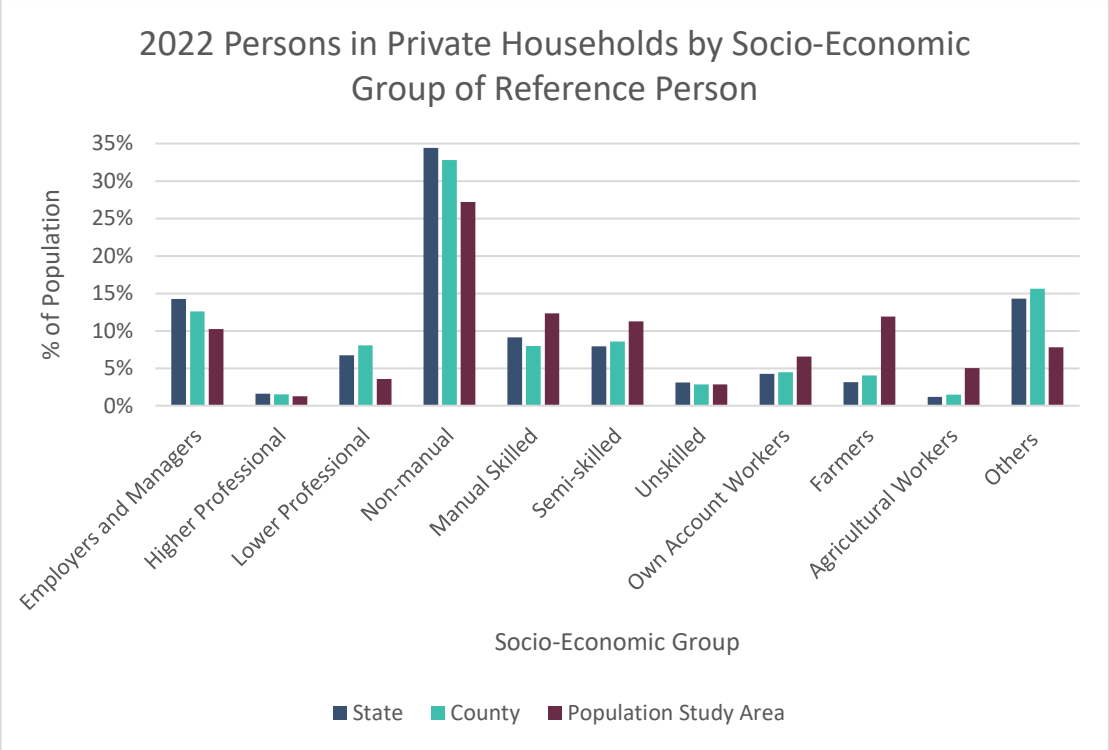

Figure 5-6 Persons in private households by socio-economic group in 2022 (Source: CSO).

The highest level of employment within the Population Study Area was recorded in the Non-Manual category. The levels of employment within the Skilled Manual, Semi-Skilled, Own Account, Farmer and Agricultural Worker categories in the Population Study Area were higher than those recorded for County Galway and the State, while those recorded within the Employer/ Manager, Higher Professional, Lower Professional, Non-Manual, Un-skilled and Other categories were lower than those recorded for County Galway and State levels.

The CSO employment figures grouped by socio-economic status includes the entire population for the Population Study Area, County and State in their respective categories. As such, the socio-economic category of 'Other' is skewed to include those who are not in the labour force.

5.3.6.3 Employment and Investment Potential in the Irish Wind Energy Industry

5.3.6.3.1 *Background*

A report entitled '*Jobs and Investment in Irish Wind Energy – Powering Ireland's Economy*'[6] 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."

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

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*'[7], 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[8] 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.'*

5.3.6.3.2 Energy Targets

The Climate Action Plan 2025 (CAP25) was launched in April 2025. Following on from Climate Action Plans 2019, 2021, 2023, and 2024, 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.

Further information on energy and climate change targets is detailed in Section 1.5 of Chapter 1, Sections 2.2 to 2.4 of Chapter 2 and Chapter 11 of this EIAR.

5.3.6.3.3 Employment Potential

The 2014 report *"An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland"*[9]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.

[7] *Siemens (2014) An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland. Available at: https://www.esri.ie/publications/an-enterprising-wind-an-economic-analysis-of-the-job-creation-potential-of-the-wind*
[8] *SEAI (2019), https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf*
[9] *IWEA (2014) An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland. Available at: https://www.esri.ie/publications/an-enterprising-wind-an-economic-analysis-of-the-job-creation-potential-of-the-wind*

The Sustainable Energy Authority of Ireland 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'.* This Roadmap estimated that onshore and offshore wind could create 20,000 direct installation and operation/maintenance jobs by 2040 and that the wind industry would also have an annual investment potential of approximately €6-12 billion by 2040.

The 2014 report '*The Value of Wind Energy to Ireland*'[10], published by Pőyry, 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'* [11] 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[12] (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*'[13] 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 January 2025, there were 6.3GW of wind energy capacity installed on the island of Ireland[14]. Of this, 4.9GW was installed in the Republic of Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Donegal, Galway, Cork, Clare and Kerry, contributing to employment potential on the Island of Ireland.

5.3.6.3.4 Economic Value

A 2019 report by Baringa, '*Wind for a Euro: Cost-benefit analysis of wind energy in Ireland 2000-2020*'[15], 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 4.1GW of wind generation capacity in Ireland between 2000 and 2020 (2018-2020 results being

[10] *Poyry The Value of Wind Energy to Ireland – March 2014*
[11] *WindEurope (2017) Wind Energy in Europe Scenarios for 2030* <https://windeurope.org/wp-content/uploads/files/about-wind/reports/Wind-energy-in-Europe-Scenarios-for-2030.pdf>
[12] https://www.marei.ie/our-climate-neutral-future-zeroby50/
[13] *WindEurope (2022) Wind Energy in Europe 2021 Statistics and the Outlook for 2022-2026* <https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-2021-statistics-and-the-outlook-for-2022-2026/>
[14] *Eirgrid,* https://www.eirgrid.ie/grid/system-and-renewable-data-reports
[15] *Baringa (2019) Wind for a Euro: Cost Benefit Analysis of Wind Energy in Ireland 2000-2020* <https://www.baringa.com/en/insights/low-carbon-futures/our-market-and-policy-studies-in-ireland/wind-for-a-euro/>

projective) will result in a total net cost to consumers, over 20 years, of €0.1 billion (€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 [16] 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 Project will, if consent is granted, contribute to the economic value that renewable energy brings to the country.

5.3.7 Land Use Patterns and Activities

The land uses within the Proposed Project Site is predominantly located within agricultural with some adjacent areas in the north of the site occupied by active raised blanket bog. Land-use in the wider landscape comprises a mix of pastoral agriculture, peat bogs and low density residential. The total area of farmland within the three EDs, around the Proposed Project Site, measures approximately 5786.4 hectares, comprising 80.5% of the Population Study Area, according to the CSO Census of Agriculture 2020. There are 228 farms located within the three EDs, with an average farm size of 27.9 hectares. Table 5-6 shows the breakdown of farmed lands within the three EDs.

Table 5-6 Farm Size and Classification within the Study Area in 2020 (Source: CSO)

Electoral Division	No of holdings	Average size (hectares)	Median age of holder	Livestock units	Total Cereals (hectares)	Average farmed (hectares)
Cooloo	84	33.2	58	4938	44.3	2790
Hillsbrook	75	22.8	63	2583	0	1713
Moyne	69	18.6	63	1770	0	1284
Total	**228**	24.9	**61**	9291	**44.3**	1929
Size of 3 EDs			7190 hectares			
Total Area Farmed within 3 EDs			5786.4 hectares			
Farmland as % of EDs			80.5%			

[16] *https://windenergyireland.com/all-documents?file_category=21*

5.3.8 Services

The Site is located approximately 1.2km north of the village of Brierfield and 5.3km west of Moylough. Galway City is located approximately 30km to the southwest of the Proposed Wind Farm site and approximately 12km southeast of Tuam. Both Tuam and Galway City centres provide retail, recreational, educational, and religious services.

5.3.8.1 Education

The nearest primary school is Brierfield National School approx. 1.35km south of the Proposed Wind Farm site at T1, beyond that Scoil Bride 1.59km to the east at T8. The nearest secondary school is located in Mountbellew – Holy Rosary College is 10.32km to the southeast. The Mountbellew Agricultural College (third-level education) is located approximately 10.68km southeast of the Proposed Wind Farm site. Atlantic Technical University (Galway Campus) is located approx. 31km southwest and the University of Galway approximately 33.1km northwest of the Site.

5.3.8.2 Access and Public Transport

The Proposed Wind Farm Site is accessed via the local R332 road which connects to the N63 national road approximately 2km to the south.

There are a number of local bus services provided in Galway through private bus operators. Healy Bus provides transport services between Loughrea, Craughwell and Galway City Monday to Saturday on bus route no. 920. Citylink also provides transport between Loughrea and Galway City, as well as providing services to Dublin City and Airport, stopping at Kilreekil, Aughrim, Ballinasloe, Athlone, Moate and various other commuter towns. This service operates on a daily basis. The TFI Local Link Bus Service also operates between Athenry and Loughrea, Kilchreest and Loughrea, Gort and Loughrea (Route 934), Ballinasloe and Loughrea (Route 548), Mullagh to Loughrea, Portumna and Loughrea and Woodford to Loughrea.

The nearest train station to the Proposed Project is the Attymon train station 17.8km South of the Proposed Wind Farm site (T1) providing connections with Galway and Dublin.

5.3.8.3 Amenities and Community Facilities

There are no amenity or community facilities located within or adjacent to the Proposed Wind Farm site, however there are several in the surrounding area. Located 3.36km to the west of the site is Killererin GAA club, a GAA pitch in the village of Barnaderg. Other sports surrounding townlands include a hurling club in Abbeyknockmoy (Abbeyknockmoy Hurling Club) and a rugby club in Tuam (Tuam Rugby Club). Amenities and community facilities, youth clubs and recreational areas are also located in Tuam.

Community Benefit proposals, which enhance local amenities and community facilities are described in Chapter 4: Description of the Proposed Project.

5.4 Tourism

5.4.1.1 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*[17], pertaining to domestic and international tourism volumes for Ireland, was published by Failte Ireland in October 2024 for the year 2023. In 2023, out-of-state (Overseas and Northern Ireland) tourist expenditure amounted to €6 billion. With a further €970 million spent by overseas visitors on fares to Irish carriers, foreign exchange earnings were €7 billion. Domestic tourism expenditure amounted to €3.1 billion, making tourism a €10 billion industry. The Central Statistics Office's estimates the number of people employed in 'Tourism Industries' to be 226,700 in Q3 2023 through an alternative method of estimating employment using PAYE tax data. Note that self-employed and primarily pensioners are excluded from the headcount.

Key Tourism Facts 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 5-7** 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 5-7 Overseas Tourists Revenue and Numbers 2023 (Source: Fáilte Ireland)

Region	Total Revenue (€m)	Total Number of Non-Domestic Tourists (000s)
Dublin	€2,289m	3,780
Mid-East/Midlands	€502m	755
South-East	€283m	521
South-West	€962m	1,321
Mid-West	€487m	724
West	**€723m**	**1,112**
Border	€337m	462
Total	**€5,583 m**	**8,675**

The West Region, in which the Site is located, comprises Counties Galway, Mayo and Roscommon. This Region benefited from approximately 12.8% of the total number of overseas tourists to the country and approximately 12.9% of the total tourism income generated in Ireland in 2019.

[17] *Fáilte Ireland (2024) Key Tourism Facts 2023* <https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/Research/Key%20Tourism%20Facts%20and%20Figures%202023/FI_Key-Tourism-Facts-2023_National-Summary_FINAL.pdf?ext=.pdf>

Table 5-8 presents the breakdown of overseas tourist numbers and revenue to the West region during 2017 ('*2017 Topline Tourism Performance by Region,* Fáilte Ireland, August 2018) [18]. As can be observed in Table 5-8, County Galway had the highest number of overseas tourists visiting the Region during 2017 and had tourism revenue at €589 million.

Table 5-8 Overseas Tourism to West Region during 2017 (Source: Fáilte Ireland)

County	Revenue Generated by Overseas and Domestic Tourists (€m)	No. of Overseas Tourists (000s)
Galway	589	1673
Mayo	78	324
Roscommon	27	54

5.4.2 Tourist Attractions

There are no key identified tourist attractions pertaining specifically to the Site.

5.4.2.1.1 *Tourism Attractions within the surrounding landscape*

The nearest identified tourist attraction is the Knockmoy Abbey ruins, located c. 5.4km southwest of the proposed site just outside the village of Abbeyknockmoy, Co. Galway.

County Galway has a wide range of nationally significant tourism assets which include the following:

- Richmond Esker Nature Reserve is located approximately 4.35km northeast of the Proposed Wind Farm.
- Mountbellew Golf Club – located 8.2km southeast of closest proposed turbine;
- Athenry Castle - a restored castle dating back to 1235. Located c.19.6km northeast of the site;
- Galway City Museum - museum with various archaeological, historical and cultural exhibitions. Located c. 33km southwest of the site;
- Salthill Promenade - promenade overlooking Galway Bay. Located c. 35.5km southwest of the site;
- Knockma Hill - A forestry trail with cairn located at the top of the hill. Located c.19km west of the site;
- Kylemore Abbey - a 6 acre Victorian walled garden with many woodland and lakeshore walks overlooking Connemara. Located c. 80.5km west from the site;
- Connemara National Park and Visitor Centre - a picturesque mountain trail with a variety of hiking trails, including part of the Twelve Bens mountain range. Located c. 74.5km northwest of the site;
- Kilconnell Franciscan Friary - an Irish historical landmark is located c. 24km southeast of the site;
- Glenamaddy Turlough and picnic area is located c. 17km northeast of the closest proposed turbine.

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

Archaeological sites and monuments are part of Irish national heritage and are recognised tourist attractions across the country. Please see Chapter 13 Archaeology and Cultural Heritage for further details.

5.4.2.2 Tourist Attitudes to Wind Farms

5.4.2.2.1 *Scottish Tourism Survey 2021*

BiGGAR Economics undertook an independent study in 2021, entitled '*Wind Farms & Tourism Trends in Scotland: Evidence from 44 Wind Farms*'[19] 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.

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

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

5.4.2.2.2 *Fáilte Ireland Surveys 2007 and 2012*

[19] *BiGGAR Economics (2016) Wind Farms and Tourism Trends in Scotland <https://biggareconomics.co.uk/wp-content/uploads/2021/11/BiGGAR-Economics-Wind-Farms-and-Tourism-2021.pdf>*

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*'.[20]

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 landscape types: Coastal, Mountain, Farmland, Bogland and Urban Industrial, and then rate on a scale of 1-5 the potential impact of a wind farm being sited in each landscape. The survey found that each potential wind farm must be assessed on its own merits. 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 Project throughout the design and assessment processes. Reference has been made to the Guidelines (DoEHLG, 2006) and 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

[20] *Fáilte Ireland (2008) Visitor Attitudes on the Environment – Wind Farms* <https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf>

Ireland Newsletter 2012/No.1 entitled '*Visitor Attitudes on the Environment: Wind Farms – Update on 2007 Research*'[21]. 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.

5.5 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.[22] 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.

[21] *Fáilte Ireland (2008) Visitor Attitudes on the Environment: Wind Farms – Update on 2007. Available at <https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).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>*

5.5.1.2 Sustainable Energy Authority of Ireland Survey 2003 and 2017

5.5.1.2.1 *Background*

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. 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.

5.5.1.2.2 *Findings*

The SEAI survey 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 impact of the turbines on the landscape was the strongest influence. The report also notes however that the findings obtained within wind farm catchment areas showed that impact on the landscape is not a major concern for those living near an existing wind farm.

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

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

The study reveals uncertainty among respondents with regards to the issues of noise levels, local benefits and the reliability or otherwise of wind power as an energy source. It goes on to state however that the finding that people who have seen wind farms rate these economic and environmental factors more favourably is a further indication that 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 impact of the development on the locality were generally positive, with some three-quarters of interviewees believing it had impacted positively.

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

Those with direct experience of a wind farm in the locality are generally impressed with it as an additional feature in the landscape. The report states:

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

[23] *Sustainable Energy Ireland 2003 Attitudes Towards The Development of Wind Farms in Ireland. Available at: https://mosart.ie/wp-content/uploads/2016/02/Attitudes-Towards-Wind-Farm-Development-Ireland.pdf*

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.

5.5.1.2.3 *Survey Update 2017*

Additionally, a survey carried out by Interactions in October 2017 published by the SEAI, show 47% of Irish adults polled are 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' whilst just over two in three cited cheaper electricity.

5.5.1.2.4 *Conclusions*

The 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.

5.5.2 Wind Energy Ireland Public Attitudes Monitor December 2022

Wind Energy Ireland (WEI, formerly IWEA) undertook a survey in 2022 to '*measure and track perceptions and attitudes around wind energy amongst Irish adults'*. The results were published in the Wind Energy Ireland Public Attitudes Monitor December 2022[24] report. A total of 1,017 adults were surveyed along with a supplementary booster sample of 201 rural dwellers. The results are as follows:

- 4 in 5 nationally (80%) are now in favour of wind power. This is an increase of +6% versus last year's results.
- Amongst rural residents, 4 in 5 registered favourable attitudes. This is the highest level recorded since tracking commenced in 2017.
- Almost half (45%) ranked cheaper electricity as the top wind energy benefit with reductions in CO_2 cited as the second wind energy benefit.
- The survey prompt '*I don't know of any benefits'* has fallen again, to just 1 in 10 this year.
- Amongst rural residents, reducing negative feedback levels is evident year on year.

[24] *Wind Energy Ireland December 2022 Public Attitudes Monitor. Available at: https://windenergyireland.com/images/Final_WEI_Annual_Attitudes_Survey_2022.pdf*

- Nationally, 58% said they would be in favour of a wind farm in their area. Again, this marks highest number in favour since tracking began.

Amongst rural residents just 1 in 10 registered being opposed.

5.5.2.1.1 *IWEA Interactions Opinion Poll on Wind Energy 2021*

In January 2021 IWEA published the results of their most recent nationwide annual poll on attitudes to wind energy, the *Public Attitudes Monitor*.[25] The results of the opinion poll were published via Wind Energy Ireland, the representative body for the Irish wind industry. The objective of the poll was to 'measure and track public perceptions and attitudes around wind energy amongst Irish adults.'

Between 12th – 18th November 2020, a representative sample of 1,004 Irish adults together with a booster sample of 203 rural residents participated in an online survey. The 2020 results reported that 50% of the nationally representative sample 'strongly favour', 32% 'tend to favour' and 15% 'neither favour nor oppose' wind power. Of the rural population surveyed 42% 'strongly favour', 40% 'tend to favour' and 14% 'neither favour nor oppose' 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 82%) there has been a marginal increase in those in favour from the rural population (from 79% to 82%).

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 view that it as a 'safe resource'.

When questioned about wind energy developments in their local area, 54% of the nationally representative sample either 'favour' or 'tend to favour' such proposals compared to 52% of the rural population reporting the same. There was a high level of agreement with positive benefits concerning wind energy the local area from both the nationwide and rural populations, with over 80% of each group in agreement that it 'reduces CO_2 emissions' and is 'good for the environment', with over 75% of each group agreeing that it leads to 'cheaper electricity'. Over 60% of each population group agreed that wind energy 'supports energy independence' and 'creates employment'.

The IWEA November 2020 survey follows the structure of previous national opinion polls on wind energy undertaken since 2017. The 2020 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.

5.5.2.2 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 syndrome does not adequately explain variations in public attitudes due to the degree of subjectivity involved.

[25] *Wind Energy Ireland January 2021 Public Attitudes Monitor. Available at: https://windenergyireland.com/images/files/2032-wei-version-2020-for-media.pdf*

5.6 Property Values

5.6.1 Property Values and Wind Farms

This section summarises the largest and most recent studies from the United States and the UK and also provides a summary of an Irish working paper 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'*.[26] 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[27]. 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[28]. 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,

[26] *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>*
[27] *LBNL (2019) The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis. Available at: https://emp.lbl.gov/publications/impact-wind-power-projects*
[28] *LBNL (2013) A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Available at: https://emp.lbl.gov/publications/spatial-hedonic-analysis-effects-wind*

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.

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 wind energy project. The decline in property values was found to recover post construction with property value impacts becoming relatively small (~2%) and statistically insignificant 9 years or more after project announcement (roughly 5 years after operation begins). This suggests that the housing market is reacting negatively to the expectation of likely impacts (after announcement) and the heightened activity during construction, but after operation begins, those negative perceptions and related home price impacts appear to fade.

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'* [30]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) [31] 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

[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*
[30] *RenewableUK, Cebr (2014) The Effect of Wind Farms on House Prices. Available at: https://tethys.pnnl.gov/sites/default/files/publications/RenewableUK_2014.pdf*
[31] *Climate Exchange (2016) Impact of wind Turbines on House Prices in Scotland. Available at: https://www.climatexchange.org.uk/wp-content/uploads/2023/09/cxc_wind_farms_impact_on_house_prices_final_17_oct_2016.pdf*

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 Wind Farm.

5.7 Residential Amenity

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

The Proposed Wind Farm is located within a rural, agricultural setting in east Galway, approximately 12km southeast of Tuam. The village of Brierfield is located approximately 1.3km south of the nearest proposed turbine, and the village of Moylough is located approximately 5.3km east of the nearest proposed turbine. The N63 National Road runs south of the Site in a general northeast-southwest orientation entering the settlement of Abbeyknockmoy and then heading northeast towards Moylough, passing within 1.27km of the nearest proposed turbine. The site is accessed via local roads from the R332 Regional Road, which travels in a southeast-northwest direction between Tuam and the N63 National Road, Co. Galway. The site itself is served by a number of existing agricultural roads and tracks.

There are 43 Sensitive Receptors located within 1 kilometre of the proposed turbine locations.

All Sensitive Receptors are located at a minimum of 720m from any proposed turbine, i.e., 4 times the tip height of 180m (specifically set out in the Draft Guidelines (DoHPLG, 2019) for the purposes of protecting visual amenity), and all involved Sensitive Receptors achieve the minimum distance of 500m from any proposed turbine location. The turbine locations adhere to the Guidelines (DoEHLG, 2006) and the Draft Guidelines (DoHPLG, 2019) in relation to turbine setback from Sensitive Receptors.

CAP25 was published in April 2025 by the Department of Environment, Climate and Communications. The associated Annex of Actions (Action EL/24/5) identifies the aim of publishing revised onshore wind energy guidelines in Q1 2025. At time of writing, the Draft Guidelines (DoHPLG, 2019) 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 (DoEHLG, 2006). Notwithstanding this, however, due to the timelines associated with the planning process for renewable energy projects and the commitment within the CAP25 to publish new wind energy guidelines for onshore wind in Q1 2025 it is possible that the Draft Guidelines (DoHPLG, 2019) may be adopted during the consideration period for the current planning application. Noise emissions and shadow flicker are controllable via inbuilt turbine technologies; therefore, the Proposed Wind Farm 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.

When considering the amenity of residents in the context of a Proposed Project, there are three main potential impacts of relevance: 1) Shadow Flicker, 2) Noise, and 3) Visual Amenity. Shadow flicker and noise are quantifiable aspects of residential amenity while visual amenity is more subjective. Detailed shadow flicker and noise 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 14 of this EIAR. Impacts on the local population during the construction, operational and decommissioning phases of the Proposed Project is assessed in relation to each of these key topics and other environmental factors such as noise, traffic, and dust; see 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, dust and general disturbance.

5.8 Baseline Environment- Health

5.8.1 Introduction

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 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.

5.8.2 Baseline

Tables 5-9 and 5-10 below details the general health of persons by percentage for the State, County Galway and the Population Study Area for the most recent census taken in Ireland, 2022 and 2016, which have data publicly available. In general, the percentage health breakdown for the State, County and study area populations are very similar. The Population Study Area, State and County all reported in the range of 80-90% for a combined 'very good' and 'good' health. In 2022, 82.9% of people in Galway stated that their health was good or very good compared with 87.3% in 2016. This is a similar trend to the national figures, which also showed a 4.1% decrease in the good/very good categories, from 87% to 82.9%.

Table 5-9 Percentage General Health Breakdown for the State and County Galway as reported in the 2016 and 2022 Census. Source www.CSO.ie

	Very Good		Good		Fair		Bad		Very Bad		Not Stated	
	2016	2022	2016	2022	2016	2022	2016	2022	2016	2022	2016	2022
State	59.4%	53.2%	27.6%	29.7%	8%	8.6%	1.3%	1.4%	0.3%	0.3%	3.3%	6.7%
County Galway	58.7%	52.9%	28.6%	30%	8.2%	8.7%	1.2%	1.3%	0.3%	0.3%	3%	6.9%

Table 5-10 Percentage General Health Breakdown for the study area as reported in the 2016 and 2022 Census. Source www.CSO.ie

Study Area- Electoral Divisions	Very Good		Good		Fair		Bad		Very Bad		Not Stated	
	2016	2022	2016	2022	2016	2022	2016	2022	2016	2022	2016	2022
Cooloo	63.0%	59.8%	27.4%	31.7%	7.3%	6.4%	1.3%	1.2%	0.2%	0.0%	0.8%	0.9%
Hillsbrook	56.2%	49.8%	32.8%	35.5%	8.2%	8.8%	1.0%	0.4%	0.3%	0.4%	1.5%	5.1%
Moyne	56.6%	54.1%	34.5%	35.4%	7.8%	8.3%	0.3%	1.0%	0.1%	0.1%	0.7%	1.1%

5.8.2.1 Air Quality

5.8.2.1.1 *Dust, NO_2, PM_{10} and PM_{25} and CO_2 Emissions*

Chapter 10 Air Quality and Chapter 11 Climate assess the potential for impact to human health from dust, CO_2 and other noxious emissions generated by additional vehicles and plant machinery as well as the release of CO_2 through excavations. The assessments consider the construction, operation and decommissioning phases. The assessments conclude that the residual effects from the construction and decommissioning phases of the Proposed Project are not significant. Please see Chapter 10 and Chapter 11 for further details.

5.8.2.2 Water quality

The Mid-Galway Public Water Scheme and Source Protection Area is located within the south of the proposed Project. The GSI also map several additional private boreholes and wells in the vicinity of the Site. Chapter 9 Water assess the potential for impact on public water supply and private wells during the construction, operation and decommissioning phases. With the application of the mitigation measures, no significant effects on the Mid Galway PWS Spring source will occur.

5.8.2.3 Noise and Vibration

Chapter 12 Noise and Vibration assesses the potential for noise and vibration impacts during the construction, operation and decommissioning phases of the Proposed Project. The assessment includes mitigation and monitoring measures that will be complied with for the construction, operation, and decommissioning phases.

5.8.2.4 Traffic and Transport

Chapter 15 Material Assets assesses the potential for traffic and transport impacts during the construction, operation and decommissioning of the Proposed Project. The assessment included a study of the additional traffic generated on the local roads during the construction phase through component and construction materials delivery as well as staff vehicles, and an assessment of potential traffic and transport impacts during the operational phase from maintenance vehicles. The assessment includes a Traffic Management Plan for the construction phase and all abnormal loads will be supervised by competent experts and An Garda Síochána.

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

A risk assessment of the Proposed Project's vulnerability to and from natural disasters can be found in Chapter 16 Major Accidents and Natural Disasters of this EIAR. A brief discussion can be found below.

5.8.2.5.1 *Pollution/Contamination/Fire*

A wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur the potential sources of pollution on-site during both the construction, operational and decommissioning phases are limited. Sources of pollution with the potential to cause environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited. Consequently, it is considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is limited and therefore a significant effect on human health is similarly limited. As described earlier, there are no significant sources of pollution in the Proposed Project 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 impacts on human health. Turbine safety is addressed in Section 5.1.4 above.

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 Proposed Project is not regulated by or connected to or close to, any Site 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.

5.8.2.5.2 *Flooding*

The Proposed Project Site is surrounded by a number of rivers and streams, with the Dangan Eighter Stream bisects the site to the north. The Lecarrow, Forty Acres and Angloragh streams flow adjacent to the site boundary. The northern section of the site are subject to medium and low probability of flooding.

The OPW's River Flood Extents Mapping, National Indicative Fluvial Mapping, Past Flood Event mapping (https://www.floodinfo.ie/map/floodmaps/), historical mapping (i.e. 6" & 25" base maps) and GSI Groundwater/Surface Water Flood Maps were consulted to identify those areas of the Site as being potentially at risk of fluvial, pluvial and surface water flooding. Several walkover surveys were also conducted as part of the site-specific FRA.

No recurring flood incidents within the Proposed Wind Farm site were identified from OPW's Past Flood Event Mapping.

The nearest mapped past flood events include recurring flood events in low lying lands 0.5km to the south of the Proposed Wind Farm Site at Polladooey (Flood ID: 1813), 0.5km to the southwest of Horseleap Lough (Flood ID: 1814) and 1.2km to the northwest of the Proposed Wind Farm site at Cloondahamper (Flood ID: 1840). The Tuam West Area Engineer Meeting Minutes states that these recurring flood events relate to "*Low lying land floods every year after heavy rain*". The area engineers meeting minutes are available to view at www.floodinfo.ie.

Identifiable map text on local available historical OSI 6" or 25" mapping does not identify any lands that are "*liable to flood*" within the Proposed Wind Farm site. The closest lands to the Site mapped as "*liable to flood*" are low-lying lands located immediately to the southeast and northwest of Horseleap Lough 1.5km from the nearest turbine.

There is no OPW CFRAM River Flood Extents Mapping available for the area of the Site as the CFRAM mapping does not cover small watercourses such as those present at the Site.

Therefore, the National Indicative Fluvial Mapping (NIFM) was consulted which has estimated current and future scenario 100-year and 1,000-year fluvial flood zones. No NIFM flood zones are mapped within the Proposed Wind Farm site. NIFM flood zones are mapped further downstream of the Site along the Grange River, the Lecarrow 30 Stream and the Abbert River.

As the Site is not mapped inside a 100-year or 1,000-year fluvial flood zones, the Site is located in Flood Zone C (Low Risk).

Also, no CFRAM rainfall (pluvial) flooding is mapped with the Site.

The GSI Groundwater Flood Maps and Winter 2015/2016 Surface Water Flooding Maps have no historic flood zones mapped within the Site. The nearest GSI mapped historic groundwater and surface water flood are the lands around Horseleap Lough.

5.8.2.5.3 *Stability/Landslide*

The GSI Landslide database (www.gsi.ie) shows no historical records of landslides near the Site or in the surrounding area. The GSI Landslide Susceptibility Map (www.gsi.ie) assesses the likelihood of a landslide happening at a specific location. According to the map, the probability of a landslide occurring at the Site is categorized as Low. This is attributed to the localized and shallow nature of the peat, as well as the relatively flat topography, which collectively result in a very low risk of peat instability or sliding. Thus, there is limited potential for significant natural disasters occurring at the site. Ireland, being geologically stable with a mild temperate climate, has limited potential for such events. The possible natural disasters are confined to flooding, fire, and landslide occurrences. Further details on the risk of instability and potential failures, particularly landslides, are discussed in Chapter 8 on Land, Soils, and Geology. This chapter concludes that the site maintains an acceptable margin of safety, making it suitable for wind farm development.

5.8.2.6 Health Baseline Summary

Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, Chapter 10: Air Quality, Chapter 11: Climate, Chapter 12: Noise and Vibration and Chapter 15: Material Assets (Traffic and Transport) provide an assessment of the effects of the Proposed Project on these areas of consideration. Chapter 16 assesses the vulnerability of the project to and from major accidents and natural disasters. There is the potential for negative effects on human health during the wind farm construction, operation and decommissioning phases related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons, release of potentially silt-laden runoff into watercourses and noise emissions. The assessments in the chapters listed above show that the residual effects will not lead to significant effects on any environmental media with the potential to lead to health effects for humans. The Noise and Vibration assessment concludes the residual effects for Sensitive Receptors will range from not significant to imperceptible for the operational phase. Furthermore, the Wind Farm noise emissions and shadow flicker are controllable via inbuilt technologies, and it will comply with the conditions imposed should it receive a grant. Likewise, the vulnerability the project to/from potential for natural disasters has been assessed as low risk for all phases.

On this basis, the potential for negative health effects associated with the Proposed Project during all phases is considered to be not significant. Furthermore, the Proposed Project is capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage the Proposed Wind Farm will have a long term, moderate positive effect on air quality as set out in Chapter 10 Air Quality which will contribute to positive effects on human health.

5.9 Shadow Flicker Assessment Results

5.9.1 Daily and Annual Shadow Flicker

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

The model results assume theoretically precautionary 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 theoretically precautionary scenario. Following the detail provided above on sunshine hours, a sunshine factor of 24.44% 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 5-11.

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 5.3.14 there are no Sensitive Receptor less than 500 metres of the proposed turbine locations.

The predicted shadow flicker levels have been modelled for all 218 Sensitive Receptors located within 1.62km (10 x 162m rotor diameter) of the proposed turbine locations. The predicted shadow flicker model results indicate:

- 47 Sensitive Receptors are theoretically predicted to experience zero shadow flicker;
- 171 Sensitive Receptors are theoretically predicted to experience some shadow flicker;
  Of the 218 Sensitive Receptors, 76 Sensitive Receptors are theoretically predicted to experience shadow flicker that exceeds the Guidelines (DoEHLG, 2006) . Please see Table 5-11 below for details.
- Appendix 5-4 of this EIAR contains the shadow flicker results for the 218 houses, i.e. including the Sensitive Receptors experiencing zero or less than the Guidelines (DoEHLG, 2006) threshold for daily and annual shadow flicker.

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

It is worth noting that the predicted exceedances of shadow flicker listed in Table 5-11 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, accessed 2024).

Section 5.10.3.2.7 below details the mitigation measures which will be employed at the potentially affected properties to ensure that the current adopted Guidelines (DoEHLG, 2006) are complied with at any property within the Shadow Flicker Study Area. The same mitigation measures also demonstrate that the proposed turbines can be operated in accordance with the shadow flicker requirements of the 2019 draft DoEHLG Guidelines, i.e. zero shadow flicker occurrences, should they be adopted as currently proposed, while the planning application is being determined.

Table 5-11 Maximum Potential Daily & Annual Shadow Flicker – Proposed Cooloo Wind Farm, Co. Galway.

House ID	ITM Coordinates (Easting)	ITM Coordinates (Northing)	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)
1	557118	748640	720	T8	00:46:00	73:38:00	17:59:57	T2, T3, T4, T5, T6	Yes
2	557082	750528	725	T9	00:52:00	56:26:00	13:47:41	T6, T7, T9	Yes
3	554940	749857	725	T6	00:52:00	62:24:00	15:15:12	T4, T5, T6, T9	Yes
4	554571	747565	728	T1	00:51:00	87:27:00	21:22:36	T1, T2, T4	Yes
5	554829	748694	736	T3	00:51:00	77:46:00	19:00:35	T2, T3, T4, T5	Yes
6	557538	749999	739	T9	00:54:00	112:01:00	27:22:55	T4, T5, T6, T7, T8, T9	Yes
7	556884	750597	746	T9	00:27:00	27:01:00	6:36:15	T6, T7, T9	No
8	557132	748609	753	T8	00:42:00	66:16:00	16:11:55	T2, T3, T4, T5, T6	Yes
9	556611	750583	756	T9	00:39:00	56:28:00	13:48:11	T6, T7, T9	Yes
10	556020	747382	759	T1	00:51:00	58:35:00	14:19:13	T1	Yes
11	554786	748627	777	T3	00:48:00	75:44:00	18:30:45	T1, T2, T3, T4, T5	Yes
12	556943	750627	783	T9	00:25:00	22:28:00	5:29:31	T6, T7, T9	No
13	556701	750634	787	T9	00:31:00	29:41:00	7:15:21	T6, T7, T9	Yes
14	556763	750641	788	T9	00:30:00	23:17:00	5:41:29	T6, T7	Yes
15	556385	747820	802	T4	00:48:00	57:29:00	14:03:05	T1, T2	Yes
16	556368	750618	808	T7	01:20:00	100:31:00	24:34:15	T6, T7, T9	Yes
17	555149	751226	831	T7	00:49:00	48:31:00	11:51:35	T7	Yes
18	554838	749907	836	T6	00:45:00	48:24:00	11:49:52	T4, T5, T6, T7, T9	Yes
19	556934	750684	838	T9	00:25:00	16:13:00	3:57:51	T6, T7	No
20	557108	748515	842	T8	00:39:00	47:30:00	11:36:40	T1, T2, T3, T4, T5, T6	Yes

21	554819	749877	848	T6	00:44:00	44:41:00	10:55:21	T4, T5, T6, T7, T9	Yes
22	556483	747792	860	T4	00:42:00	43:33:00	10:38:44	T1, T2	Yes
23	554717	748407	878	T3	00:44:00	123:24:00	30:09:52	T1, T2, T3, T4, T5	Yes
24	555050	751217	878	T7	00:46:00	55:45:00	13:37:40	T7	Yes
25	555270	751347	890	T7	00:26:00	10:44:00	2:37:25	T7	No
26	557827	749006	908	T8	00:43:00	52:40:00	12:52:27	T4, T5, T8, T9	Yes
27	557731	749892	919	T9	00:42:00	58:53:00	14:23:37	T4, T5, T8, T9	Yes
28	557306	748474	931	T8	00:32:00	44:59:00	10:59:45	T2, T3, T4, T5	Yes
29	556322	751064	937	T7	00:42:00	30:19:00	7:24:39	T7	Yes
30	554626	748663	938	T3	00:40:00	60:59:00	14:54:25	T1, T2, T3, T4, T5	Yes
31	554906	746753	945	T1	00:00:00	0:00:00	0:00:00	N/A	No
32	554990	746711	953	T1	00:00:00	0:00:00	0:00:00	N/A	No
33	554626	748450	956	T3	00:40:00	99:58:00	24:26:11	T1, T2, T3, T4, T5	Yes
34	556905	750813	963	T9	00:26:00	18:01:00	4:24:15	T6, T7	No
35	556544	747703	965	T4	00:39:00	39:21:00	9:37:08	T1, T2	Yes
36	554594	748665	970	T3	00:38:00	60:00:00	14:40:00	T1, T2, T3, T4, T5	Yes
37	557234	748410	970	T8	00:35:00	34:02:00	8:19:09	T2, T3, T4, T5	Yes
38	554608	748447	975	T3	00:39:00	97:18:00	23:47:04	T1, T2, T3, T4, T5	Yes
39	555172	751399	975	T7	00:27:00	11:48:00	2:53:04	T7	No
40	557331	748431	980	T8	00:31:00	40:37:00	9:55:43	T2, T3, T4, T5	Yes
41	554880	746721	985	T1	00:00:00	0:00:00	0:00:00	N/A	No
42	556396	751065	998	T7	00:39:00	24:54:00	6:05:12	T7	Yes
43	556511	747605	999	T2	00:40:00	56:32:00	13:49:09	T1, T2	Yes
44	554847	746711	1008	T1	00:00:00	0:00:00	0:00:00	N/A	No
45	555225	751472	1023	T7	00:00:00	0:00:00	0:00:00	N/A	No
46	555163	751449	1024	T7	00:16:00	4:13:00	1:01:51	T7	No
47	557152	748275	1034	T4	00:38:00	36:49:00	8:59:59	T1, T2, T3, T4	Yes

48	556729	750888	1037	T9	00:30:00	30:39:00	7:29:32	T6, T7	Yes
49	554540	748329	1042	T1	00:38:00	84:00:00	20:32:00	T1, T2, T3, T4, T5	Yes
50	554522	748671	1042	T3	00:36:00	58:01:00	14:10:55	T1, T2, T3, T4, T5	Yes
51	556103	746936	1053	T1	00:05:00	1:04:00	0:15:39	T1	No
52	555044	751422	1054	T7	00:34:00	21:03:00	5:08:44	T7	Yes
53	556599	747630	1054	T4	00:36:00	36:03:00	8:48:44	T1, T2	Yes
54	554953	751367	1056	T7	00:39:00	36:24:00	8:53:52	T7	Yes
55	555089	746574	1060	T1	00:00:00	0:00:00	0:00:00	N/A	No
56	557933	748868	1062	T8	00:37:00	50:10:00	12:15:47	T4, T5, T8	Yes
57	555163	751490	1062	T7	00:00:00	0:00:00	0:00:00	N/A	No
58	556680	750910	1064	T9	00:32:00	31:38:00	7:43:57	T6, T7	Yes
59	556527	750977	1068	T7	00:36:00	22:49:00	5:34:39	T6, T7	Yes
60	554833	751284	1069	T7	00:38:00	37:32:00	9:10:29	T7	Yes
61	556269	751319	1072	T7	00:38:00	41:10:00	10:03:47	T7	Yes
62	554818	751279	1076	T7	00:37:00	35:10:00	8:35:47	T7	Yes
63	556320	751281	1078	T7	00:37:00	37:10:00	9:05:07	T7	Yes
64	556647	750922	1080	T9	00:33:00	30:48:00	7:31:44	T6, T7	Yes
65	554481	748624	1082	T3	00:35:00	62:46:00	15:20:35	T1, T2, T3, T4, T5	Yes
66	554771	751241	1083	T7	00:37:00	27:05:00	6:37:13	T7	Yes
67	557171	748182	1084	T4	00:36:00	40:38:00	9:55:57	T1, T2, T3, T4	Yes
68	554736	751211	1089	T7	00:36:00	24:03:00	5:52:44	T7	Yes
69	554826	746614	1105	T1	00:00:00	0:00:00	0:00:00	N/A	No
70	555261	751576	1111	T7	00:00:00	0:00:00	0:00:00	N/A	No
71	557312	748286	1111	T8	00:32:00	24:38:00	6:01:17	T2, T3, T4, T5	Yes
72	555149	746510	1113	T1	00:00:00	0:00:00	0:00:00	N/A	No
73	554683	751186	1115	T7	00:35:00	20:55:00	5:06:47	T7	Yes
74	554737	751270	1128	T7	00:35:00	24:44:00	6:02:45	T7	Yes

75	556417	747244	1129	T2	00:33:00	18:38:00	4:33:17	T1	Yes
76	556967	747794	1130	T4	00:26:00	32:40:00	7:59:07	T1, T2, T3	No
77	554429	748634	1134	T3	00:33:00	58:07:00	14:12:23	T1, T2, T3, T4, T5	Yes
78	556559	747410	1136	T2	00:36:00	42:30:00	10:23:20	T1, T2	Yes
79	555488	746493	1137	T1	00:00:00	0:00:00	0:00:00	N/A	No
80	554706	751258	1143	T7	00:35:00	22:19:00	5:27:19	T7	Yes
81	554715	746624	1148	T1	00:00:00	0:00:00	0:00:00	N/A	No
82	556574	747406	1151	T2	00:35:00	42:45:00	10:27:00	T1, T2	Yes
83	554854	746551	1151	T1	00:00:00	0:00:00	0:00:00	N/A	No
84	557952	750022	1151	T9	00:33:00	33:35:00	8:12:33	T5, T8, T9	Yes
85	555293	751628	1153	T7	00:00:00	0:00:00	0:00:00	N/A	No
86	554684	746633	1156	T1	00:00:00	0:00:00	0:00:00	N/A	No
87	554904	746512	1169	T1	00:00:00	0:00:00	0:00:00	N/A	No
88	555242	751634	1172	T7	00:00:00	0:00:00	0:00:00	N/A	No
89	556509	751232	1188	T7	00:33:00	18:26:00	4:30:21	T7	Yes
90	554634	751242	1188	T7	00:33:00	18:23:00	4:29:37	T7	Yes
91	557292	748200	1188	T8	00:32:00	26:02:00	6:21:49	T2, T3, T4	Yes
92	555505	746429	1203	T1	00:00:00	0:00:00	0:00:00	N/A	No
93	555247	751670	1205	T7	00:00:00	0:00:00	0:00:00	N/A	No
94	556693	747503	1207	T2	00:33:00	33:17:00	8:08:09	T1, T2	Yes
95	554534	746675	1209	T1	00:00:00	0:00:00	0:00:00	N/A	No
96	558027	749965	1210	T8	00:31:00	28:18:00	6:55:04	T5, T8, T9	Yes
97	554684	746567	1213	T1	00:00:00	0:00:00	0:00:00	N/A	No
98	554605	751250	1216	T7	00:32:00	17:00:00	4:09:20	T7	Yes
99	554270	746961	1217	T1	00:34:00	27:26:00	6:42:21	T1, T2	Yes
100	554343	748643	1220	T3	00:30:00	48:22:00	11:49:23	T1, T2, T3, T4, T5	Yes
101	556291	746904	1221	T1	00:28:00	17:38:00	4:18:37	T1	No

102	555319	751709	1226	T7	00:00:00	0:00:00	0:00:00	N/A	No
103	555254	751698	1231	T7	00:00:00	0:00:00	0:00:00	N/A	No
104	554415	749581	1239	T6	00:30:00	33:48:00	8:15:44	T2, T3, T4, T5, T6, T7	Yes
105	554455	746694	1247	T1	00:00:00	0:00:00	0:00:00	N/A	No
106	554437	749372	1254	T6	00:30:00	46:12:00	11:17:36	T2, T3, T4, T5, T6	Yes
107	556401	747017	1255	T1	00:32:00	34:05:00	8:19:53	T1	Yes
108	555568	746387	1256	T1	00:00:00	0:00:00	0:00:00	N/A	No
109	554570	751290	1268	T7	00:31:00	15:46:00	3:51:15	T7	Yes
110	554288	748649	1275	T3	00:29:00	43:23:00	10:36:17	T1, T2, T3, T4, T5, T6	No
111	556387	746934	1285	T1	00:32:00	30:32:00	7:27:49	T1	Yes
112	555559	746355	1286	T1	00:00:00	0:00:00	0:00:00	N/A	No
113	554390	749406	1292	T6	00:29:00	41:29:00	10:08:25	T2, T3, T4, T5, T6	No
114	554268	748608	1296	T3	00:28:00	39:09:00	9:34:12	T1, T2, T3, T4, T5, T6	No
115	554355	749558	1301	T6	00:28:00	33:30:00	8:11:20	T2, T3, T5, T6, T7	No
116	556225	751644	1312	T7	00:00:00	0:00:00	0:00:00	N/A	No
117	554481	751253	1318	T7	00:29:00	17:07:00	4:11:03	T6, T7	No
118	554298	750869	1320	T7	00:28:00	17:32:00	4:17:09	T6, T7	No
119	554325	749614	1326	T6	00:27:00	36:25:00	8:54:07	T2, T3, T5, T8, T7	No
120	556600	747138	1335	T2	00:27:00	12:39:00	3:05:32	T1	No
121	556480	746996	1335	T1	00:30:00	23:47:00	5:48:49	T1	Yes
122	556503	747024	1343	T1	00:29:00	19:35:00	4:47:13	T1	No
123	555955	746441	1345	T1	00:00:00	0:00:00	0:00:00	N/A	No
124	555905	746401	1357	T1	00:00:00	0:00:00	0:00:00	N/A	No
125	556655	747166	1358	T2	00:26:00	12:10:00	2:58:27	T1, T2	No
126	555938	746411	1363	T1	00:00:00	0:00:00	0:00:00	N/A	No
127	557582	748117	1368	T8	00:24:00	16:50:00	4:06:53	T2, T4, T5	No
128	556041	746461	1372	T1	00:00:00	0:00:00	0:00:00	N/A	No

129	554217	746762	1375	T1	00:07:00	1:50:00	0:26:53	T1	No
130	556607	747079	1380	T2	00:27:00	13:01:00	3:10:55	T1	No
131	556225	751723	1381	T7	00:00:00	0:00:00	0:00:00	N/A	No
132	556171	751752	1382	T7	00:00:00	0:00:00	0:00:00	N/A	No
133	554442	751310	1383	T7	00:27:00	14:25:00	3:31:27	T6, T7	No
134	554182	748702	1383	T3	00:26:00	40:12:00	9:49:36	T1, T2, T3, T4, T6	No
135	554414	751275	1386	T7	00:28:00	17:24:00	4:15:12	T6, T7	No
136	556641	747106	1387	T2	00:26:00	11:41:00	2:51:21	T1	No
137	555257	751860	1387	T7	00:00:00	0:00:00	0:00:00	N/A	No
138	554171	748614	1393	T3	00:26:00	32:39:00	7:58:52	T1, T2, T3, T4, T6	No
139	556753	747227	1399	T2	00:26:00	25:54:00	6:19:52	T1, T2	No
140	557287	747749	1401	T4	00:20:00	23:30:00	5:44:40	T1, T2, T3, T4	No
141	554383	751263	1405	T7	00:27:00	19:04:00	4:39:39	T6, T7	No
142	558297	748839	1407	T8	00:27:00	26:04:00	6:22:19	T8, T9	No
143	554030	748225	1407	T1	00:26:00	23:18:00	5:41:44	T1, T2, T3	No
144	556075	746432	1415	T1	00:00:00	0:00:00	0:00:00	N/A	No
145	557880	748249	1417	T8	00:18:00	10:31:00	2:34:15	T4, T5	No
146	558399	749246	1417	T8	00:24:00	13:04:00	3:11:39	T8, T9	No
147	554238	749554	1417	T6	00:25:00	25:56:00	6:20:21	T3, T5, T6, T7	No
148	556154	746484	1418	T1	00:00:00	0:00:00	0:00:00	N/A	No
149	554200	750896	1422	T7	00:25:00	14:17:00	3:29:29	T6, T7	No
150	558209	748623	1422	T8	00:27:00	28:37:00	6:59:43	T4, T8	No
151	556807	747263	1424	T2	00:28:00	32:45:00	8:00:20	T1, T2	No
152	558393	749114	1427	T8	00:24:00	14:17:00	3:29:29	T8, T9	No
153	554355	751260	1428	T7	00:26:00	19:46:00	4:49:55	T6, T7	No
154	557991	748328	1432	T8	00:17:00	7:59:00	1:57:05	T4, T5	No
155	558422	749300	1437	T8	00:23:00	12:09:00	2:58:12	T8, T9	No

156	557271	747671	1437	T4	00:20:00	15:56:00	3:53:41	T1, T2, T3, T4	No
157	557735	748119	1440	T8	00:21:00	19:02:00	4:39:09	T4, T5	No
158	555213	751904	1440	T7	00:00:00	0:00:00	0:00:00	N/A	No
159	557293	747687	1444	T4	00:20:00	17:12:00	4:12:16	T1, T2, T3, T4	No
160	554157	746726	1445	T1	00:08:00	2:32:00	0:37:09	T1	No
161	558344	748850	1447	T8	00:25:00	25:31:00	6:14:15	T8, T9	No
162	556235	746512	1447	T1	00:00:00	0:00:00	0:00:00	N/A	No
163	554324	751249	1448	T7	00:25:00	19:48:00	4:50:24	T6, T7	No
164	557321	747712	1451	T4	00:19:00	20:59:00	5:07:45	T1, T2, T3, T4	No
165	556003	746341	1455	T1	00:00:00	0:00:00	0:00:00	N/A	No
166	554206	749481	1458	T6	00:24:00	27:42:00	6:46:16	T2, T3, T5, T6,T7	No
167	554105	748608	1459	T3	00:24:00	31:15:00	7:38:20	T1, T2, T3, T6	No
168	556632	751519	1468	T7	00:26:00	14:06:00	3:26:48	T7	No
169	557981	748268	1469	T8	00:17:00	8:21:00	2:02:28	T4, T5	No
170	557962	748250	1469	T8	00:17:00	8:46:00	2:08:35	T4, T5	No
171	556115	746392	1470	T1	00:00:00	0:00:00	0:00:00	N/A	No
172	558181	748490	1472	T8	00:22:00	16:11:00	3:57:21	T4, T8	No
173	557444	747860	1472	T4	00:27:00	31:01:00	7:34:55	T2, T3, T4	No
174	554166	750956	1472	T7	00:24:00	13:11:00	3:13:21	T6, T7	No
175	557427	747827	1474	T4	00:26:00	33:01:00	8:04:15	T2, T3, T4	No
176	554187	749504	1474	T6	00:24:00	22:42:00	5:32:56	T3, T5, T6, T7	No
177	558204	748515	1476	T8	00:26:00	21:16:00	5:11:55	T4, T8	No
178	558010	748281	1479	T8	00:16:00	7:51:00	1:55:08	T4, T5	No
179	558030	748299	1480	T8	00:16:00	7:33:00	1:50:44	T4, T5	No
180	557449	747849	1481	T4	00:27:00	27:15:00	6:39:40	T2, T4, T5	No
181	557970	748239	1483	T8	00:17:00	8:35:00	2:05:53	T4, T5	No
182	556311	746531	1483	T1	00:00:00	0:00:00	0:00:00	N/A	No

183	558103	748371	1484	T8	00:15:00	3:16:00	0:47:55	T4	No
184	558122	748388	1488	T8	00:15:00	3:08:00	0:45:57	T4	No
185	554304	751293	1488	T7	00:25:00	8:48:00	2:09:04	T7	No
186	558472	749448	1490	T8	00:21:00	10:39:00	2:36:12	T8, T9	No
187	558309	750036	1492	T8	00:24:00	14:44:00	3:36:05	T8, T9	No
188	558481	749294	1496	T8	00:22:00	10:56:00	2:40:21	T8, T9	No
189	558092	748331	1503	T8	00:16:00	3:20:00	0:48:53	T4	No
190	556700	751497	1503	T7	00:25:00	11:09:00	2:43:32	T7	No
191	558169	748421	1503	T8	00:15:00	7:23:00	1:48:17	T4, T8	No
192	557503	747900	1504	T4	00:25:00	18:06:00	4:25:28	T2, T4	No
193	558488	749275	1504	T8	00:21:00	10:50:00	2:38:53	T8, T9	No
194	558192	748444	1508	T8	00:17:00	11:26:00	2:47:41	T4, T8	No
195	556035	746289	1516	T1	00:00:00	0:00:00	0:00:00	N/A	No
196	557530	747926	1517	T4	00:25:00	16:17:00	3:58:49	T2, T4	No
197	556094	746312	1526	T1	00:00:00	0:00:00	0:00:00	N/A	No
198	557773	748038	1529	T8	00:21:00	14:06:00	3:26:48	T4, T5	No
199	554123	749510	1537	T6	00:22:00	22:31:00	5:30:15	T3, T6, T7	No
200	557745	748012	1537	T8	00:21:00	11:46:00	2:52:35	T4, T5	No
201	558251	748458	1547	T8	00:23:00	14:42:00	3:35:36	T8	No
202	554011	748659	1553	T3	00:22:00	31:38:00	7:43:57	T1, T2, T3, T6	No
203	555993	746222	1556	T1	00:00:00	0:00:00	0:00:00	N/A	No
204	557647	747939	1557	T8	00:23:00	11:56:00	2:55:01	T2, T4	No
205	554272	751380	1562	T7	00:24:00	8:14:00	2:00:45	T7	No
206	553906	746898	1564	T1	00:25:00	15:07:00	3:41:43	T1	No
207	555127	752011	1567	T7	00:00:00	0:00:00	0:00:00	N/A	No
208	557619	747913	1569	T8	00:23:00	13:03:00	3:11:24	T2, T4	No
209	556425	746519	1572	T1	00:00:00	0:00:00	0:00:00	N/A	No

210	553983	748663	1581	T3	00:22:00	28:45:00	7:01:40	T1, T2, T3, T6	No
211	557600	747890	1582	T8	00:23:00	13:53:00	3:23:37	T2, T4	No
212	553989	746717	1586	T1	00:22:00	13:26:00	3:17:01	T1	No
213	554079	749435	1591	T6	00:21:00	17:44:00	4:20:05	T3, T6, T7	No
214	553931	748436	1595	T1	00:23:00	17:26:00	4:15:41	T1, T2, T3	No
215	554744	746117	1595	T1	00:00:00	0:00:00	0:00:00	N/A	No
216	553942	746764	1599	T1	00:25:00	20:49:00	5:05:19	T1	No
217	558277	748403	1600	T8	00:18:00	10:09:00	2:28:52	T8	No
218	554039	749486	1623	T6	00:21:00	22:33:00	5:30:44	T3, T6, T7	No

5.9.2 Cumulative Shadow Flicker

There are no proposed, permitted, or operational wind farms within 5km of the Proposed Wind Farm site. The nearest turbine is over 7.8km to the west (Cloonlusk Wind Farm). Due to the separation distance between the proposed turbines and all surrounding proposed, permitted, or operational wind farms (i.e., when applying a 10 times rotor diameter study area to all other wind farms within 10km, the respective study areas do not overlap with the Study Area), there is no potential cumulative shadow flicker effects.

5.10 Likely Significant Effects and Associated Mitigation Measures

The below assessment evaluates the impact (where there is the potential for an impact to occur) on population, employment levels, land-use, tourism, residential amenity and human health during the construction, operation and decommissioning phases, as a result of the Proposed Project.

5.10.1 'Do-Nothing' Scenario

If the Proposed Project 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 Project would not occur.

If the Proposed Project were not to proceed, the opportunity to capture part of Galway'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.

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5.10.2 Construction Phase

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

5.10.2.1 Health and Safety

Construction of the Proposed Project will necessitate the presence of a construction site and travel on the local public road network to and from the 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.

Proposed Mitigation Measures

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

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2016 (S.I. No. 36 of 2016);
- S.I. No. 528/2021 - Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021 and
- Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

The mitigation measures presented below are also detailed in the Construction and Environment Management Plan (CEMP) (Appendix 4-5). Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of measures.

A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project. Safepass registration cards are required for all construction, delivery, and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The developer is required to ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety and Health Plan. Public safety will be addressed by restricting site access during construction. Fencing will be erected in areas of the site where uncontrolled access is not permitted.

Appropriate warning signs will be posted, directing all visitors to the site manager. Appropriate warning measures including 'goalposts' will be used as appropriate to prevent contact with any overhead lines that traverse the construction site.

The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006*'.

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 Effect

With the implementation of the above, there will be a short-term potential slight negative residual effect on health and safety during the construction phase of the Proposed Project.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.10.2.2 Population

Those working on the construction phase of the Proposed Project will travel daily to the Site from the wider area. The construction phase will have no effect on the population of the area in terms of changes to the population trends or density, household size or age structure.

Proposed Mitigation Measures

No mitigation required.

Residual Effects

No residual effects.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.10.2.2.2 *Employment and Investment*

Proposed Wind Farm

The design, construction, operation and decommissioning of the Proposed Wind Farm will provide employment for technical consultants, contractors and maintenance staff. As discussed, it is proposed to

construct the wind farm and grid connection concurrently which would require approximately 100 employees in total, with an estimated 80 jobs focussing on the construction phase of the Proposed Wind Farm. The construction phase of the wind farm will last between 18- 24 months and the decommissioning phase will likely last approximately 6-9 months.

The Proposed Wind Farm 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 moderate positive indirect effect. The Irish Wind Energy Association estimates that there are over 5,500 people employed in roles related to wind energy in Ireland in 2020. This figure is anticipated to grow significantly in the coming years.

Proposed Grid Connection

The design, construction and operation of the Proposed Grid Connection will provide employment for technical consultants, contractors and maintenance staff. As discussed, it is proposed to construct the wind farm and grid connection concurrently which would require approximately 100 employees in total, with an estimated 20 jobs focusing on the construction phase of the Proposed Grid Connection. Construction of the Grid Connection infrastructure is estimated to last approximately 9 months of the overall 18-24 month construction timeframe.

Proposed Mitigation Measures

No mitigation required.

Residual Effects

The injection of money in the form of salaries and wages to those employed during the construction phase of the Proposed Project has the potential to result in an increase in household spending and demand for goods and services in the local area. This would result in local retailers and businesses experiencing a short-term positive effect on their cash flow. This will have a short-term slight positive indirect effect.

Significance of Effects

The significance of effects on employment levels and local investment during the construction phase will be slight.

5.10.2.2.3 *Land Use Patterns & Activities*

Pre-Mitigation Impacts

Proposed Wind Farm

Current land use within the Proposed Wind Farm predominately comprises agricultural with some adjacent areas in the north occupied by active raised blanket bog. Land-use in the wider landscape comprises a mix of pastoral agriculture, peat bogs and low density residential.

There is no potential for impact on residential and commercial land use in the area surrounding the Proposed Wind Farm. During the construction phase there may be slight interference with agricultural practices where farm practises may be redirected to other fields temporarily.

Proposed Grid Connection

The current land use and activities at the Proposed Grid Connection footprint comprises pastoral agriculture and transport/access along the local road network. Grazing stock at the substation, compound and end mast footprint will temporarily be relocated during the construction phase and local temporary traffic disruptions are likely along the R332 and L6301; however, once the construction of each element is complete, agricultural practises can return in the areas surrounding the onsite infrastructure and traffic flow will resume as normal.

The existing land-use of road networks will continue on the Proposed Grid Connection. There will be no change to existing land-uses in the wider area as a result of the Proposed Grid Connection.

Proposed Mitigation Measures

The following measures will be adhered for the Proposed Project. Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of measures.

- The construction of the Proposed Grid Connection through the public road network will be undertaken in a rolling construction method with 100m of road constructed and back filled each day providing access in the evenings and night hours along the Proposed Grid Connection.
- A Traffic Management Plan, agreed with the Local Authority, will be in place for the construction phase of the grid route.
- Local access for residents living along the grid route will not be closed for the construction phase as there are alternative access roads into the area.
- Farm access into the Proposed Wind Farm site will be permitted as and when required.

Residual Effects

Due to the small footprint of the above ground elements of the Proposed Project 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 Project Infrastructure is not significant.

5.10.2.2.4 *Property Values*

As noted in Section 5.6 above, the conclusions from available international literature indicate that during the construction phase there is potential for a short-term slight negative impact on property values, suggesting that property values react negatively to the expectation of likely impacts and construction of a wind farm.

Proposed Mitigation Measures

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

Residual Effect

Following the implementation of the above mitigation measures, there will be a short-term negative imperceptible effect from the construction phase of the Proposed Project on property values.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.10.2.2.5 *Tourism*

Pre-Mitigation Impacts

Proposed Wind Farm

Given that there are currently no tourism attractions specifically pertaining to the Proposed Wind Farm site there are no impacts on tourism associated with the construction phase of the Proposed Wind Farm site.

The Proposed Wind Farm site has some rural aesthetic qualities given the relative lack of buildings and infrastructure present on the Site. The Proposed Wind Farm site consists of undulating hills of agricultural farmland fields and small pockets of peatlands defined by vegetated field boundaries; however, these views are common throughout the local area and due to the Proposed Wind Farm site intensive agricultural land-use, it is noted that the landscape has been subject to substantial levels of human interference and modification. Views from within the Proposed Wind Farm site are generally contained given the surrounding landscape and the treelines and hedgerows present on Site. With regard to tourist attractions and amenity use surrounding the Proposed Wind Farm site, described in Section 5.3.9, traffic management safety measures will be in place, where required. Please see below for Traffic impact mitigation measures and Chapter 15 Material Assets.

Proposed Grid Connection

Given that there are currently no tourism attractions specifically pertaining to the Site there are no impacts on tourism associated with the construction phase of the Proposed Grid Connection. Furthermore, these proposed structures are located on private property therefore no entrance to tourists is currently or will be permitted. There are no tourist attractions located along the Proposed Grid Connection underground cabling route. The Proposed Grid Connection underground cabling route is located within the public road network for the majority of its length, however, tourists seeking to travel to various attractions in the wider landscape during the construction phase, can utilise other routes and therefore will not be significantly impacted by the rolling construction phase of the underground cabling route on the local road network, the N63, R332, R347, L2125, L2114, L2115 and L2128. However, should tourists want to utilise portions of any of these roads, the laying of cables will be carried out in a rolling nature at an average rate of 100m to 200m of cabling being installed at any one time. The location of the construction works will be transient in nature with the extent of the section of road closed kept to a minimum.

Mitigation Measures

No mitigation required.

Residual Effects

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 Project.

Significance of Effects

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

5.10.2.2.6 *Residential Amenity*

Pre-Mitigation Impacts

Proposed Wind Farm

The potential for impacts on residential amenity are discussed in Section 5.3.14 above. There is the potential for impacts on residential amenity during the construction phase of the Proposed Wind Farm due to air, traffic, noise and vibration emissions due to additional traffic and plant machinery.

Proposed Grid Connection

There is potential for impacts on residential amenity dur the construction of the Proposed Grid Connection. The Proposed Grid Connection underground cabling route will be located within c.18km of National, Regional and Local roads which has the potential to give rise to local traffic disruptions.

Proposed Mitigation Measures

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

Residual Effect

Based on the above, it is concluded that air, traffic, noise and vibrations emissions will result in a short-term, slight, negative residual effect on residential amenity due to the construction phase of the Proposed Project.

Significance of Effects

The effect on residential amenity due to construction phase the Proposed Project is Not Significant.

5.10.2.2.7 *Air Quality: Dust, NO_2, PM_{10} and PM_{25} and Co2 Emissions*

Pre-Mitigation Impacts

Proposed Wind Farm

Potential dust and exhaust emission sources during the construction phase of the Proposed Wind Farm include upgrading of existing access tracks and construction of new access roads, turbine and meteorological mast foundations, temporary construction compound. The construction of the spoil management areas will require the use of construction machinery and plant, thereby giving rise to dust and exhaust emissions.

An increase in dust and exhaust emissions has the potential to cause a nuisance to Sensitive Receptors in the immediate vicinity of the Proposed Wind Farm site. The entry and exit of construction vehicles from the Proposed Wind Farm site may result in the transfer of mud to the public road, particularly if

the weather is wet. This may cause nuisance to residents and other road users. These impacts 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 Wind Farm are further described in Chapter 10: Air Quality.

Proposed Grid Connection

Potential dust and exhaust emission sources during the construction phase of the Proposed Grid Connection include upgrading of existing access tracks and construction of the onsite 110kV substation, battery storage compound and the laying of approximately 20.9km of underground electrical cabling and the road upgrade works which are associated with this process. The entry and exit of construction vehicles from along the R332 and L6301 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. These impacts 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 Wind Farm are further described in Chapter 10: Air Quality.

Proposed Mitigation Measures

The majority of aggregate material for the construction of roads and turbine bases will be sourced from local quarries. Construction materials will be delivered to the Site via selected haul routes that will be determined based on the source of the construction material. In order to facilitate the construction of the Proposed Project, all crushed stone, hardcore materials and ready-mix concrete that will be required during the construction phase will be sourced from local, appropriately authorised quarries. For the purposes of assessment within the EIAR, quarries within a 20km range of the Proposed Wind Farm site that could potentially provide stone and concrete have been assessed and are illustrated on Figure 4-32. Truck wheels will be washed to remove mud and dirt before leaving. All plant and materials vehicles shall be stored in the compound area or other dedicated areas. Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. Construction traffic will be restricted to defined routes and a speed limit will be implemented.

The active construction area along the Proposed Grid Connection Rute will be small, ranging from 100-150m in length at any one time. Should separate crews be used during the construction phase they will generally be separated by 1-2km. All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise. Aggregate materials for the construction of the cabling route will be sourced locally to reduce the amount of emissions associated with vehicle movements. Potential dust emissions during the construction period will not be significant and will be relatively short-term in duration.

All mitigation as outlined in Chapter 10 Air Quality will be implemented in order to reduce insofar as possible, impacts on air quality in the vicinity of Proposed Project construction works.

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

Residual Effects

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

Significance of Effects

The effects on air quality from exhaust emissions during the construction phase of the Proposed Project are considered to be imperceptible.

5.10.2.2.8 Water Quality

Pre-Mitigation Impacts

Proposed Wind Farm

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. The Mid-Galway Public Water Scheme and Source Protection Area intersects the south of the Proposed Site. The GSI map several additional private boreholes and wells in the vicinity of the Proposed Wind Farm. Chapter 9 Hydrology and Hydrogeology assess the potential for impact on public water supply and private wells during the construction phase. The pre-mitigation impact on water quality is assessed as Indirect, negative, moderate, temporary, likely effect.

Proposed Grid Connection

The Mid-Galway Public Water Scheme and Source Protection Area intersects the Proposed Grid Connection Route in the townland of Slievegorm. The majority of the Proposed Grid Connection cable is within the carriageway of public roads and due to the shallow nature of the trench excavation, effects on groundwater quality/flows is not expected. Chapter 9 Hydrology and Hydrogeology assess the potential for impact on public water supply and private wells during the construction phase. The pre-mitigation impact on water quality is assessed as Indirect, negative, moderate, temporary, likely effect.

Proposed Mitigation Measures

A bespoke drainage design which includes but is not limited to interceptor drains, check dams, swales and ponds, will be implemented at the Site.

Chapter 9 details all best practise and mitigation measures to minimise the potential for entrainment of suspended sediment ss or potential hydrocarbon leak. Please see Chapter 9 for details and Chapter 18 for a full list of Mitigation and Monitoring measures for the Proposed Project.

Residual Effects

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

Significance of Effects

The effects on water quality during the construction phase of the Proposed Project are considered to be imperceptible.

5.10.2.2.9 Noise and Vibration

Proposed Wind Farm

Pre-Mitigation Impacts

There will be an increase in noise levels in the vicinity of the Proposed Wind Farm 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 the Proposed Wind Farm site. This will be a short-term, very low sensitivity and low magnitude of change human health. 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 one to two days however, and the main concrete pours are usually conducted in one continuous pour, which is done within a matter of hours.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the Proposed Wind Farm are further described in Chapter 12: Noise and Vibration.

Proposed Grid Connection

There will be an increase in noise levels in the vicinity of the Proposed Grid Connection 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 the Proposed Grid Connection works. This will be a short-term, very low sensitivity and low magnitude of change on human health due to increased noise levels from construction. The noisiest construction activities associated with the construction activities are excavation and concrete pouring of the substation and end mast foundations.

Proposed Mitigation Measures

Best practice measures for noise control will be adhered to on Site during the construction phase of the Proposed Project to impacts associated with this phase of the development. Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of measures.

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use;
- All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines will be shut down between work periods (or when not in use) or throttled down to a minimum;
- Regularly maintain all equipment used onsite, including maintenance related to noise emissions;
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures will be provided.

Residual Effects

Predicted construction noise and vibration levels are below the assessment criteria at all receptors, for all phases of construction. Due to the low background noise levels at some locations, elements of construction noise could be audible at the closest residential receptor for certain periods during the construction phases. However, with or without the good practice construction mitigation measures outlined above there would be **no significant residual effects**.

Significance of Effects

For the reasons outlined above, no significant noise and vibration effects are anticipated for the construction and decommissioning phases. Good practice during construction and decommissioning is recommended to minimise any potential noise impacts.

5.10.2.2.10 *Traffic and Transport*

Pre-Mitigation Impacts

Proposed Wind Farm

During the 9 days when the concrete foundations are poured, the effect on the surrounding road network will be that an additional 584 PCUs will travel to/from the Proposed Wind Farm site. On the delivery route it is forecast that the increase in traffic volumes on these days will range from between +6.5% and +11.8% on the N63 (Links 1 to 3). On the R322 leading to the Proposed Wind Farm site (Link 4) where background traffic flows are lower, it is forecast that traffic flows will increase by 30.4%. On these busiest 9 days it is estimated that this will have a temporary, negative and slight effect on the N63 and R332. No Significant effects are forecast.
During the remaining 314 days when the construction of the Proposed Wind Farm continues, including the site preparation and groundworks and construction of the , an additional 411 PCUS will travel to and from the Site. It is forecast that the increase in traffic volumes on these days will be between +4.6% and 8.3% on the N63 (Links 1 to 3). On the L58333 leading to the Proposed Wind Farm site (Link 4) it is forecast that traffic flows will increase by 21%. On these 341 days it is estimated that this will have a temporary, negative and slight effect on the N63 and R332 leading to the Proposed Wind Farm site. No Significant effects are forecast.

During the 24 days / nights that the abnormal loads carrying the large turbine components travel to the Proposed Wind Farm site, an additional 105 PCUs will travel to/from the Proposed Project. It is forecast that the increase in traffic volumes on these days will be between +1.2% and 2.1% on the N63 (Links 1 to 3), while on the R322 leading to the Proposed Wind Farm site (Link 4) it is forecast that traffic flows will increase by 5.5% on these 24 days / nights. It is forecast that there will be a temporary, slight negative effect on the TDR as the delivery of the abnormally sized loads is undertaken at night. No Significant effects are forecast.

For 9 days an additional 64 PCUs will travel to/from the Proposed Wind Farm site delivering smaller component parts using standard HGVs, it is forecast that the increase in traffic volumes on these days will range 0.7% and +1.3% on the N63 (Links 1 to 3). On the R322 leading to the site (Link 4) it is forecast that traffic flows will increase by 3.3%. On these 9 days it is considered that the additional traffic will have a temporary imperceptible negative effect on the N63, and a temporary slight negative effect on the R339 leading to the site. No Significant effects are forecast

Proposed Grid Connection

With respect to the traffic volumes that will be generated during the construction of the underground electrical cabling route, it is estimated that there will be approximately 30 daily return trips made by trucks removing spoil and transporting materials to the site, and 4 return trips made by a car to transport construction staff, to and from the Site. By its nature the effect impacts of these additional trips on the network will be transient and will therefore be temporary and slight.

By its nature the effects of these additional trips and diversions on the network will be transient, will be temporary and will be slight.

Mitigation and Monitoring Measures

The successful completion of the Proposed Project will require significant coordination and planning and a comprehensive set of mitigation measures will be put in place before and during the construction stage in order minimize the effects of the additional traffic generated by the Proposed Project. A detailed **Traffic Management Plan (TMP)**, incorporating all the mitigation measures included as Appendix 15-2 of this EIAR, will be finalised and confirmatory detailed provisions in respect of traffic management agreed with the road's authority and An Garda Síochána prior to construction works commencing on Site. In addition, the traffic management measures proposed for the following construction traffic scenarios are set out for the grid connection in Appendix 15-2: Traffic Management Plan for Cooloo Wind Farm Development;

- Delivery of Abnormally sized loads,
- Management of Standard HGVs on R332 leading to site,
- Traffic management measures during construction of cable grid connection

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

Residual Effects

During the 18 month construction stage of the Proposed Project, it is forecast that the additional traffic that will travel on the public road network serving the Site will have a short-term slight negative effect on existing road users on the delivery route. While the severity of the traffic effects relates to the additional volumes of traffic movements generated during the construction of the Proposed Project, the implementation of the mitigation measures included in the proposed traffic management plan will ensure a controlled and efficient operation during this stage, and minimise the impacts on local road users.

Significance of Effects

Based on the assessment above, the effects on traffic from the Proposed Project during construction will be Not Significant.

5.10.2.2.11 *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 Wind Farm. Eight risks (Critical Infrastructure Emergencies, Severe Weather, Flooding, Utility Emergencies, Traffic Incident, Contamination, Fire/Gas Explosion and Collapse / Damage to structures) specific to the construction phase have been identified and are presented in Chapter 16 Major Accidents and Natural Disasters. As outlined in Section 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 construction is identified as 'Contamination' of the Site and risk of 'Fire/Explosion' during construction.

Proposed Mitigation Measures

- The Proposed Project is designed and will be constructed in line with current best practice and, as such, mitigation against the risk of major accidents and/or disasters will be embedded through the design. In accordance with the provision of the European Commission '*Guidance on the preparation of Environmental Impact Assessment Reports'* 2017, a Risk Management Plan will be prepared and implemented on site to ensure an effective response to disasters or the risk of

accidents. The plan will include sufficient preparedness and emergency planning measures.

- Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures which details all proposed mitigation and monitoring measures for the construction, operation and decommissioning of the Proposed Project.
- Potential effects associated with contamination during construction, operation and decommissioning are addressed fully in Chapter 8 Land Soil and Geology and Chapter 9 Hydrology and Hydrogeology of this EIAR. The mitigation measures outlined therein to protect environmental receptors as well as the procedures and measures described in the Construction and Environmental Management Plan (CEMP) will ensure that the risk from these sources is low.
- A CEMP has been prepared for the Proposed Project and is included in Appendix 4-5 of this EIAR. Upon a grant of planning permission for the Proposed Project, the CEMP will be updated prior to the commencement of the development. The CEMP will be a live document maintained by the contractor that will work to ensure that potential risks of major accident and/or disaster are identified, avoided and mitigated, as necessary. Refer to Appendix 4-5 for the CEMP that sets out the minimum standards to be employed by the contractor.

Residual Effects

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

Significance of Effects

Based on the above and the risk assessment in Chapter 16, the effects to/from Major Accidents and Natural Disasters during the construction phase of the Proposed Project are not significant.

5.10.2.2.12 *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 is therefore no shadow flicker impacts associated with the construction phase of the Proposed Wind Farm or the construction or operational phase of the Proposed Grid Connection.

5.10.3 Operational Phase

5.10.3.1 Population

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

5.10.3.1.1 *Population Levels*

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

Mitigation and Monitoring Measures

No mitigation required.

Residual Effects

No residual effects.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.10.3.1.2 *Employment and Investment*

Pre-Mitigation Impacts

Proposed Wind Farm

The operational phase of the Proposed Wind Farm will present an opportunity for mechanical, civil, and electrical contractors and craftspeople to become involved with the maintenance and operation of the wind farm. On a long-term scale, the Proposed Wind Farm will create approximately 2-3 jobs involving during the operational phase relating to the maintenance and control of the wind farm, having a long-term slight positive effect.

The injection of money in the form of rental income to the landowners who are participating in the Proposed Wind Farm 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.

Rates payments for the Proposed Wind Farm will contribute significant funds to Galway County Council, which will be redirected to the provision of public services within Co. Galway. 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.

Based on the current Renewable Energy Support Scheme (RESS) guidelines it is expected that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the first 15 years of operation of the Proposed Project. If this commitment is changed in upcoming Government Policy, the fund would be adjusted accordingly.

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about, significant, positive change in the local area. To make this happen, the first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. The group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund.

Should the Proposed Project be developed under RESS, it would attract a community contribution in the region of approx. €300,000/year for 15 years for the local community. The value of this fund would be directly proportional to the electricity generated by the wind farm. The number and size of grant allocations will be decided by a Community Fund liaison committee with various groups and projects benefiting to varying degrees depending on their funding requirement. Should the Proposed Project not be developed under RESS, the Applicant still commits to the contributions above. Should RESS not be developed, applicant still commits to the above.

Commercial rates from the wind farm will contribute significant funds to the Galway County Council to support the provision of public services within this county. These services include road maintenance, fire services, environmental protection, street lighting, footpath maintenance, etc. along with other community and cultural support initiatives. This will have a long-term slight positive direct impact.

Proposed Grid Connection

During the operational phase, the proposed onsite 110kV substation will be under the operation of Eirgrid where representatives will be required to undertake maintenance visits. This will have a long-term imperceptible positive effect on employment. Payment of commercial rates by the Developer to the local authorities will have a long-term benefit for the local area during the operational phase due to the reinvestment of these funds into local projects e.g., road maintenance, green spaces etc.

As mentioned above in relation to the Proposed Wind Farm, the Proposed Grid Connection indirectly facilitates the Community Benefit Fund intended for the local community.

Mitigation Measures

No mitigation required.

Residual Effects

With the implementation of the above schemes, there will be a long-term positive effect on local communities.

Significance of Effects

Based on the assessment above there will be significant direct and indirect effect on local communities from investment during the operational phase. The effects on employment levels during the operational phase will be not significant.

5.10.3.1.3 *Land use Patterns and Activities*

Pre-Mitigation Impacts

Proposed Wind Farm

The footprint of the Proposed Wind Farm will occupy only a small percentage of the Site; 3% or 10.6ha of an overall 355ha Site. Farming and forestry practices will not be impacted during the operational phase.

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 Wind Farm will not impact significantly on other land-uses within the Site and the wider area.

Proposed Grid Connection

The Proposed Grid Connection's footprint is limited to a small percentage of the Site. During the operational phase, farming practises will resume around the substation and battery storage compound and traffic movements on the Proposed Grid Connection underground cabling route will resume as normal. The small scale of the substation and end mats relative to the Site and Population Study Area, its ability to coexist with ongoing Site activities and activities within the landscape indicate that the Proposed Grid Connection infrastructure will have no significant impact on other land-uses within the Site and the wider area.

Mitigation Measures

No mitigation required.

Residual Effects

Due to the small footprint of the Proposed Project and even more so on a local scale, the residual effect is considered Negative, direct, slight, permanent impact 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 Project will be Not Significant.

5.10.3.1.4 *Property Values*

Pre-Mitigation Impacts

Proposed Wind Farm

As noted in Section 5.6 the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses.

Proposed Grid Connection

As noted in Section 5.6 the conclusions from available international literature indicate that property values are not significantly impacted by the positioning of grid infrastructure.

Mitigation Measures

No mitigation required.

Residual Effects

It is on this basis that it can be reasonably concluded that there would be a long-term imperceptible effect from the Proposed Project.

Significance of Effects

No significance of effects.

5.10.3.1.5 *Tourism*

Pre-Mitigation Impacts

Proposed Wind Farm

There are no tourism attractions within or adjacent to the Site that could be impacted by the operation of the Proposed Wind Farm. The nearest tourist attraction is Knock Abbey ruins. As outlined in Chapter 13. the Knock Abbey ruins is recognised as a tourist Amenity Area in County Galway. There will be an effect on the setting and character of this landscape receptor.

Proposed Grid Connection

There are no tourist attractions within the vicinity of the Proposed Grid Connection. It is considered that the substation, will be read in the landscape as an ancillary part of the wind farm development and

therefore will not deter visitors to tourist attractions or scenic landscapes where turbines are visually evident. The end masts will blend in with adjacent existing 110kV masts, therefore no new land use is introduced. The grid connection cable route will be contained underground As such, the Proposed Grid Connection it will have no operational impact on tourism.

Mitigation Measures

No mitigation required.

Residual Effects

Based on the literature review in Section 5.4, the majority of studies indicate that wind farm developments do not deter visitors to tourist attractions or scenic landscapes where turbines are visually evident. As such, it is considered that the Proposed Project will have a long-term imperceptible negative impact of visitor experience to attractions in the wider landscape.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.10.3.1.6 *Residential Amenity*

Pre-Mitigation Impacts

Proposed Wind Farm

Potential impacts on residential amenity during the operational phase of the Proposed Wind Farm could arise primarily due to noise, shadow flicker or changes to visual amenity. Detailed noise and shadow flicker modelling have been carried out as part of this EIAR, which shows that the Proposed Wind Farm will be capable of meeting all required guideline limits in relation to noise and the shadow flicker set out in the 2006 DoEHLG Guidelines or 2019 draft DoEHLG Guidelines if adopted. The noise and vibration assessment is detailed in Chapter 12. It should be noted that the Proposed Wind Farm will be brought in line with the noise thresholds imposed on the development by the consenting authority should the application be granted. The visual impact of the Proposed Wind Farm is addressed in Chapter 14: Landscape and Visual. The turbine locations have been designed to maximise turbine separation distances to dwellings in the area, with no turbines located within 740 metres of non-involved Sensitive Receptors, achieving the recommended four times turbine setback for visual amenity purposes.

Proposed Grid Connection

The Proposed Grid Connection electrical cabling route is located underground; therefore, no residential amenity effects are deemed to arise from this element.

Mitigation and Monitoring Measures

- There are no turbines proposed within 740m (4 x tip height) of any non-involved Sensitive Receptors. As detailed above, the closest proposed turbine (T03) is 741m from the nearest non-involved Sensitive Receptor.
- All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and shadow flicker in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the Proposed Project works, including along the proposed turbine and construction materials haul route and the Proposed Grid Connection.

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

Residual Effects

The residual effect is considered to be a negative, moderate, and long-term on residential amenity.

Significance of Effects

Based on the assessment above the effects on residential amenity during the operational life of the Proposed Project will be Not Significant.

5.10.3.2 Health

5.10.3.2.1 *Health and Safety*

Pre-Mitigation Impact

Proposed Wind Farm

Rigorous safety checks are conducted on the turbines and ancillary infrastructure during design, construction, commissioning and operation to ensure there are no health and safety risks posed to staff and landowners. This will have a potential long-term, slight impact on health and safety during the operation phase.

Proposed Grid Connection

Rigorous safety checks and continued maintenance are conducted along the 110kV underground cabling connection and all ancillary works during design, construction, commissioning and operation to ensure the risks posed to staff and landowners are negligible. This will have a potential long-term, slight impact on health and safety during the operational phase. The high voltage cable within the public road corridor is the main risk posed to staff. Any waste generated at the Proposed Grid Connection 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 Project to ensure that the risks posed to staff and landowners remain negligible throughout the operational life of the wind farm.

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.

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 Effects

With the implementation of the above mitigation measures, there will be a long-term, negligible Residual Effects on health and safety during the operational life of the Proposed Project.

Significance of Effects

Based on the assessment above there will be negligible significant of effects on health and safety during the operational life of the Project.

5.10.3.2.2 *Noise and Vibration*

Pre-Mitigation Impact

Proposed Wind Farm

The predicted Proposed Wind Farm operational noise levels at all NALs lie below the daytime and night time Site-Specific Noise Limits. In addition, the cumulative noise predictions from the Proposed Wind Farm and other operational and consented wind farms lie below the Total 2006 Guidelines Noise Limits. Whilst it is not possible to predict if OAM will occur, potential mitigation measures to reduce OAM have been identified in Section 12.7.2 above. The detail of the appropriate mitigation to be adopted will be determined once the wind farm is operational if and when OAM were to occur, following on-site noise measurements and assessments triggered by a complaint investigation. There would be no significant residual effects.

At some locations, under some wind conditions, and for a certain proportion of the time, operational noise from the Proposed Wind Farm would be audible; however, it would be at an acceptable level in relation to the 2006 Guidelines and as such, regardless of which turbine dimensions are selected within the proposed range, there would be no significant residual effects from operational wind turbine noise.

Proposed Grid Connection

Following installation of an acoustic fence for the Proposed BESS, a reduction in predicted noise immission levels would be seen at the most sensitive northwestern NSRs proximate to the site and would aid in keeping the magnitude of impacts minor at these locations. There would be no significant residual effects from operational BESS noise.

Mitigation and Monitoring

Please see Chapter 12 Section 12.7 for noise and vibration mitigation and monitoring proposed for the Proposed Project. Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of mitigation and monitoring measures for the proposed for the Proposed Project.

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 and Vibration for details.

Significance of Effects

As stated in the noise assessment in Chapter 12, 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, NO_2, PM_{10} and PM_{25} and CO2 Emissions*

Pre-Mitigation Impact

Proposed Wind Farm

The Proposed Wind Farm will require daily visits of maintenance staff in LGVs and the infrequent generation of small volumes of hydrocarbon waste. The Proposed Wind Farm will generate electricity from a renewable source, contributing to a positive impact on air quality. Over the envisaged 35-year lifespan of the Proposed Wind Farm 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.

Proposed Grid Connection

The sources of dust and other emissions generated during the operational phase will be from infrequent visits by Eirgrid maintenance to the 110kV on Site substation staff in light good vehicles (LGVs) approximately one or two visits per day, and private LGVs. Maintenance of the substation infrastructure may, on occasion, generate of small volumes of hydrocarbon waste. Any waste generated at the Site will be managed in accordance the Waste Management Act 1996 and under the relevant EU legislation. This will have a potential long-term, imperceptible impact on health during the operation phase.

Mitigation Measures

Please see Chapter 10 Section 10.3 for air quality mitigation and monitoring proposed for the Proposed Project. Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of mitigation and monitoring measures for the proposed for the Proposed Project.

Residual Effects

Impacts from dust and other emissions to air from the maintenance of the Proposed Project on Sensitive Receptors during the operational phase of the Proposed Project is considered to be a brief and imperceptible effect. Overall, considering offsetting of dust and greenhouse gas emissions from fossil fuels as a result of the Proposed Project, 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 Project is considered have no significant effects on air quality.

5.10.3.2.4 *Water Quality*

Pre-Mitigation Impact

Proposed Wind Farm

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.

Proposed Grid Connection

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. 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 and 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. Please see Chapter 9 for details. The full list of mitigation and monitoring measures for the Proposed Project are detailed in Chapter 18.

Settlement ponds, checks dams and buffered outfalls will prevent roads acting as preferential flowpaths by providing attenuation and water quality treatment.

Residual Effects

With the implementation of the Proposed Wind Farm 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 water quality will be Not Significant.

5.10.3.2.5 Traffic and Transport

Pre-Mitigation Impact

The impacts on the surrounding local highway network will be negligible given that there will only be an average of 3 trips made to and from the Proposed Wind Farm site by car or light goods vehicle per day, with none required for the Proposed Grid Connection underground electrical cabling route.

Residual Effects

The effects of the maintenance traffic on the surrounding highway network will therefore be imperceptible.

Significance of Effects

Based on the assessment above the effects on traffic will be Not Significant.

5.10.3.2.6 Major Accidents and Natural Disasters

Pre-Mitigation Impacts

Proposed Wind Farm

A risk register has been developed which contains all potentially relevant risks identified during the operational phase of the Proposed Wind Farm. 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 and Natural Disasters. As outlined in Section 16.4.1, the scenarios with the highest risk score in terms of the occurrence of major accident and/or disaster during operation are identified as 'Contamination' and 'Fire/Explosion' during operation.

Proposed Grid Connection

A risk register has been developed which contains all potentially relevant risks identified during the operational phase of the Proposed Grid Connection. 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 and Natural Disasters. The risk register concludes that there is low potential for significant natural disasters to occur at the Proposed Grid Connection. 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 'Contamination' and 'Fire/Explosion' during operation.

Mitigation Measures

- The Proposed Project is designed and will be operated 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.

- Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures which details all proposed mitigation and monitoring measures for the construction, operation and decommissioning of the Proposed Project.
- Potential effects associated with contamination during construction, operation and decommissioning are addressed fully in Chapter 8 Land Soil and Geology and Chapter 9 Hydrology and Hydrogeology of this EIAR. The mitigation measures outlined therein to protect environmental receptors as well as the procedures and measures described in the Construction and Environmental Management Plan (CEMP) will ensure that the risk from these sources is low.
- A CEMP has been prepared for the Proposed Project and is included in Appendix 4-5 of this EIAR. Upon a grant of planning permission for the Proposed Project, the CEMP will be updated prior to the commencement of the development. The CEMP will be a live document maintained by the contractor that will work to ensure that potential risks of major accident and/or disaster are identified, avoided and mitigated, as necessary. Refer to Appendix 4-5 for the CEMP that sets out the minimum standards to be employed by the contractor.

Residual Effects

The impact assessment concludes that the risk of a major accident and/or disaster during the operational phase of the Proposed Project 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, the effects to/from Major Accidents and Natural Disasters during the operational phase of the Proposed Project are not significant.

5.10.3.2.7 Shadow Flicker

Pre-Mitigation Impacts

Of the 218 No. properties modelled; it is predicted that of 76 Sensitive Receptors may experience shadow flicker that exceed the limits identified in the DoEHLG, 2006 Guidelines. However, this prediction does not consider wind direction or screening provided by intervening vegetation and topography. Therefore, in reality, shadow flicker occurrences may be less than predicted. However, excluding these circumstances and relying on the prediction modelling alone, shadow flicker could potentially have a long-term slight negative impact on each Sensitive Receptor.

Mitigation and Monitoring Measures

Where daily shadow flicker exceedances have been predicted at buildings by the modelling software, a Site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. 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 followed. Please refer to Chapter 18 Schedule of Mitigation and Monitoring Measures for a full list of measures.

- 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.).
- Recording the house number, time and duration of Site visit and the observation point GPS coordinates.
- Recording the nature of the Sensitive Receptors, its orientation, windows, landscaping in the vicinity, any elements of the built environment in the vicinity, vegetation.
- In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded.

Screening Measures

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

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

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

Wind Turbine Control Measures

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

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

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

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

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

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 Project a report can be prepared for the Local Authority describing the shadow flicker mitigation measures used at the wind farm and confirming the implementation and successful operation of the system.*

This method of shadow flicker mitigation has been technically well-proven at wind farms in Ireland and 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 5-12 below lists the 76 properties at which a shadow flicker mitigation strategy may be necessary to ensure the 2006 DoEHLG Guidelines 30-minute per day

shadow flicker threshold is not exceeded. In this case, the relevant turbine(s) would be programmed to switch off for the time required to reduce daily shadow flicker to below the guideline limit of 30 minutes. The SCADA control system would be utilised to control shadow flicker in the absence of being able to agree alternative mitigation measures with the relevant property owner. The mitigation strategy outlined in Table 5-12 below is based on the theoretical precautionary scenario. The details presented in Table 5-12 list the days per year and the turbines that could be programmed to switch off at specific times, in order to reduce daily shadow flicker to a maximum of 28 minutes, which is below the guideline limit of 30 minutes.

Table 5-12 Shadow Flicker Mitigation Strategy for Daily and Annual Shadow Flicker Exceedance – Turbine Numbers and Dates

Property No.	No. of Day	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Dates)*	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)	Post-mitigation Maximum Annual Shadow Flicker (hrs:mins:sec)
1	78	T4, T5	25th Mar - 4th Apr, 25th May - 19th Jul, 9th Sept - 19 th Sept	≤00:28:00	≤30:00:00
2	53	T9	1st Jan - 17th Jan , 26th Nov - 31st Dec	≤00:28:00	≤30:00:00
3	50	T6, T9	9th Mar 2nd Apr, 11th Sept - 5th Oct	≤00:28:00	≤30:00:00
4	97	T1, T2, T4	2nd Apr - 27th Apr, 13th May - 3rd Jun, 10th Jul - ast Aug, 16th Aug - 10th Sept	≤00:28:00	≤30:00:00
5	74	T2, T3, T4	26th Jun - 8th Feb, 22nd Mar - 12th Apr, 31st Aug - 22nd Sept, 3rd Nov - 17th Nov	≤00:28:00	≤30:00:00
6	131	T4, T5, T8, T9	1st Jan - 3rd Feb , 10th Mar - 31st Mar, 13th Sept - 4 Oct, 9th Nov - 31st Dec	≤00:28:00	≤30:00:00
8	70	T3, T4, T5, T6	27th Mar - 7th Apr, 30th May - 14th Jul, 6th Septh - 17th Sept	≤00:28:00	≤30:00:00
9	48	T6, T7, T9	1st Jan - 8th jan, 24th Mar - 29th Mar, 14th Sept - 20th Sept, 5th Dec - 31st Dec	≤00:28:00	≤30:00:00
10	68	T1	24th Apr - 27th May, 18th Jul - 20th Aug	≤00:28:00	≤30:00:00
11	70	T2, T3, T4	3rd Feb - 15th Feb, 30th Mar - 19th Apr, 24th Aug - 14th Sept, 27th Oct - 9th Nov	≤00:28:00	≤30:00:00
13	4	T7	22nd Mar - 23rd Mar, 21st Sept - 22nd Sept	≤00:28:00	≤30:00:00
14	1	T7	22nd Mar	≤00:28:00	≤30:00:00
15	61	T1, T2	14th Mar - 19th Mar, 20th Apr - 14th May, 30th Jul - 23rd Aug , 26th Sept - 30th sept	≤00:28:00	≤30:00:00
16	94	T6, T7, T9	1st Jan - 20th Jan , 16th Mar - 1st Apr, 12th Sept - 28th Sept, 22nd - 31st Dec	≤00:28:00	≤30:00:00
17	60	T7	1st Jan - 20th Jan , 22nd - 31st Dec	≤00:28:00	≤30:00:00
18	39	T6, T9	7th Mar - 26th Mar, 18th Sept - 6th Oct	≤00:28:00	≤30:00:00
20	26	T3, T4	5th Apr - 17th Apr, 27th Aug - 8th Sept	≤00:28:00	≤30:00:00
21	38	T6, T9	11st Mar - 29th Mar, 15th Sept - 3rd Oct	≤00:28:00	≤30:00:00

Property No.	No. of Day	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Dates)*	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)	Post-mitigation Maximum Annual Shadow Flicker (hrs:mins:sec)
22	36	T2	21st Apr - 8th May, 5th Aug - 22nd Aug	≤00:28:00	≤30:00:00
23	140	T1, T2, T3, T5	1st Jan - 21st Jan, 24th Feb - 7th Mar, 23rd Apr - 19th May , 25th Jul - 21st Aug, 7th Oct - 18th Oct, 22nd Nov - 31st Dec	≤00:28:00	≤30:00:00
24	72	T7	1st Jan - 26th Jan, 16th Nov - 31st Dec	≤00:28:00	≤30:00:00
26	46	T8	4th May - 26th May, 18th Jul - 9th Aug	≤00:28:00	≤30:00:00
27	67	T5, T8, T9	31st Jan - 20th Feb , 25th Mar - 6th Apr, 7th Sept - 18th Sept, 22nd Oct - 11th Nov	≤00:28:00	≤30:00:00
28	7	T3, T4	10th Apr - 13th Apr, 1st Sept - 3rd Sept	≤00:28:00	≤30:00:00
29	33	T7	31st Jan - 16th Feb, 27th Oct - 11th Nov	≤00:28:00	≤30:00:00
30	36	T2, T3, T4	10th Feb - 14th Feb, 28th Mar - 9th Apr, 4th Sept - 16th Sept, 28th Oct - 1st Nov	≤00:28:00	≤30:00:00
33	104	T1, T2, T3	1st Jan - 20st Jan, 25th Feb - 3rd Mar, 17th Apr - 1st May, 12th Aug - 26th Aug, 11th Oct - 17th Oct, 22nd Nov - 31st Dec	≤00:28:00	≤30:00:00
35	29	T2	30th Apr - 13th May, 31st Jul - 14th Aug	≤00:28:00	≤30:00:00
36	28	T2, T3, T4	12th Feb - 14th Feb , 28th Mar - 7th Apr, 5th Sept - 15th Sept, 28th Oct - 30th Oct	≤00:28:00	≤30:00:00
37	13	T4	15th Apr - 20th Apr, 23rd Aug - 29th Aug	≤00:28:00	≤30:00:00
38	105	T1, T2, T3	1st Jan - 22nd Jan, 26th Feb - 4th Mar , 18th Apr - 30th Apr, 3th Aug - 26th Aug , 10th Oct - 17th Oct, 21st Nov - 31st Dec	≤00:28:00	≤30:00:00
40	4	T4	13th Apr - 14th Apr, 29th Aug - 30th Aug	≤00:28:00	≤30:00:00
42	26	T7	5th /feb - 17th Feb , 25th Oct - 6th Nov	≤00:28:00	≤30:00:00
43	41	T2	12th May - 31st May, 13th Jul - 2nd Aug	≤00:28:00	≤30:00:00
47	23	T4	28th Apr - 8th May , 5th Aug - 16th Aug	≤00:28:00	≤30:00:00
48	1	T7	4th Mar	≤00:28:00	≤30:00:00

Property No.	No. of Day	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Dates)*	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)	Post-mitigation Maximum Annual Shadow Flicker (hrs:mins:sec)
49	74	T1, T2, T3, T5	20th Jan - 4th Feb, 9th Mar - 13th Mar, 28th Apr - 12th May, 31st Jul - 15th Aug, 1st Oct - 6th Oct, 8th Nov - 23rd Nov	≤00:28:00	≤30:00:00
50	16	T3, T4	29th Mar - 5th Apr, 8th Sept - 15th Sept	≤00:28:00	≤30:00:00
52	21	T7	1st Jan, 12th Dec - 31st Dec	≤00:28:00	≤30:00:00
53	22	T2	6th May - 16th May, 28th Jul - 7th Aug	≤00:28:00	≤30:00:00
54	50	T7	1st Jan - 15th Jan, 27th Nov - 31st Dec	≤00:28:00	≤30:00:00
56	36	T8	16th May - 2nd Jun, 11st Jul - 28th Jul	≤00:28:00	≤30:00:00
58	2	T7	2nd Mar, 12th Oct	≤00:28:00	≤30:00:00
59	16	T7	19th Feb - 26th Feb , 17th Oct - 24th Oct	≤00:28:00	≤30:00:00
60	34	T7	12th Jan - 28th Jan, 14th Nov - 30th Nov	≤00:28:00	≤30:00:00
61	52	T7	1st Jan - 22nd Jan , 21st Nov - 16th Dec, 28th Dec - 31st Dec	≤00:28:00	≤30:00:00
62	30	T7	15th Jan - 29th Jan, 14th Nov - 28th Nov	≤00:28:00	≤30:00:00
63	32	T7	12th Jan - 27th Jan, 16th Nov - 1st Dec	≤00:28:00	≤30:00:00
64	5	T7	28th Feb - 2nd Mar, 13th Oct - 14th Oct	≤00:28:00	≤30:00:00
65	31	T1, T3, T4	1st Jan - 2nd Jan, 4th Jan - 5th Jan, 2nd Apr - 8th Apr, 5th Sept - 11th Sept, 6th Dec - 16th Dec, 28th Dec - 31st Dec	≤00:28:00	≤30:00:00
66	25	T7	22nd Jan - 3rd Feb, 9th Nov - 20th Nov	≤00:28:00	≤30:00:00
67	23	T4	7th May - 17th May, 27th Jul - 7th Aug	≤00:28:00	≤30:00:00
68	22	T7	27th Jan - 6th Feb, 5th Nov - 15th Nov	≤00:28:00	≤30:00:00
71	4	T4	25th Apr- 6th Apr, 17th Aug - 18th Aug	≤00:28:00	≤30:00:00
73	17	T7	2nd Feb - 9th Feb, 2nd Nov - 10th Nov	≤00:28:00	≤30:00:00

Property No.	No. of Day	Turbine(s) Producing Shadow Flicker Exceedance	Days of Year When Mitigation May be Required (Dates)*	Post-mitigation Maximum Daily Shadow Flicker (hrs:mins:sec)	Post-mitigation Maximum Annual Shadow Flicker (hrs:mins:sec)
74	21	T7	23rd Jan - 1st Feb, 10th Nov - 20th Nov	≤00:28:00	≤30:00:00
75	10	T1	30th Apr - 4th May, 9th Aug - 13th Aug	≤00:28:00	≤30:00:00
77	9	T3, T4	1st Apr - 5th Apr, 8th Sept - 11th Sept	≤00:28:00	≤30:00:00
78	34	T2	5th Jun - 8th Jul	≤00:28:00	≤30:00:00
80	18	T7	26th Jan - 3rd Feb , 8th Nov - 16th Nov	≤00:28:00	≤30:00:00
82	36	T2	4th Jun - 9th Jul	≤00:28:00	≤30:00:00
84	13	T8, T9	6th Feb - 9th Feb, 19th Mar - 20th Mar, 24th Sept - 25th Sept, 2nd Nov - 6th Nov	≤00:28:00	≤30:00:00
89	10	T7	1st Feb - 5th Feb , 7th Nov - 11th Nov	≤00:28:00	≤30:00:00
90	11	T7	1st Feb - 6th Feb, 6th Nov - 10th Nov	≤00:28:00	≤30:00:00
91	7	T4	2nd May - 4th May, 8th Aug - 11th Aug	≤00:28:00	≤30:00:00
94	11	T2	16th May - 4th May, 24th Jul - 28th Jul	≤00:28:00	≤30:00:00
96	11	T5, T8	13th Feb - 14th Feb , 17th Feb - 19th Feb, 23rd Oct - 26th Oct, 28th Oct - 29th Oct	≤00:28:00	≤30:00:00
98	8	T7	3rd Feb - 6th Feb, 6th Nov - 9th Nov	≤00:28:00	≤30:00:00
99	26	T1, T2	9th Jun - 4th Jul	≤00:28:00	≤30:00:00
100	2	T3	10th Sept - 11th Sept	≤00:28:00	≤30:00:00
104	1	T6	2nd Sept	≤00:28:00	≤30:00:00
106	1	T6	16th Aug	≤00:28:00	≤30:00:00
107	11	T1	22nd May - 26th May, 17th Jul - 22nd Jul	≤00:28:00	≤30:00:00
109	2	T7	2nd Feb , 9th Nov	≤00:28:00	≤30:00:00
111	28	T1	2nd Jun - 14th Jun, 17th Jun, 26th Jun, 29th Jun - 11th Jul	≤00:28:00	≤30:00:00
121	1	T1	20th May	≤00:28:00	≤30:00:00

Overall, the details presented in Table 5-12 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 of 30 minutes, by programming the relevant turbines to switch off at the required dates and times. There are no properties modelled which are anticipated to exceed annual shadow flicker threshold

Notwithstanding the approach set out above should shadow flicker associated with the Proposed Wind Farm be perceived to cause a 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 wind farm, 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

Following the implementation of the above suite of mitigations measures, the DoEHLG, 2006 Guidelines limit of 30 minutes per day or 30 hours per year will not be exceeded and 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.

5.10.4 Decommissioning Phase

The wind turbines proposed as part of the Proposed Project are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Wind Farm may be decommissioned fully. The Proposed Grid Connection and on-site substation will remain in place as it will form part of the national electricity grid under the control of ESBN.

The works required during the decommissioning phase are described in Section 4.11 in Chapter 4: Description of the Proposed Project. 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 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. By its nature, the Decommissioning Plan is a working document and, in accordance with the NatureScot guidance, an updated decommissioning plan will be agreed with the local authorities three months prior to decommissioning the Proposed Project. The principles that will inform the final decommissioning plan are contained in the CEMP in Appendix 4-5.

5.10.5 Cumulative Effects

The potential for impact between the Proposed Project (Proposed Wind Farm and Proposed Grid Connection combined), wind projects, and other relevant non-wind projects (existing, permitted or proposed) has been carried out with the purpose of identifying what influence the Proposed Project will have on population and human health as well as the interactions between these factors, when considered cumulatively and in combination with relevant existing, permitted or proposed projects and plans in the vicinity of the Site, as set out in Chapter 2 of this EIAR. Please see Section 2.9 of Chapter 2 for cumulative assessment methodology. Please refer to Appendix 2-3 for a comprehensive listing of the

considered cumulative and in combination with relevant existing, permitted or proposed projects and plans in the vicinity of the Site.

5.10.5.1 Health and Safety

The Proposed Project 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 projects (wind energy or otherwise) would be expected to follow all relevant Health and Safety Legislation during the construction, operation and decommissioning phases of the development. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

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

5.10.5.2 Employment and Economic Activity

Cumulative projects within 20 kilometres of the Proposed Project 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

5.10.5.3 Tourism and Amenity

There are no key identified tourist attractions pertaining specifically to the Site.

It is not considered that the Proposed Project together with other projects in the area will cumulatively affect any tourism infrastructure in the wider area. As also noted in Section 5.4 above, the conclusions from available research indicate there is a generally positive disposition among tourists towards wind development in Ireland.

Given the Proposed Project's relative isolation and remoteness, it is considered that the Proposed Project will support the development of the wider area, attracting local and new visitors to the area which could be uncovered as part of a wider regional strategy.

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

5.10.5.4 Traffic

Construction of the Proposed Project at the same time as cumulative projects located in the surrounding area has the potential to give rise to cumulative impacts on traffic. There are currently no permitted wind farm developments within 5km of the Proposed Wind Farm site. The closest wind farm to the Proposed Wind Farm is the operational Cloonlusk Wind Farm, located approximately 7.8km to the west. The considerable distance will result in no potential for cumulative effects between the Proposed Project and the neighbouring developments.

The mitigation measures in relation to traffic set out in Section 5.10.2.2.10 above will ensure that any cumulative effects that arise will be short term in duration and imperceptible in significance.

5.10.5.5 Air (Dust)

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

During the construction phase of the Proposed Project 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 to Section 10.3.3 of Chapter 10 are implemented during the construction phase of the Proposed Project, there will be no significant cumulative negative effect on air quality.

The nature of the Proposed Project 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.

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 effect on property values within 1km of the proposed turbines of the Proposed Wind Farm site. 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 Services

The rate payments from the Proposed Project and other projects in the area will contribute significant funds to Galway County Council, which will be redirected to the provision of public services within the County.

In addition, the injection of money into local services though the establishment of community benefit funds is also expected to be a long-term positive cumulative effect.

5.10.5.8 Shadow Flicker

As outlined above, no dwellings may be impacted by shadow flicker from the Proposed Project in combination with other existing, permitted, or proposed wind farms.

5.10.5.9 Residential Amenity

Pre-Mitigation Effects

In the extremely unlikely event that all permitted and proposed projects as described in the cumulative assessment in Chapter 2 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 Project that will be located within 740 metres of any non-involved 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 insofar as possible effects on residential amenity at properties located in the vicinity of the Proposed Project works, including along the proposed turbine and construction materials haul route. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

Residual Effects

The Proposed Project will have a short-term, slight negative residual 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 (DoEHLG, 2006) levels, resulting in a long-term, not significant residual impact from on residential amenity.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects.

5.1 Summary

Following consideration of the residual effects (post-mitigation) it is noted that the Proposed Project will not result in any significant effects on human beings in the area surrounding the Proposed Project. Following appropriate mitigation the Guidelines (DoEHLG,2006) Shadow Flicker limits will not be exceeded at any property. It is noted that the Proposed Project 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. Provided that the Proposed Project 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.