5.0 POPULATION & HUMAN HEALTH

5.1 INTRODUCTION

This chapter examines the existing environment and addresses the potential effects on population and human health arising from the proposed Cloghercor Wind Farm project, as described in Chapter 2 of this EIAR (Description of the Proposed Project).

5.1.1 Background

The two environmental factors of population and human health are addressed under separate headings throughout this chapter. The assessment on population considers the current land use of the proposed site, the current activities occurring within and in the vicinity of the site, local population information, employment profiles, tourism, visitor attractions and community gain opportunities. The assessment on human health includes a detailed literature review of studies and research carried out on the potential effects of wind farm developments on human health.

The study area for population and human health includes review of relevant information on a county and national scale but is mainly concentrated on the Electoral Districts (ED) within which the proposed project is located.

The potential effects of the proposed project on other environmental factors which may also have an effect on human beings, as set out in Chapter 8 (Land, Soils and Geology); Chapter 9 (Hydrology and Hydrogeology); Chapter 10 (Shadow Flicker); Chapter 11 (Material Assets, Telecommunications and Aviation); Chapter 12 (Noise and Vibration); Chapter 13 (Landscape and Visual Impact); Chapter 14 (Air Quality and Climate) and Chapter 16 (Traffic and Transportation), are addressed in this Chapter and discussed in more detail in the relevant Chapters of this EIAR. A separate section setting out the likely interactions between this assessment and other technical assessments is presented in Chapter 17 (Interaction of the Foregoing).

This assessment has been carried out in accordance with the following guidelines:

- Department of Housing, Planning and Local Government (DoHPLG), *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (2018);
- Environmental Protection Agency (EPA), *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (2022);
- 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);
- DoHPLG, *Draft Revised Wind Energy Development Guidelines* (2019).

5.1.2 Proposed Project

The proposed project will comprise 19 no. wind turbines and all associated infrastructure as described in Chapter 2 of this EIAR (Description of the Proposed Project). It includes all elements of the proposed project including the proposed wind farm, as well as the works along the turbine delivery route (TDR), recreational facilities, biodiversity enhancement lands and the grid connection.

5.1.3 Statement of Authority

This chapter was prepared by Serena Byrne, and John Staunton of TOBIN Consulting Engineers. Serena Byrne is a project scientist at TOBIN Consulting Engineers, with over 11 years' multidisciplinary experience in engineering and environmental consulting. She has recently completed a MSc in Environmental Sustainability in University College Dublin on a part time basis, including an EIA Procedures module.

This chapter has been reviewed by John Staunton PhD, Senior Project Manager and Environmental Scientist in TOBIN. John has more than fourteen years' postgraduate experience in both research and environmental consultancy. John holds a BSc and PhD in Environmental Science and has considerable experience in project managing wind energy developments and carrying out associated impact assessments including in preparing assessments in relation to population and human health (human beings).

5.2 METHODOLOGY

5.2.1 Population

A desktop study and site visit were carried out in order to examine relevant information pertaining to this population impact assessment. The site visit was used to verify descriptions and information of the local area, and thus inform the impact assessment. Maps from Ordnance Survey Ireland (OSI) were used to identify current and historical land use in the area as well as relevant amenity facilities surrounding the proposed wind farm site and within the main settlement areas around the proposed project.

Information on population statistics, employment and social data for the areas surrounding the proposed project have been obtained from the Central Statistics Office (CSO) and predominantly from the 2016 and 2011 Census records; full 2022 census data was not available at the time of writing this report. The first official 2022 Census summary report is expected to be published by the CSO in April 2023; where relevant preliminary 2022 census data is available at the time of writing, this has been reviewed. Data has been captured on an ED basis as this is the most appropriate scale for collated census data and is commonly used for defining the existing population profile. The ED's within which the proposed project is located comprise the study area for this assessment.

Fáilte Ireland tourist literature for County Donegal was examined in relation to tourism amenity in conjunction with the websites of relevant tourism assets, locations and amenities in the area. County Donegal is located in Ireland's Wild Atlantic Way[1], a branding initiative developed by Fáilte Ireland to make the area *"Ireland's first defined touring route, stretching along the Atlantic coast from Donegal to West Cork…..synonymous with spectacular landscapes, adventure activities and welcoming tourism operators…."*[2]. Information on other tourist attractions and initiatives in the area have been sourced from relevant websites, such as Discover Ireland, Go Visit Donegal, Tourism Ireland, those hosted by the Donegal Tourism Board and published literature.

As part of the EIAR scoping process, a consultation letter on the proposed project was sent to a number of consultees as described in Chapter 1 (Introduction) including Fáilte Ireland on 21.06.2021 but no response was received. Other relevant bodies scoped (with no response)

[1] https://www.discoverireland.ie/wild-atlantic-way/map

[2] https://www.failteireland.ie/Regional-experience-brands/Wild-Atlantic-Way.aspx

were Mountaineering Ireland, Waterways Ireland, Údarás na Gaeltachta and the Department of Tourism Culture Arts Gaeltacht, Sports and Media.

The Cloghercor Wind Farm Community Benefit Proposal is set out in Section 2.2 of Chapter 2 of this EIAR and has been developed in accordance with the terms and conditions of the Government's Renewable Energy Support Scheme (RESS). The provisions of the Community Benefit Proposal which will have an effect on the local population are discussed in Section 5.3.1.

The following key information sources and guidance have been used in the completion of the population aspect of this chapter:

- CSO – 2016 and 2011 Census and associated data;
- Fáilte Ireland website – https://www.failteireland.ie/;
- Fáilte Ireland, *EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects*;
- Ireland's Wild Atlantic Way website - https://www.thewildatlanticway.com/;
- Donegal County Council, Donegal County Development Plan 2018 – 2024;
- OSI – Mapping and aerial photography; and
- Walking trails - https://www.sportireland.ie/outdoors/find-your-trails outdoors and http://trails.ie/index.php.

The effects of the proposed project on the human environment are assessed in compliance with the EIAR Guidelines as outlined in Chapter 1 (Introduction).

5.2.2 Human Health

This section has been carried out from a review of published literature on the effects of wind energy developments on human health.

Aspects examined in this section primarily relate to impacts from the proposed project on socio-economic activities and on local community health. These two themes are discussed primarily in this chapter but may be further addressed in other technical chapters, where relevant.

The following specific guidance documents have been consulted in the completion of the human health impact aspect of this chapter:

- Institute of Environmental Management and Assessment (IEMA), *Health in Environmental Impact Assessment - A Primer for a Proportionate Approach* (2017);
- Institute of Public Health Ireland, *Health Impact Assessment* (2009);
- US Environmental Protection Agency, *Health Impact Assessment Resource and Tool Compilation* (September 2016);
- World Health Organisation (WHO), *Environmental Noise Guidelines for the European Region* (2018);
- WHO, *Night-time Noise Guidelines for Europe* (2009); and
- WHO, Global Air Quality Guidelines (2021).

EIA Directive

The 2014 amendment to the 2011 EIA Directive (2014/52/EU) directs that population and human health factors be assessed in an EIAR. The EIA Directive does not define the term 'human health', however the 2017 EC Guidance on the preparation of the EIAR states that *"human health is a very broad factor that would be highly project dependent. The notion of human*

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

EPA EIAR Guidelines (2022)

The 2022 EPA EIAR Guidelines[3] published by the EPA 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 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)'"*. Paragraph (f) of Annex I of the SEA Directive lists the environmental factors including soils, water, landscape, air etc.)[4].

The 2022 EPA EIAR Guidelines also state that the above health assessment approach is *"consistent with the approach set out in the 2002 EPA EIS Guidelines where health was considered through assessment of the environmental pathways through which it could be affected, such as air, water or soil"*. The 2002 EPA Guidelines state *"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"*.

The 2022 EPA EIAR Guidelines also note that in an EIAR, *"the assessment of impacts on population & human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in the EIAR e.g. under the environmental factors of air, water, soil, etc."* and that *"assessment of other health & safety issues are carried out under other EU Directives, as relevant. These may include reports prepared under the Integrated Pollution Prevention and Control, Industrial Emissions, Waste Framework, Landfill, Strategic Environmental Assessment, Seveso III, Floods or Nuclear Safety Directives. In keeping with the requirement of the amended Directive, an EIAR should take account of the results of such assessments without duplicating them".*

The classification and description of effects in this EIAR chapter follows the terms provided in Table 3-4 of the 2022 EPA Guidelines and are duplicated in Table 1-1 of Chapter 1 (Introduction) in this EIAR for reference.

IEMA Discussion Document (2017)

The Institute for Environmental Management and Assessment (IEMA) in the UK issued a discussion document in 2017 (IEMA, 2017) which it describes as a primer for discussion on what a proportionate assessment of the impacts on health should be in EIA. It is a useful

[3] https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment.php

[4] Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the Environment - https://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf

document when considering what can and should be assessed in the context of EIA. Regard has been given to the general approach advocated in this document when compiling this chapter.

One of the messages in the IEMA document in terms of assessing health in EIA, is that there should be a greater emphasis on health outcomes (i.e. the potential effects on human health), rather than simply the health determinants (i.e. the agents or emissions which could have the potential to have health effects). The IEMA document noted that in EIA, there has previously been a strong focus on just the agents or emission levels (e.g. dust) rather than focusing on the effects of these agents/emission levels on human health. This change in emphasis does not mean a complete change in practice.

The IEMA document notes that *"public health is defined as the science and art of promoting and protecting health and well-being, preventing ill-health and prolonging life through the organised efforts of society and has three domains of practice: health protection, health improvement and improving services"*. The IEMA document suggests that these three domains should be considered in the assessment of health in EIA. Examples of health protection issues to be considered could include issues such as chemicals, radiation, health hazards, emergency response and infectious diseases whilst health improvement issues could include lifestyles, inequalities, housing, community and employment. Examples of improving services issues could include service planning, equity and efficiencies.

The WHO defined health, in its broader sense, in its 1948 constitution as *"a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"*. Therefore, whilst the 2022 EPA EIAR Guidance is useful in terms of health protection, for a more holistic assessment, as per the IEMA document, it is also worthwhile to look at broader health effects in terms of opportunities for improvement of health and for improvement of access to services. While it is important to do this, it is also important not to attribute every conceivable event as being a health effect. To further rely on the WHO definition, a health effect would be something that would have a material impact on somebody's physical, mental and social well-being, be that positive or negative.

HSE Position Paper on Wind Turbines and Public Health (2017)

The Public Health Medicine, Environment and Health Group of the HSE were tasked with investigating the potential public health issues involved with wind farm development, given the increase in wind farm development in Ireland in recent years. The issues often cited in terms of health impacts are considered, including noise, shadow flicker and electromagnetic frequency.

The paper has reviewed the scientific basis for reports on negative heath impact resulting from wind farms. Its findings conclude that the evidence is weak, where present, and in many cases, is lacking. The paper states that *"Published scientific evidence is inconsistent and does not support adverse effects of wind turbines on health"* and that *"adequate setback distances and meaningful engagement with local communities are recommended in order to address public concern"*. In respect of the proposed project, there is a minimum setback distance of 925m from the proposed turbine locations to the nearest sensitive receptor which is in excess of the minimum setback requirements in the 2006 and Draft 2019 WEDGs.

The position paper states that *"Further research is required to investigate the effects of wind farms on public health. Large-scale prospective cohort studies would be most informative for identifying potential health effects of exposure to wind turbine noise; further cross-sectional studies are unlikely to contribute meaningfully to the current limited evidence base."*

The paper recommends the use of relevant national planning guidelines (which would include the 2006 WEDGs) in order to determine applicable limits for noise, shadow flicker and setback distances from sensitive properties.

Therefore, health protection and health improvement are considered in this chapter. The methodology for assessing health protection is considered further below.

5.2.2.1 Health Impact Assessment and Environmental Impact Assessment

The 2017 IEMA Discussion Document notes that Health Impact Assessment (HIA) and EIA are separate processes and that whilst a HIA can inform EIA practice in relation to human health, a HIA alone will not necessarily meet the EIA human health requirement. HIA is not routinely carried out for major infrastructure schemes in Ireland.

Guidance on HIA was issued by the Institute of Public Health in Ireland (IPHI) in 2009 (IPHI, 2009). There are, however, considerable difficulties in performing a HIA as outlined by the IPHI for infrastructural projects such as the proposed wind farm project. Not least of these is the difficulty of getting baseline health data. It is quite difficult due to patient confidentiality, and other reasons, to accurately determine levels of even relatively common medical conditions in a relatively defined population that might be affected by a proposed project. In the absence of an accurate baseline, it is very difficult to assess qualitative and quantitative changes that might occur. One could use more generalised data that might exist for larger areas such as a city or county, but these would be at most an estimate of the local baseline and not accurate enough to allow for meaningful interpretation.

The 2017 IEMA Discussion document also notes that the WHO provides an overview of health in different types of impact assessment (WHO, 2014) and presents the WHO perspective on the relationship of HIA to other types of impact assessment as follows:

"The health sector, by crafting and promoting HIA, can be regarded as contributing to fragmentation among impact assessments. Given the value of impact assessments from a societal perspective, this is a risk not to be taken lightly…The need…and justification for separate HIA cannot automatically be derived from the universally accepted significance of health; rather, it should be demonstrated whether and how HIA offers a comparative advantage in terms of societal benefits…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."*

It is clear, therefore, that the WHO does not support a stand-alone HIA unless it could be demonstrated to be of advantage over an EIAR. It is for these reasons that this health assessment is part of the EIAR and there is no stand-alone HIA.

The 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, whilst the health assessment in the context of EIA focuses the attention of the assessment on likely significant effects, i.e. on effects that are deemed likely to occur and, if they were to occur, would be expected to be significant (as per the requirements of the EIA Directive). Conducting a HIA will not necessarily meet the EIA Directive population and human health assessment requirement.

5.2.2.2 Health Protection

The assessment of human health for the proposed project, in terms of health protection, follows the approach set out in the 2022 EPA EIAR Guidelines and in the EC's Guidance on the preparation of the EIAR. It is also similar in nature to the US Environmental Protection Agency (USEPA) Guidance, entitled *Health Impact Assessment Resource and Tool Compilation* (USEPA, 2016). Human health protection is considered through the assessment of the environmental factors (pathways) through which health could be affected such as air, noise, water and soils. The USEPA Guidance includes a four-step approach which is represented graphically below.

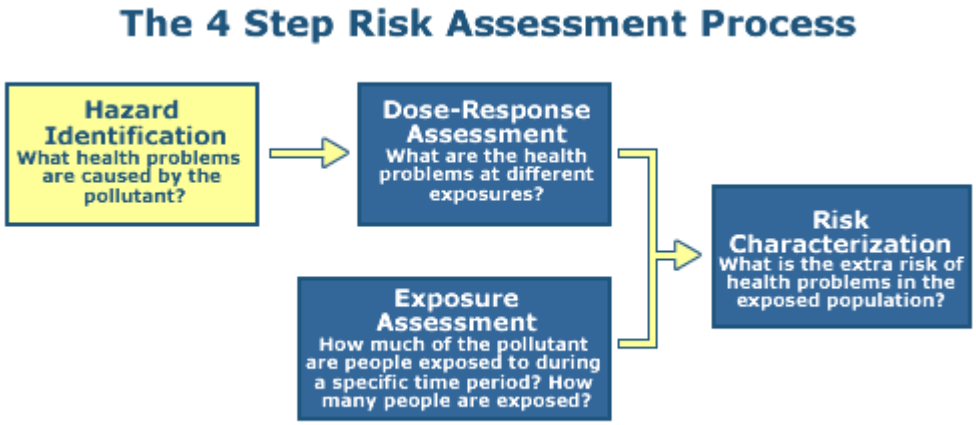


Figure 5-1: Four-step Risk Assessment Process (Source: USEPA, 2016)

This USEPA risk assessment process is similar to the 2022 EPA EIAR Guidelines in that the potential noise, air, soils and water impacts which could affect human health are identified (Hazard Identification), the scale of these potential impacts (Dose-Response Assessment) and their duration (Exposure Assessment) are assessed and the significance of the potential effect on human health is determined (Risk Characterisation).

It should be noted that the identification of individual environmental hazards and the associated potential impacts and duration are undertaken in other chapters of this EIAR namely, Noise, Shadow Flicker, Material Assets, Air Quality and Climate. The associated significance in terms of the potential effect on human health is then considered in this chapter.

In the assessment of cumulative effects, any other existing, permitted or proposed developments in the surrounding area (see Chapter 4 of this EIAR - Planning, Policy and Development Context) have been considered where they have the potential to generate in-combination or cumulative effects with the proposed project. The potential for cumulative effects on the local population and human health is considered below, while elements such as noise, shadow flicker, traffic and visual impacts are discussed in the relevant chapters.

5.3 EXISTING ENVIRONMENT

5.3.1 Population

Land Use

The site of the proposed wind farm (Figure 1-2 of this EIAR) has an area of 1945 ha and comprises a single, slightly elongated land parcel; the site is c. 9.1km long in the northeast-southwest direction and is c. 3.7km wide in a southeast-northwest direction at the widest point. A large portion of the proposed project is located on lands under the ownership and control of Coillte. The proposed project also has a significant number of third-party private landowners who have consented to the application and proposed project.

The site lies between the R250 that runs from Glenties to Fintown and the River Gweebarra estuary. The site runs in a northeast-southwest direction. The River Gweebarra estuary is located adjacent to the northwest boundary of the wind farm site, although the nearest infrastructure (operational phase public entrance and grid connection) is located approximately 550m from this. The nearest turbine will be approximately 1.05km from the estuary, and the entire site drains into the estuary. In terms of settlements, the site lies between Doochary, Lettermacaward and Glenties, which are located 2.1km north, 850m west and 3.5km south of the site of the proposed wind farm respectively and 2.3km north, 3.4km west and 6.2km south of nearest turbine, respectively.

A larger settlement Dungloe town (An Clochán Liath), is located c. 10.5 km northwest of the site of the proposed wind farm. The Donegal CDP (2018-2024) includes Dungloe and Glenties as *'Strategic Towns'*, with the following reasons for identification as such:

- Dungloe / An Clochán Liath: Performing a 'Special Economic Function.'; Tourism and Wild Atlantic Way; Irish Language; and Centre for delivery of Local Authority services;
- Glenties: Performing a 'Special Economic Function.'; Tourism (and linked to Ardara); and Heritage, Recreation and Culture.

The main urban centres in the region are Donegal Town, located 22km southeast of the proposed wind farm site and Letterkenny Town, located 30km northeast of the proposed wind farm site.

The application includes an onsite 110kV substation with a loop-in underground grid connection to the existing 110kV overhead line in Cloghercor. The underground grid connection crosses one public road. Some temporary works associated with the turbine delivery route works will be required to accommodate delivery of oversized/abnormal loads delivery to site (i.e. turbine components). This will involve transient temporary works in closer proximity to sensitive receptors. See Chapter 2 of this EIAR (Description of the Proposed Project) for more details.

The land use activities on the proposed wind farm site are primarily commercial forestry, with some areas of open peatland that is extensively grazed. The surrounding landscape is a mixture of forestry, agricultural land and peat bog. Corine Land Cover within the study area is made up of forest and semi-natural areas and wetlands including scrub, herbaceous vegetation and peat bogs. The majority of the land cover where turbines are proposed to be situated is coniferous forest (Corine, 2018).

Table 5-1 – Land Cover of the Study Area as per Corine 2018 (EPA Maps, 2022)

Corine 2018 Land Cover within the Study Area			
Code	**Level 1 Description**	**Level 2 Description**	**Level 2 Description**
312	Forest and semi-natural areas	Scrub and/or herbaceous vegetation associations	Transitional woodland scrub
324	Forest and semi-natural areas	Forest	Coniferous forests
412	Wetlands	Inland wetlands	Peat bogs

The most significant natural features in the surrounding landscape are the Gweebarra estuary valley, and the upland areas within and around the proposed wind farm particularly to the east of the proposed wind farm, towards Fintown.

The site lies between the Gweebarra River Estuary (immediately north-west of the site) and the Cloghercor South hill (Blue Stack Mountains) southeast of the site. The landscape is predominately hilly to mountainous in the wider area, with the proposed wind farm site being located on an elevated area beside the Gweebarra River Estuary with a topography of between 0m and 365m OD. A number of other areas to the east and south of the site are also elevated.

Donegal, including the area surrounding the proposed project, features a high level of amenity used for walking and hiking, including national looped walks, waymarked routes, coastal paths, island loops, hills and mountains. The nearest walking trail identified in the vicinity of the proposed wind farm is the Slí na Finne - Slí Dhun na nGall, loop, situated to the east of the site. This loop runs north from Fintown, turning south down to Cullion and Cloghan, before continuing south to the Blue Stack Mountains, looping west and then north back up to Fintown. It is almost 51km in length and located c. 3km east of the proposed wind farm site. This is designated as a National Waymarked Trail by the National Trails Office of the Irish Sports Council (Sport Ireland). Coillte recreational trails are also present in Donegal including the Doochary to Fintown walk, situated c. 2.5km north-northeast of the proposed wind farm site, which is a section of Bealach na Gaeltachta Waymarked Way. This walking route passes through woodland and provides views across the surrounding countryside.

The nearest National Road is the N56, which is situated to the west and northwest of the wind farm site (within c. 750m of the wind farm site at the nearest point), running in a north-south direction, connecting the following towns and villages in the vicinity; Glenties, Maas, Mulnamina More, Lettermacaward, and Dungloe. The N56 provides access to the area around the site and is an important route within the County, with Donegal CDP (2018-2024) referring to it as the following "*The N56 National Secondary road serving the south, west and north-west and north of the County is a second critical element of the County's National Roads network. As well as providing a vital transport corridor for the residents and businesses of the area, the road also aligns significantly with the Wild Atlantic Way tourism route"* (Donegal CDP, 2018).

The wider road network in and around the site includes the following regional roads; R254, R252, and R250. The proposed wind farm site will be accessed via the L6483 local road, which ties-in with the R252 and the L6363. The L6483 local road runs in a northeast-southwest direction to the west-northwest of the site. The R254 intersects with the R252,

which runs in a northwest-southeast direction, crossing the Gweebarra River, and is situated to the north, c. 2km from the wind farm site at the nearest point. The R250 route is situated to the south-southeast (c. 1km from the wind farm site at the nearest point), between the area of the wind farm and the Blue Stack Mountains, running in a northeast-southwest direction.

Public transportation is available in the wider area around the proposed wind farm site but is limited to services provided by road. A number of bus services operate in Donegal and the local area operated by Transport for Ireland (TFI) and a number of private operators which provide a link to national routes through Donegal Town and to the north of the county and Derry. TFI operate the 'Donegal TFI Local Link Bus Services'[5], which serves a number of stops in the county and vicinity of the proposed project including, Glenties, Doochary, and Fintown. Inter-city bus services connecting Donegal to a number of destinations across Ireland are available including the Dublin to Donegal Expressway Route (Bus Éireann), and Bus Feda (Donegal to Galway)[6].

There are no train services provided by Irish Rail or Translink (Northern Ireland) to County Donegal. The nearest train services available are located in Sligo (Sligo to Dublin line, operated by Irish Rail), and from Derry-Londonderry (Derry Londonderry-Belfast line, operated by Translink).

A number of primary schools[7] were identified in the vicinity of the proposed wind farm site and along the local road network. The following six primary schools were identified along the road network to the north, east, west and south of the wind farm site:

- Scoil Naisiunta Leitir Mhic An Bhaird (F94 R962), Lettermacaward (c. 800m northwest of the wind farm site boundary, situated along the N56);
- Min A Ghabhann National School (F94 K072), Lettermacaward (c. 1.5km northwest of the wind farm site boundary, situated along local road in Lettermacaward);
- Scoil Naisiunta Duchoraidh (F94 YP28), Doochary (c. 2.4km northeast of the wind farm site boundary, situated along the R252);
- Scoil Naisiunta Cholmcille (F94 VR04), Fintown (c. 4km east of the wind farm site boundary, situated along the R250);
- Scoil Naisiunta Chill Coinnigh, (F94 CX21), Glenties (c. 2.6km west of the wind farm site boundary, situated along the L2513);
- Scoil Mhuire (F94 HT62), Glenties (c. 4.1km south of the wind farm site boundary, situated off the N56, along the R253);
- St. Riaghan's National School, Drumnacrosh, Glenties (c. 8 km south-west of the wind farm site boundary, situated along the R262 (adjacent to proposed blade set down area).

[5] https://www.transportforireland.ie/getting-around/network-maps/donegal-tfi-local-link-bus-services/

[6] https://www.govisitdonegal.com/visitor-information/transport

[7] Primary Schools identified through Schooldays and Google Maps, distance noted is between school and nearest point of wind farm site boundary - https://www.schooldays.ie/articles/primary-Schools-in-Ireland-by-map

Approximately three post-primary schools[8] were identified providing second level education in the local area of the proposed wind farm site and along the local road network:

- St Columba's Comprehensive School, Glenties (c. 3.5km south of the wind farm site boundary, situated along the N56);
- Gairm Scoil Chu Uladh Gaelscoil, Bellanamore (c. 8.8km east of the wind farm site boundary, situated along the R252);
- Rosses Community School, Dungloe (c. 11km northwest of the wind farm site boundary, situated along the N56)

The nearest large third level institution is the Atlantic Technological University (ATU) Donegal with campuses located in Letterkenny (c. 32km northeast) and Killybegs (c. 25km southwest).

A number of community facilities and amenities are available in the locality, with Lettermacaward and Glenties providing those nearest the proposed wind farm site. Lettermacaward village is home to an active GAA club (Na Rossa GAA Club), a service station, shops, health centre, public houses, accommodation, community hall and churches.

The town of Glenties is larger than Lettermacaward, with more facilities and services present within the town including; primary and secondary schools, Naomh Conail Glenties GAA Club, a church, a credit union, a community centre, a health centre, a fire station and a Garda station. The town has a number of retail services including a number of small shops and services and there are a number of public houses, bars, cafes, restaurants and accommodation (B&B's / hotels / holiday homes) present.

Dungloe c. 10 km north of the proposed wind farm site, is the nearest large town, and serves as the main administrative and retail centre in West Donegal. Within the town there are a number of facilities and services including a number of banks, a public services centre, a business park, a recycling centre, a credit union, Dungloe Community Hospital, Dungloe GAA Club, primary and secondary schools, a fire station, and a Garda station. The town has a number of retail services including a number of large supermarkets, smaller shops, and local retail businesses and services. Furthermore, there are outdoor amenities (parks/walks), public houses, cafes, restaurants and accommodation (B&B's / hotels / holiday homes) within Dungloe.

Further amenities and services are available in the larger towns of Donegal Town and Letterkenny Town.

The closest existing wind farm to the proposed project is the Loughderryduff (Maas) Wind Farm, located c. 4.5km southwest of the proposed wind farm site. The shortest turbine to turbine distance between the Loughderryduff wind farm and the proposed project is approximately 8.5km.

The turbine delivery route starts in Killybegs and runs through Glenties to the proposed wind farm site. These are the main settlements in the area of the route and there are areas of localised works between the two of these settlements which are required to allow turbines to be transported to the site. Most services (shopping, accommodation, amenities, food, etc.) can be found in these two towns.

[8] Secondary Schools identified through Schooldays and Google Maps, distance noted is between school and nearest point of wind farm site boundary - https://www.schooldays.ie/articles/secondary-Schools-in-Ireland-by-map

Population Trends

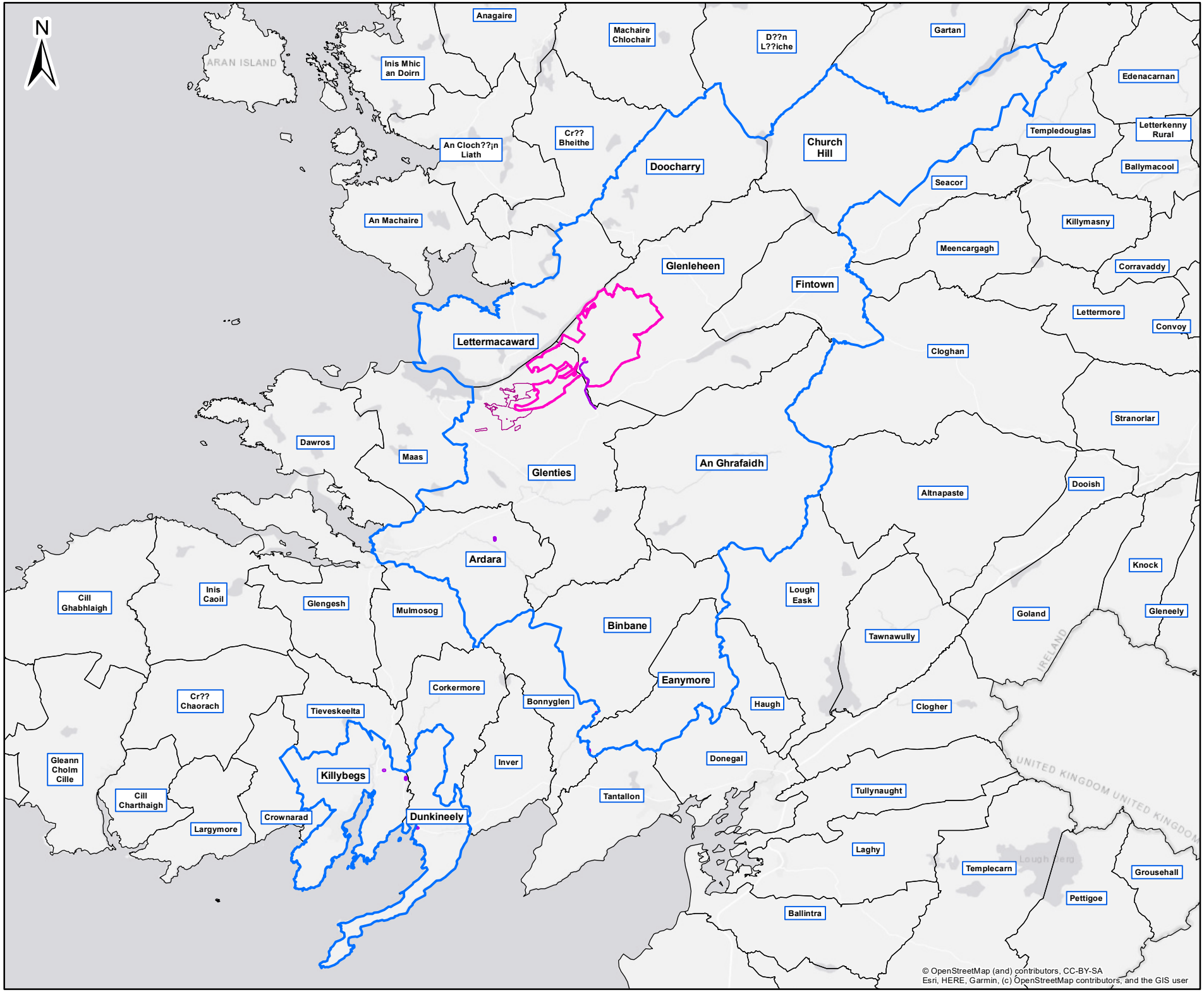
An examination of the existing population in the study area has been carried out to identify population trends, density and to define the properties/receptors surrounding the proposed wind farm site. Census data from the period 2006-2016 available from the CSO[9] has been summarised in Table 5-2 and Table 5-3.

The proposed wind farm works are located in the local authority area of Donegal County Council and within/adjacent to the Electoral Division (ED) of Glenleheen (Gleann Léithín). The following ED's border with Glenleheen (Gleann Léithín) ED and surround the proposed project; Doocharry (An Dúchoraidh), Lettermacaward (Leitir Mhic an Bhaird), Church Hill (Mín an Lábáin), Fintown (Baile na Finne), Graffy (An Ghrafaidh) and Glenties (Na Gleannta). See Figure 5-2.

The study area boundary is situated across two ED's; Glenleheen (Gleann Léithín) and Glenties (Na Gleannta). The proposed wind farm site is situated entirely within the ED of Glenleheen (Gleann Léithín). Glenties (Na Gleannta) is closest to the south-western boundary of the wind farm site, while Lettermacaward (Leitir Mhic an Bhaird) is closest to north-west boundary of the wind farm site.

All seven EDs identified have been included in defining the existing population in the study area and vicinity of the proposed project.

[9] https://www.cso.ie/en/census/ (Accessed on 04 August 2022)



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement
- Population and Human Health Study Area
- Electoral Divisions

* all land identified is within Boundary of the Proposed Project

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Kilometres

NOTES
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
A	08/03/2023	Final issue	S.P	J.S

Client: Cloghercor Wind Farm ltd.

Project: Cloghercor Wind Farm

Title: Figure 5-2: Population and Human Health Study Area and Electoral Districts

Scale @ A4: 1:250,000

Prepared by: S.Pezzetta | Checked: J.Staunton | Date: March 2023

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Table 5-2: Population Trends 2006 – 2016 (Proposed Project Works)

Area	Population 2006	Population 2011	Population 2016	% Change from 2006 - 2016
State	4,239,848	4,588,252	4,761,865	+12%
Donegal County	146,956	161,137	159,192	+8%
Glenleheen (Gleann Léithín) (33051)	191	179	158	-17%
Doocharry (An Dúchoraidh) (33046)	85	85	88	+4%
Lettermacaward (Leitir Mhic an Bhaird) (33059)	679	708	636	-6%
Church Hill (Mín an Lábáin) (33098)	281	356	379	+35%
Fintown (Baile na Finne) (33048)	316	313	280	-11%
Graffy (An Ghrafaidh) (33053)	209	181	157	-25%
Glenties (Na Gleannta) (33052)	1,481	1,508	1,443	-3%
Study Area (total)	**3,242**	**3,330**	**3,141**	**-3%**

Census results between 2011 and 2016 show a fall in population in Donegal of -1.2%. However, during the 10-year period of 2006 to 2016, the population nationally increased by approximately 12% and the population of County Donegal increased by approximately 8%, while the population of the ED's within which the proposed project is located decreased by approximately -3%. This illustrates that the population of the local area has decreased over the 10-year period compared to County and National rates.

The temporary ancillary works in the public road network which are required as part of the turbine delivery works also incorporate the additional ED's of Killybegs, Dunkineely, Eanymore, An Bhinn Bhán and Ard na Rátha (with 2016 census populations of 2,293, 899, 517, 165 and 1,175 respectively). It is noted however, that these proposed ancillary works are minor in the overall context of the proposed project. The location of the proposed project in the context of the above ED's is shown in Figure 5-2.

Population density is a useful indicator of the settlement patterns in the area surrounding the proposed project and Donegal County overall. Table 5-2 shows population density for the study area as well as Donegal County and shows a generally sparser population in the study area compared with the overall county.

The 2016 census identified that the average rural population density in Ireland is 27 persons/km^2 showing that the population density in the area surrounding the proposed project is well below the national average at 18.9 persons/km^2.

As noted above, the proposed works along the delivery route are minor in the context of the proposed project and mostly constitute temporary works along the public road to facilitate the turbine deliveries with one blade changeover area.

The proposed project is located mostly within a Gaeltacht (Ghaeltacht Dhún na nGall).

Table 5-2: Population Density 2016

Area	Population Density 2016 (persons/km^2)
State	27
Donegal County	33.4
Glenleheen (Gleann Léithín) (33051)	1.9
Doocharry (An Dúchoraidh) (33046)	2.0
Lettermacaward (Leitir Mhic an Bhaird) (33059)	16.6
Church Hill (Mín an Lábáin) (33098)	5.9
Fintown (Baile na Finne) (33048)	8.6
Graffy (An Ghrafaidh) (33053)	2.0
Glenties (Na Gleannta) (33052)	17.6
Killybegs	76.4
Dunkineely	42.2
Eanymore	18.5
An Bhinn Bhán	3.5
Ard na Rátha	32.2
Study Area (average)	**18.9**

Property/Receptors

The locations of properties and buildings (referred to as receptors) in the vicinity of the proposed wind farm site have been identified using address data from the GeoDirectory database which is used to populate Eircodes.

The validity of the GeoDirectory data has been confirmed by way of publicly available mapping, aerial imagery, street-level imagery and a ground truthing survey carried out in July-August 2022.

All receptors within 2km of the site boundary have been identified and verified by means of the above desktop reviews and site surveys. This information is used to inform assessments within this EIAR, in particular for shadow flicker analysis (Chapter 10) and noise modelling (Chapter 12). A 2km buffer from the wind farm site boundary was used to ensure that those properties within reasonable proximity of the main wind farm infrastructure are defined, and it is an appropriate distance for the proposed turbine range. The locations of these receptors in relation to the proposed project are shown in Figure 5-3.

In addition, a search of planning applications within 2km of the wind farm site boundary was carried out (most recently in January 2023) to identify proposed developments and consented, but as yet not built, developments.

A total of 535 no. receptors from the GeoDirectory database, ground truthing exercise, and planning search were identified and are presented in Table 5-7 (provided as Appendix 5-1). Each receptor identified has been assigned an ID number (e.g., P123) for reference.

During the verification process, properties/buildings that would not be considered sensitive receptors (i.e. farm sheds, garages, commercial buildings, etc.) or that were not deemed habitable without requiring major works (e.g. no roof) to remedy were identified. Any developments submitted for planning or consented (but as yet unbuilt) developments were included, but any such properties that would not be considered sensitive as described above were omitted. From the planning search, any invalidated planning applications or consented (but unbuilt) developments where the expiry period for development had elapsed were excluded.

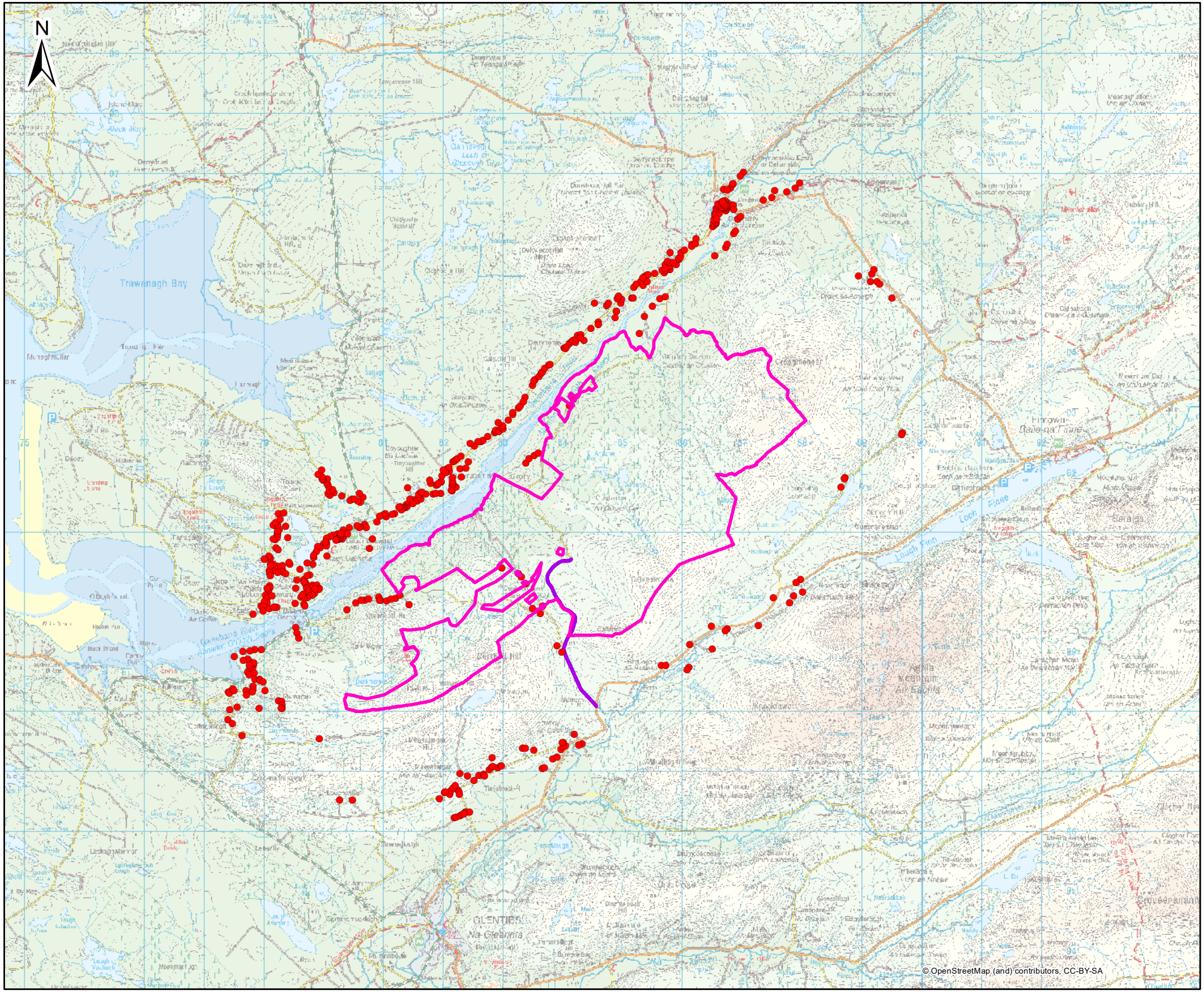
A more extensive planning summary in the context of potential cumulative effects was also carried out and is described in Chapter 4 (Policy, Planning and Development Context).

Table 5-3 presents a summary of the identified receptors. The closest sensitive receptor curtilage is located >880m from the nearest proposed turbine location which is in excess of the minimum setback requirement of 500m set out in the 2006 WEDGs. The 2019 Draft WEDGs recommend a minimum setback distance from a turbine to the curtilage of a residential property equal to 4 times the turbine tip height or 500m, whichever is largest. The proposed project includes for the installation of turbines with a tip height of between 185-200m, therefore (assuming the tallest tip height within this range of 200m) the minimum setback distance required in accordance with the 2019 Draft WEDGs is 800m. The proposed project complies with this requirement.

Table 5-3: Summary of Receptors Within 2km of Wind Farm Site Boundary

Receptor Type	No. Within 2km of Wind Farm Site Boundary
Residential Sensitive Receptors ('residential' and 'both' property types)[10]	505
Other Receptors (e.g. derelict or with condition/status unconfirmed) For the purpose of this assessment these were assumed to be sensitive (those that were derelict could be renovated to be habitable).	10
Commercial Properties	20
Total	**533**

[10] Properties designated as 'both' refers to a property with both residential and commercial elements; e.g. a farm in rural areas, or a commercial premises with residential accommodation, such as public houses and shops.



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Sensitive Receptors (Population & Human Health)

*all land identified is within Boundary of the Proposed Project

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Kilometres

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4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
A	06/03/2023	Final issue	S.P	J.S

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 5-3
Receptors within 2km of the Proposed Wind Farm Sitte

Scale @ A4: 1:80,000

Prepared by: S.Pezzetta | Checked: J.Staunton | Date: March 2023

Project Director: O.Fitzpatrick

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Draft: A

As part of the community engagement process and public consultation, the sensitive receptors identified in Table 5-7 (in Appendix 5-1), as well as other local residents up to 2km from the proposed wind farm, were the main focus of initial project engagement to inform them of the proposed project and to gather their feedback on the project. Further information on the public consultation process is provided in Chapter 1 (Introduction).

Property Values

Data available from the CSO on property values is presented in terms of Eircode Routing Key areas. The proposed wind farm site is located within one Eircode Routing Key boundary, namely F94: Donegal. In August 2022, the CSO published the Residential Property Price Index (RPPI) data for the 12-months to June 2022[11]. The CSO stated that the *"RPPI has reached the value of 163.6 points for June 2022, which is equal to its highest level recorded at the peak of the property boom, in April 2007"*. The RPPI shows that residential property prices rose by 14.1% in the 12-months to June 2022, with the lowest median price paid for a dwelling in Longford (€140,000), and the highest in Dún Laoghaire-Rathdown in Dublin (€605,000). The RPPI shows that the median price of residential properties sold in the F94 Eircode area in Donegal was €150,000. The national median price for a dwelling purchased in the 12-months to June 2022 was €290,000[12].

Employment/Economy

Employment is an important indicator of the economic standing of an area. This section examines employment status and unemployment levels in the region of the proposed project. The Labour Force Survey undertaken by the CSO provides details of unemployment on a regional level. Donegal is located in the Northern & Western Region (IE041)[13]. The Northern & Western Region is also further broken down into Border (Cavan, Donegal, Leitrim, Monaghan, Sligo) and West (Galway, Mayo, Roscommon). Data for the Northern & Western Region and Border Region has been used to illustrate unemployment in the area.

Table 5-4 illustrates the findings from the Q1 2022 Labour Force Survey published by the CSO[14]. The first case of Covid-19 was reported in Ireland at the end of February 2020 and measures required in accordance with the public health guidance were introduced on 12 March 2020. As a result, the Labour Force Survey statistics from Q1 2020 toQ1 2022 are affected by the crisis. Therefore, over the past two years employment figures have fluctuated since the beginning of the Pandemic due to public health measures including lockdowns and business closures.

The unemployment rate in Table 5-4 is the number of unemployed persons expressed as a percentage of the total labour force (aged 15-74). The unemployment rate for the State in Q1 2022 was 4.8%, while the unemployment rate for the Northern & Western Region was 4.1% showing that unemployment in the region (in Q2 2022) was lower than the State.

The unemployment rate for the Border Region was 4.8% showing that unemployment in the region (in Q2 2022) is in line with that of the State.

[11] https://www.cso.ie/en/releasesandpublications/ep/p-rppi/residentialpropertypriceindexjune2022/housepricesbyeircode/ (Accessed on 15 August 2022)
[12] https://www.cso.ie/en/csolatestnews/pressreleases/2022pressreleases/pressstatementresidentialpropertypriceindexjune2022/ (Accessed on 15 August 2022)
[13] https://ec.europa.eu/eurostat/web/nuts/nuts-maps - NUTS 3 – Nomenclature of Territorial Units for Statistics (NUTS) created by Eurostat
[14] https://www.cso.ie/en/releasesandpublications/ep/p-lfs/labourforcesurveyquarter12022/ (Accessed on 11 August 2022)

The participation rate is the number of persons available to the labour force (i.e. persons from 15-74 years old either working or looking for work) expressed as a percentage of the total population. In Q1 2022, the participation rate in the State was 64.8% compared with 62.3% in the Northern & Western Region, and 60.9% in the Border Region.

Table 5-4: Labour Force Survey (Q1 2022)

Location	Unemployment Rate	Participation Rate
State	4.8%	64.8%
Northern and Western Region	4.1%	62.3%
Border Region	4.8%	60.9%

The CSO also publishes figures relating to the Live Register. These figures are not strictly a measure of unemployment as they include persons who are legitimately working part-time and signing on part-time. However, the Register can be used to provide an overall trend within an area.

The data in Table 5-5 show that over the 12 month period to July 2022, there was a 9% increase in the number of persons on the Live Register[15] in the State as a whole and a 9% increase in the number of persons on the Live Register in the Northern and Western Region. The Northern and Western Region is further broken down by Border and West; Donegal is situated within the Border Region, which experienced a 10% increase in the number of persons on the Live Register between July 2021 and July 2022. Overall, there is an increasing trend in Live Register figures, the latest figures indicating a need for further employment in the Border Region, including County Donegal.

Table 5-5: Live Register Figures (July 2021 – July 2022)[16]

Location	July 2021	July 2022	% Change
State	184,213	196,700	+9%
Northern and Western (Border and West)	34,292	37,821	+9%
Border	17,843	18,184	+10%

Chapter 4 of the Donegal CDP 2018-2024 sets out the Economic Development strategic aim for Donegal County which is *"To provide for the appropriate growth of economic development and employment opportunities across all sectors in accordance with the Core Strategy and the ambitions of the North West City Region initiative and consistent with the principles of proper planning and sustainable development"*.

At a strategic level within County Donegal, the CDP has identified a number of areas and opportunities for development under the Economic Development Strategy, including:

- Relationship with the Core Strategy and Settlement Hierarchy;
- The Retail Strategy;
- Availability of Land and Infrastructure;
- The Rural Area;

[15] https://www.cso.ie/en/releasesandpublications/er/lr/liveregisterjuly2022/
[16] https://www.cso.ie/en/releasesandpublications/br/b-lfs/labourmarketinsightbulletinseries11q12022/

- Interagency Liaison and Collaboration;
- Town and Village Renewal: As A driver of Economic Opportunity.

Some of the relevant policy objectives identified in the Donegal CDP in support of the above are:

- ED-O-1: To facilitate cross-border collaboration and to enable and sustain regional economic, cultural and social development opportunities.
- ED-O-2: "To ensure that sufficient land is provided at appropriate locations for employment generating uses and that such land will be protected from inappropriate development that would prejudice its long-term development."
- ED-O-3: "To facilitate and direct appropriate employment generating developments into the Gateway centre of Letterkenny and the Strategic Support Towns, and to support the economic development of smaller towns and villages throughout the county."
- ED-O-5: "To promote appropriate rural economic development by encouraging diversification that supports the growth of emerging rural enterprises functionally related to the countryside."
- ED-O-9: To maximise the appropriate development of the county's renewable energy resources and to support and facilitate the creation of a sustainable local renewable energy market place in Donegal from where energy operators can transport, store, trade and export their "local renewable energy product" to domestic and non-domestic markets subject to environmental designations and amenity considerations.

The Donegal CDP acknowledges that the green economy will provide opportunities for investment and employment creation in emerging sectors such as renewable energy, energy efficiency and waste and water management.

In addition, the CDP states "*There remains a need to attract opportunities for employment to replace jobs lost during the recession across all sectors including the construction, manufacturing, textiles, retail, agricultural and fishing industries and a need to examine the potential to develop the County as the lead area for the green economy as well as for the growth areas of Internationally-Traded Services, higher value added food production and tourism*".

Tourism

The National Tourism Development Authority (Fáilte Ireland) periodically collates statistics on overseas visitors to Ireland and regions within the country.

Table 5-6 shows the most recent overseas tourism statistics from 2018[17] and 2019[18] for the country and the Border Region, which includes County Donegal. Tourism figures for 2020 and 2021 would have been severely affected by the Covid 19 pandemic, and would not be reflective of the post-pandemic situation.

[17] https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/Key-Tourism-Facts-2018.pdf?ext=.pdf (Accessed on 08 August 2022)
[18] https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/KeyTourismFacts_2019.pdf?ext=.pdf (Accessed on 08 August 2022)

Table 5-6: Overseas Tourism Statistics 2018 & 2019

Location Travelled To	Tourist No.'s	Revenue Generated
Ireland (2019 – preliminary)	9,674,000	€5,174 million
Border Region (2019)	768,000	€259 million
Ireland (2018)	9,609,000	€5,217 million
Border Region (2018)	752,000	€244 million

In relation to domestic tourism (tourism involving residents of one country traveling only within that country), the Fáilte Ireland 2019 data reports 11.6 million domestic trips in 2019, an increase of over 6.4% on 2018. The majority (40%) of domestic trips were recorded as short (1-3 days) holiday trips, with trips to visit friends/relatives reported at 33% of all domestic trips.

Most of these trips are shown to occur in the late summer period (July – September) with the majority of domestic holidaymakers engaging in hiking/walking (46%), followed by visits to Houses/Castles (27%), National Parks (26%), and Gardens (23%) being the other top activities engaged in by domestic holidaymakers.

Fáilte Ireland statistics for 2017[19] show that County Donegal attracted 255,000 overseas visitors making the county the 11th most popular county for overseas visitors. The county supported 376,000 domestic trips in that year (Failte Ireland, 2017).

Donegal has some of Ireland's most highly visited tourist attractions with three included in Failte Ireland's list of popular visitor attractions in Ireland (Failte Ireland, 2017)[20]:

- Glenveagh Castle and Grounds (211,000 visitors);
- Malin Head Viewing Point (172,329 visitors); and
- Sliabh Liag Cliffs (164,546 visitors).

Glenveagh Castle and Grounds is the closest of these three visitor attractions, located c. 20km northeast of the proposed wind farm site, with the other two sites noted, Sliabh Liag and Malin Head, c. 30km and c. 75km away respectively.

Donegal[21] is also situated along Ireland's Wild Atlantic Way. The Wild Atlantic Way is a tourism initiative which takes in a 2,500km touring route stretching along the Atlantic Coast from Donegal to West Cork with 181 Discovery Points, 21% of which are located in County Donegal, and 15 signature discovery points, 3 of which are in County Donegal. The Wild Atlantic Way initiative centres around the brand of '*Where the wild Irish land and seascapes meet – the world's longest defined coastal touring route*'. It is aimed at those who '*want to experience an off the beaten track experience that genuinely immerse them in multiple ways so that they feel stimulated energised and uplifted'* (Tourism Development and Innovation: A Strategy for Investment 2016-2022, 2016)[22] and is based around the three overarching themes:

[19] http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/2_Regional_SurveysReports/2017-topline-regional-performance-(003).pdf?ext=.pdf (Accessed on 09 August 2022)
[20] https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/5_International_Tourism_Trends/Tourism-Facts-2017_2.pdf?ext=.pdf (Accessed on 09 August 2022)
[21] Discover Ireland – Cultural County Donegal. www.discoverireland.ie/donegal (Accessed on 09 August 2022)
[22] https://www.gov.ie/en/publication/57ace4-tourism-development-innovation-a-strategy-for-investment-2016-2022/ (Accessed on 09 August 2022)

- Spirit of Adventure (Adventure);
- Life Shaped by the Atlantic (Culture); and
- Where Land and Sea Collide (Landscape and Seascape).

The CDP summarises the strategic objectives of the Wild Atlantic Way as to:

- Generate and sustain economic opportunity and economic development.
- To-repackage the Atlantic seaboard as a destination to overseas and domestic visitors and establish a destination brand and touring route product of sufficient scale and singularity.
- Increase in visitor numbers, dwell time spend and satisfaction.
- Increase visitor numbers to less visited areas and encourage better visitor management in areas achieving greater visitor numbers.
- Improve linkages between and add value to a range of attractions and activities (and experiences)
- Reinforce the particular strengths and characteristics of the key destinations along the route.
- To ensure that the wild Atlantic Way is delivered in accordance with the principles of sustainable tourism.

Donegal has some of the wildest coastal scenery, including 3 signature discovery points, Sliabh Lag, Cionn Fhánada (Fanad Head), and Malin Head, and benefits from key related attractions such as Glenveagh National Park. Being a relatively undiscovered stretch of the route, Donegal is well placed to take advantage of the opportunity presented by the Wild Atlantic Way. Donegal CDP highlights how the success of this tourism initiative and recent media exposure (such as being voted the Coolest Place on the Planet for 2017 by National Geographic Traveller Magazine) has marketed Donegal as being "*on a par with other destinations, significantly raised market awareness both for overseas and domestic visitors, resulted in a growth in visitor numbers in recent years and thus presents a unique opportunity for significant further growth*".

A section of the Wild Atlantic Way route passes close to the proposed wind farm site, along the N56, between Mulnamina More, crossing Gweebarra Bridge, through Lettermacaward and Meenderry before continuing northwards towards Cloughwally.

The Donegal CDP states that "*this Plan aims to strengthen rural communities by supporting agricultural-diversification, tourism and opportunities for rural economic development of an appropriate nature and scale, where local employment opportunities can be provided*" and includes amongst its strategic aims:

Strategic Objective S-O-4 of the CDP is: "*to support the development and implementation of a sustainable economic model for County Donegal embracing growth in areas such as innovation, research and development, County Donegal Development Plan 2018-2024 Part A: The Strategic Plan Chapter 1: Introduction and Vision Page 9 rural diversification, tourism initiatives, energy advances and the promotion of sustainable start up enterprises and as an integral component of accelerating the socio-economic growth in the North West".*

The CDP states its core aim in relation to Tourism is: *"To enable Donegal to compete as a world class tourism destination by protecting key tourism assets and supporting the sustainable development of new and existing tourism products and attractions*".

As mentioned, Donegal is located in the Border Region. The County shares 181km of border with Northern Ireland (adjoining the Councils of Derry City and Strabane and; Fermanagh and Omagh) and a further 11km of border with County Leitrim as well as 65 road crossings (58 with

Northern Ireland, 7 with County Leitrim) which include a number of important strategic transport connections (Donegal CDP, 2018).

The CDP discusses the "border dimension" in relation to County Donegal and how this has "*impacted on and shaped day-to-day social and economic activities as well as higher level strategic policy formulation, implementation and investment"*. The CDP considers the entire extent of the County as coming within the impacts of the border dimension. The CDP outlines the "*Characteristics of The Border Dimension*" and includes the following in relation to tourism:

***2B.2.9**: "County Donegal evidences a successful and strengthening tourism sector accounting for three times as many visitors as DC&SDC* [Derry City & Strabane District Council]. *Substantial work to develop visitor attractions, visitor experience and accommodation is continuing including full engagement in the promotional and marketing strategy of the WAW. The improvement of connectivity, including cross-border greenways is important in supporting visitor access to the region".*

Strategic Objectives related to the Border Dimension include:

***TOU-O-8**: "To support the development of and protect the functionality of key tourism access infrastructure into and throughout the county such as roads infrastructure (including the A5 Dublin to Derry Road, the Atlantic Corridor and the N56), Air Infrastructure (including Donegal Airport, City of Derry Airport, and Knock/Ireland West Airport) and Sea access (including port infrastructure at Killybegs and ferry infrastructure throughout the County)".*

***TOU-O-15**: "To collaborate with relevant tourism bodies and local authorities in Northern Ireland to unlock the full tourism potential of the North West cross border region".*

The CDP outlines the following Strategic Objective in relation to Economic development and tourism:

ED-O-7: "*To facilitate the appropriate development of tourism throughout the County through the support of sustainable tourism projects and the promotion of creative industries as a resource subject to environmental, heritage, infrastructure and amenity considerations".*

5.3.2 Human Health

Evidence shows that different communities have varying susceptibilities to health impacts both positive and negative as a result of social and demographic structure, behaviour and relative economic circumstance. Whilst specific health data for individuals in the vicinity of the proposed project is confidential and difficult to establish, as has been detailed in Section 5.2.2, a community profile has been identified to establish the baseline health profile of the area and compare this profile to the rest of the country.

A group made up of the Health Services Executive (HSE) and the Irish Health Repository (IHP), known as Lenus, have published separate health profiles for all the Local Authorities areas in Ireland. The most recent County Health Profiles published are from 2015[23] (Lenus, 2015) and have been used to establish a community health profile for the County Donegal area in which the proposed project is situated.

The key facts in the 2015 Health Profile relating to County Donegal are:

[23] https://www.lenus.ie/bitstream/handle/10147/584046/Donegal.pdf;jsessionid=C781D96A6E864DD9F98022E7ED791AFB?sequence=1 (Accessed on 08 August 2022)

- Donegal has the second highest dependency ratio i.e. the number of those aged 0-14 and 65 and over as a percentage of the total population - 56.9% (national of 49.3%);
- It is the second most disadvantaged local authority area in Ireland, 94% of its population is below average levels of affluence or disadvantaged;
- It has the largest proportion of population with no formal or primary education only at 24.9% (national rate 15.2%);
- Donegal has low birth rate of 13.1 (national 15.8) and one of the lowest breast feeding rates of 33.3% (national rate 46.6%);
- For males and females the incidence of malignant melanoma in Donegal is lower than the national average. It has the lowest national rate for male colorectal cancer but the rate for female colorectal cancer is above the national rate;
- Donegal has the lowest rate of mortality for deaths due to injuries and poisoning for all ages.

It is important to realise when viewing these figures that they relate to the entire administrative area of County Donegal and a population of 161,137 in the 2011 Census. While we can take this published data as being correct, it may not necessarily accurately reflect the health profile of smaller areas which are within the study area and close to the proposed project.

In 2020, the Central Statistics Office (CSO) published it's second "Irish Health Survey"[24], the data for which was collected in 2019 and early 2020. The first survey was collected for reference year 2015. This publication is part of an EU wide health survey and as other EU countries report on their data, it will be possible to compare how the Irish health experience compares to that of our EU neighbours. Some key findings of the survey included:

- *"Affluent people are more likely to feel their health status is Very good or good than people who are disadvantaged - 92% of Very affluent persons compared to 78% of persons who are Very disadvantaged;*
- *Over a quarter of persons aged 15 years and over report having a long lasting condition, with older persons reporting higher levels;*
- *Majority of persons (82%) report no limitations in everyday activities due to a health problem;*
- *Over a fifth (21%) of Unemployed persons report some form of mental ill-health compared to 9% of those In employment;*
- *Prevalence of hospital in-patient admissions rises with age and disadvantage level;*
- *In general, females and older people more likely to use a preventive health service;*
- *Physical activity declines with age and relative disadvantage level;*
- *Younger persons more likely to drink 6 or more units of alcohol in one sitting; and*
- *Over half of persons aged 15 years and over in the State are overweight or obese" (CSO 2020).*

The Census 2016[25] responses regarding general health[26] found that 87% of the Ireland's population felt they had 'Very Good' or 'Good' health, down slightly from 2011 when it was

[24] https://www.cso.ie/en/releasesandpublications/ep/p-ihsmr/irishhealthsurvey2019-mainresults/introductionandkeyfindings/

[25] https://www.cso.ie/en/csolatestnews/presspages/2017/census2016profile9-healthdisabilityandcarers/

[26] https://www.cso.ie/en/statistics/health/

88.3%. Nearly six in ten or 59.5% of men felt their health was 'Very Good', compared with 59.3% of women. The census results also clearly show the decline in general health with age, with 79% of 15-19 year olds in 'Very Good' health, compared with those aged 40-44 (58.6%) and 65 to 69 (31.3%). Census 2016 responses for Donegal indicated the percentage of persons with 'Very Good' and 'Good' health was 85.6% (67,564 Males / 68,624 Females), while 9.84% indicated they were in 'Fair' health, and 1.81% (1,376 Males / 1, 498 Females) indicated they were in 'Bad' to 'Very Bad' health. The 2016 census also indicated that there are 22,955 (11,339 Males / 11,616 Females) with disabilities living in Donegal, and that there are 7,211 (2,771 Males / 4,440 Females) carers in the County.

The map of deprivation included in the County Health Profile shows that the area in which the proposed project is situated is disadvantaged as shown in Figure 5-4: Map of Levels of Deprivation in County Donegal (Source: Extract from Health Profile 2015 Donegal).

A review of latest deprivation indices (2016) by ED available from Pobal[27], shows that the ED in which the proposed wind farm is situated is disadvantaged, with the surrounding EDs ranging from marginally below average to disadvantaged and very disadvantaged.

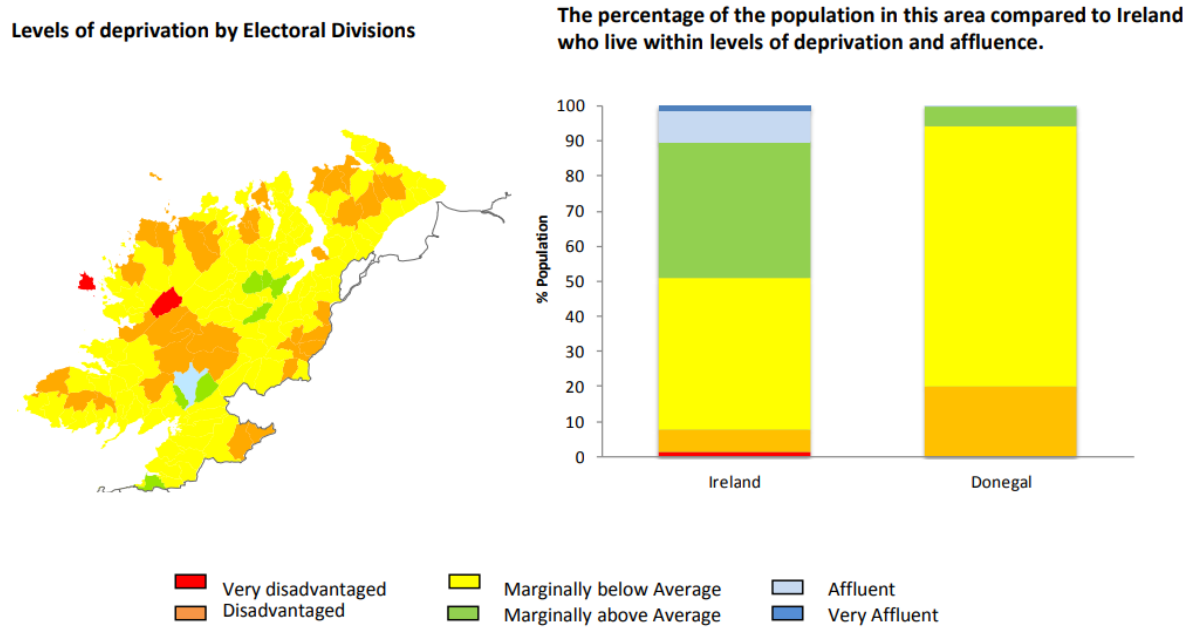

Figure 5-4: Map of Levels of Deprivation in County Donegal (Source: Extract from Health Profile 2015 Donegal)

As outlined previously, it is not possible or necessary to identify every vulnerable individual. However, every human community contains vulnerable individuals; be those the old, the very young or because they have conditions which may make them more susceptible. Examples are as diverse as humans themselves but can include asthma, autism, and those with psychological illness. It is important to note that Health Standards are set for the vulnerable and not for the robust.

[27] https://maps.pobal.ie/WebApps/DeprivationIndices/index.html - Pobal administers and manages Government and EU funding to address disadvantage and support social inclusion

The emergence of the Covid-19 virus in Ireland in the early part of 2020 has presented a new human health risk and concern amongst the general public across the country and within the proposed project study area. Public health measures, including varying levels of restrictions, have been implemented since 2020 and the medium to long term effects of the virus on national and local human health is not currently known. The existing environment in terms of Covid-19 impact is in flux and the public health advice requires cognisance to be taken of potential restrictions and all measures required to prevent the spread of the disease.

5.4 POTENTIAL EFFECTS

5.4.1 Do Nothing Effects

In the Do-Nothing Scenario, the existing lands will continue to be utilised for forestry purposes with little or no changes in the baseline at the site. Activities such as periodic tree felling will continue with the movement of equipment and personnel associated with same. The current land practice will allow for only limited use of the site by the community and public.

The opportunities for local employment and additional economical spend from the proposed project will not be realised.

In the Do-Nothing Scenario, there will be no emissions generated from construction works and no potential for noise, shadow flicker or visual effects associated with wind turbines at this site.

The health benefits to the country associated with replacing fossil fuels with renewable wind energy from the proposed project will be lost and alternative candidate sites will need to be identified, either onshore or offshore, to ensure Ireland meets it commitments to reducing carbon emissions.

5.4.2 Population

5.4.2.1 Construction Phase

Land Use

The construction of the proposed project will involve long-term land use change primarily for the excavation of borrow pits and the construction of access roads, turbine hardstandings, site compounds and substation. The construction itself may have short term slight negative effect on the forestry operations within the site. There will also be a short-term, negative effect due to the forestry felled for the construction compounds, which will be returned to forestry use on completion of the construction works which is anticipated to last for c. 24 months. The access roads and substation will remain in place indefinitely which will have a permanent positive effect on forestry land-use, improving access to the commercial crop while the hardstandings will be reinstated after the operational phase.

Population Trends

A report by Wind Energy Ireland (WEI) on the economic impact of onshore wind in Ireland[28] identified that the wind energy sector currently supports 5,130 jobs[29] throughout the sector and its supply chain and has the potential to grow jobs throughout the sector and its supply chain to 7,020 jobs, supporting the delivery of Ireland's target to deliver 80% renewable energy in Ireland by 2030, as set out in the Government's Climate Action Plan.

In terms of the population within the area of the wind farm site, the effect of these jobs on local population levels is likely to be a short-term increase in construction workers staying in local accommodation in the area over the period of c. 24 months which will add value to the local economy. The proposed project is not anticipated to have any negative effect on the use or promotion of Irish language in the area during the construction phase. Should the community benefit fund be utilised to sponsor Irish language projects, the proposed project would potentially result in a positive use and promotion of Irish language.

This would be a positive direct short term effect as a result of the proposed project being constructed.

Property/Receptors

Access to the proposed wind farm site will be via a new site entrance onto the L6483 local road via the R250 regional road and via a second site entrance (to be used as a construction phase site exit) on the L6363 local road via the R252 regional road. The potential traffic effects are discussed in detail in Chapter 16 (Traffic and Transportation).

Negative effects on residential properties and the local population as a result of the construction works, which will include increased traffic movements, increased potential for local noise and air quality (including dust) emissions as well as potential for the works to impact on local residents' enjoyment of their homes (i.e. residential amenity). The haul roads proposed are existing public roads which are already used by heavy goods vehicles (HGVs), however there will be a short-term increase in effects during the construction phase due to the increased vehicle trips and on-site construction activity. The design of the proposed project has included a minimum set-back distance of c. 885m (which is greater than 4 times the tallest tip height being considered) between the curtilage of all sensitive residential receptors (or c. 925m minimum from houses) and the proposed turbine locations, which will reduce the potential for the construction of the wind turbine infrastructure to have a significant effect on residential amenity. The closest borrow pit location is c. 635m from a sensitive residential property and onsite access road works will take place at a minimum distance of c. 277m from the nearest sensitive residential property. There will be some additional works required off site for the turbine delivery route, however these are small scale and transient in nature. They may result in temporary localised noise and dust emissions, and there may also be some traffic management implications for road users. Although these TDR works will be located near sensitive receptors, they will be similar to any other normal road works that might be carried out. These effects are assessed in detail in the Chapter 9 (Air Quality and Climate) and Chapter 12 (Noise and Vibration).

[28] https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf

[29] This figure does not include employment in grid development by some players and is therefore a conservative estimate (WEI, 2021). https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf

Based on the above predicted effects to residential amenity (including noise, dust and roads), the construction phase will likely have a moderate, negative effect on the local population and will be short-term in nature.

Property Value

It is not anticipated that the construction works for the proposed project will have any significant effect on the local property values. A major UK study entitled *The Effect of Wind Farms on House Prices* carried out in March 2014, discussed in more detail in Section 5.4.1.2, noted that *"The econometric analysis established that construction of wind farms at the sites examined across England and Wales has not had a detectable negative impact on house price growth within a 5km radius of the sites"*.

Although there have been no similar studies carried out in Ireland regarding the effects of wind farm construction on property value, it is reasonable to make the above assumption, based on the available published studies presented in Section 5.4.1.2.

Construction works for the wind farm will be carried out within the site boundary and construction traffic travelling to the site will use existing public roads. The grid connection will be contained within the wind farm site, only crossing a local road at one point, and the works along the turbine delivery route will be localised, relatively minor and temporary.

Based on the above, there are no anticipated effects on property value in the area of the wind farm site.

Employment/Economy

The proposed project will create and support direct and indirect employment during the construction phase at local level, primarily through local construction workforce on site, and at a national level, through more specialised construction services and supply of building materials. It is anticipated that the wind farm will have the following effects locally:

- Development activities such as site monitoring/surveys, site investigations, legal fees, consultancy studies during pre-construction and construction works, etc.;
- Spending locally by construction employees; and
- Accommodation and sustenance will be required in the locality for those workers on site.

Guidance from a 2009 IWEA study[30] states "*Our analysis has shown that the wind energy sector in Ireland can support 1.50 jobs per MW to be installed on the island*". Based on the proposed project capacity of between 95-136.8MW, this equates to between approximately 142-205 jobs across a number of different sectors. The study (from 2009) estimated that 68% of the Irish jobs created are in the construction industry. It is therefore estimated that between 96 to 139 persons will be directly employed during the peak construction period.

The area will experience a benefit from secondary investment associated with increased visitors and spend within the area. An ESRI report entitled *An Enterprising Wind: An Economic Analysis of the Job Creation Potential of the Wind Sector in Ireland* (2014) estimates the level of indirect job creation to be between 0.15 and 0.55 jobs per direct job created. Construction materials such as quarried products and concrete supplies can be sourced locally and will support local business. Throughout the construction phase, there is potential that plant, equipment and associated operatives can be sourced locally. Indirect employment

[30] IWEA and Deloitte, *Jobs and Investment in Irish Wind Energy: Powering Ireland's Economy* (2009)

opportunities will be created in the region through increased quarrying activity and off-site concrete batching as well as potential increased employment in the local hospitality and café/restaurant industries driven by use of the facilities by construction staff. The *Value of Wind Energy to Ireland* (Pöyry, 2014) report states that *"the wind industry would make a valuable contribution to the Irish economy by …providing a good platform for continued growth during the 2020s compounding the benefit to the economy"*. It also states that wind farm developments in Ireland, such as the proposed project, have the combined potential to support 10,120 jobs (person-years) during construction between 2020 and 2030.

As previously mentioned, the 2021 WEI report on the economic impact of onshore wind in Ireland identified that the wind energy sector currently supports c. 5,130 jobs throughout the sector and its supply chain and has the potential to grow jobs throughout the sector and its supply chain to c. 7,020 jobs. The WEI states that *"the sector creates direct jobs through its direct activities, indirect employment in particular through capital activities, such as in legal and financial advisory roles and in firms involved in storage, electrical supply, related services, and induced employment, through spend by direct employees in local shops"*.

Currently, the sector supports payment of labour incomes equalling €225 million, with a significant share flowing to rural communities through its direct and indirect activities and employment (WEI, 2021). Approximately 62% of labour income in the wind energy sector is generated from the supply chain, demonstrating how the sector can impact / result in wider employment (WEI, 2021). Furthermore, the sector contributes to the generation of a range of pay-related taxes totalling approximately €75 million, with employer PRSI over €25 million, while income-related payments by workers throughout the supply chain amounts to over €50 million (i.e., €40 million in income tax and €10 million in Employee PRSI) (WEI, 2021).

In terms of onshore wind impacts on regional and rural economic activity in Ireland, the WEI's key findings include:

- *"Wind farms in Ireland are predominantly focused in the regions, which results in the investment, economic activity and employment predominantly being based outside of the major urban areas. It is viewed as a critical component contributing to the current and long term economic development of regional and rural areas.*
- *Baseline (2020) wind farm generation capacity influences regions' relative contribution to overall economic impact. Currently, as a share of the Gross Value Added (GVA) impacts of operating activities, the Southern Region generates the greatest capacity and national impacts (~€83 million), followed by the Northern and Western Region (~€50 million), and the Eastern and Midlands Region (~€7 million). The Baseline contribution highlights the spread of impacts across Ireland.*
- *The sector provides a stable source of revenue for many local authorities, with total contributions of ~€45 million annually, and providing local authorities with a valuable source of revenue that can be reinvested in local communities. As the sector's footprint grows over the next decade to 2030, its financial contribution to many local authorities will also increase and has the potential to reach €100 million by 2030.*
- *Total baseline local authority contributions are greater than €5 million in a number of counties (e.g. Cork County and Tipperary). In some counties, contributions can also account for a strong share of local authorities' total commercial rates income (e.g. 22.0% and 15.5% of total income in Leitrim and Tipperary respectively)".*

The Cloghercor Wind Farm will also make a valuable contribution to Donegal County Council's economic aims for further development of its green economy.

The construction of Cloghercor Wind Farm will have an estimated capital cost in the region of between €123.5 million to €177.8 million[31] and an estimated 11% of the total capital cost will relate to site works[32] which has the potential to support local contractors and suppliers. The *Life-cycle of an Onshore Wind Farm* published by IWEA in March 2019 stated that *"One recent 169MW windfarm project estimated that €20 million was spent with local suppliers and contractors within 30 kilometres of the site during construction"*.

As a result, the construction phase of the proposed project will have a short-term, slight and positive effect on employment and the economy in the local area and the Northern-Western Region.

Tourism

As set out in Section 5.3.1, there are a number of relevant tourism attractions and public amenities in the vicinity of the study area including part of the Wild Atlantic Way route along the N56, walking/hiking trails, the Gweebarra River Estuary, and Glenveagh National Park.

No designated tourist sites or walkways/trails were identified as intersecting with the wind farm area.

Occasional/temporary traffic effects due to movement of project vehicles and plant/machinery and the requirement for abnormal loads related to the delivery of the turbines to site may impact local road traffic during the construction phase. Abnormal loads will occur at set times and along designated routes. Potential for effects to local traffic and visitors to the area will be short-term, intermittent, and not significant.

No other direct or indirect effects on tourist or recreational attractions are predicted. Measures to be employed by the appointed Contractor during the construction works to ensure the health and safety of tourists and the general public are outlined in the Construction Environmental Management Plan (CEMP) in Appendix 2-2.

It is predicted that the proposed project will have a slight, short-term and negative effect on local tourism during construction due to the increased road traffic movements during the construction period (See Chapter 16 (Traffic & Transport).

Biodiversity Enhancement Lands

This EIAR chapter considers the biodiversity enhancement lands for the project, however it is considered that as this element of the project is limited to guiding a particular future land management style (with no excavation or construction required), this project element in particular will have no impact on Population and Human Health.

5.4.2.2 Operational Phase

Land Use

The proposed project will involve permanent works on the existing land primarily including turbine foundations, hardstand areas at turbines, internal roads and an on-site substation. The

[31] Using an average investment cost of €1.3 million per MW – SEAI, *A Macroeconomic Analysis of Onshore Wind Development to 2020* (2015)

[32] Irish Wind Farmers Association - FAQ | Meitheal na Gaoithe Irish Wind Farmers Association (mnag.ie)

proposed infrastructure will cover an area of 27ha within the proposed wind farm site area of 1945ha, which represents only 1.4% of the total. The forestry land use within the infrastructure area will be lost (with the exception of the temporary construction compound areas which will be replanted post construction), however replacement forestry lands will be planted elsewhere in the state. There will be a recreational amenity facility created at the site, and there will be a wind farm located on the site, producing clean renewable energy which will have a long-term moderate positive effect on land use.

Overall the proposed project will have no significant negative effects, and some positive effects on the existing land use at the site during the operational phase.

Population Trends

It is not anticipated that the proposed project will have any significant effect on the current population trend in County Donegal or locally as there are no notable studies that support this. The improved facilities within the wind farm site and surrounding the proposed project which will be supported by the significant community benefit fund could make the local area attractive for people to move to. The proposed project is not anticipated to have any effect on the use or promotion of Irish language in the area during the operational phase.

A survey of the public perception of wind power in Scotland and Ireland carried out in 2003/2004 by researchers at the School of Geography & Geosciences, University of St. Andrews, Fife and The Macaulay Institute, Aberdeen (2005) found that large majorities of people are strongly in favour of their local wind farm and that positive attitudes to wind power increase through time and with proximity to wind farms. Retrospective questioning regarding pre- and post-construction attitudes at existing wind farms noted that those who changed to a more positive attitude following construction of the wind farm, gave reasons that the wind farm is *"not unattractive (62%), that there was no noise (15%), that community funding had been forthcoming (15%) and that it could be a tourist attraction (8%)"*.

Therefore, the operational phase is expected to have an imperceptible effect on population trends.

Property/Receptors

The turbine layout at the proposed wind farm has been designed with cognisance of the local population and receptor locations. In accordance with the 2006 WEDGs, there are no turbines located within 500m of a residential property. The draft 2019 WEDGs recommend a minimum setback distance of four times the tip height from a proposed turbine to the curtilage of any residential property and the proposed project complies with this recommendation. A minimum setback distance of 800m has been applied as this encompasses the full range of tip heights considered for this project x4 (i.e. 740m to 800m setback distance) and will therefore provide an adequate setback distance irrespective of which turbine is selected within the range.

Potential effects on receptors with regard to noise, traffic, telecommunications and visual appearance are assessed in the relevant chapters of this EIAR. The proposed project will offer local amenities and a community project fund which will be positive for local residents. There will be a potential for noise, visual effects and low levels of additional traffic on local roads (accessing the amenity facility and for site maintenance). In general, there will be a long term slight negative effect on local receptors.

Shadow Flicker

Chapter 10 (Shadow Flicker) discusses the shadow flicker phenomenon in detail and sets out the criteria which determine the occurrence of shadow flicker, which is summarised as:

- The presence of screening;
- The location and orientation of the property;
- The distance of the property from turbines;
- The presence of direct sunlight;
- The time of day and year;
- Wind speed;
- Direction of wind; and
- The presence of people.

Given the above requirements for the presence of a shadow flicker impact, it could be said that for the vast majority of the time at any given property, shadow flicker should not cause any issues from any given turbine irrespective of which turbine is selected within the range.

Modelling of predicted shadow flicker occurrence is presented in Chapter 10 (Shadow Flicker) and assessed against the current 2006 WEDGs. Cloghercor Wind Farm Limited is committed to exceeding the current guidelines requirements and ensuring there is no shadow flicker occurrence at any sensitive receptor in the vicinity of the site. This will be ensured through the mitigation measures set out in Chapter 10 (Shadow Flicker).

On this basis, following the implementation of the mitigation measures, there will be no shadow flicker occurrence at any sensitive receptor and, therefore, there will be no potential for an effect on residential amenity due to shadow flicker.

Property Value

A UK study, entitled *The effect of wind farms on house prices*, was carried out by the Centre of Economics and Business Research (Cebr) in March 2014. The key findings of the study were:

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

However, a similar study published in April 2014 by the London School of Economics (LSE) Spatial Economic Research Centre found an average reduction in the value of houses (based on 125,000 house sales between 2000 and 2012) of between 5% and 6% within 2km of very large wind farms.

These contradicting studies led to further research in Scotland in 2016 [33] which was based on analysis of over 500,000 property sales in Scotland between 1990 and 2014. This study, again, found no evidence of a negative impact from wind turbines on house prices and suggests that *"generally speaking the effect is either positive…or not distinguishable from zero"*.

The authors of the report tried to explain why the research carried out in Scotland found a very different result to that carried out in England even though the approach was very similar to that used in the LSE study. They suggested a number of possibilities including:

[33] ClimateXChange, *The impact of wind turbines on house prices in Scotland* (October 2016)

- Attitudes towards wind farms may be different in Scotland than in other parts of the UK;
- In Scotland, a much higher proportion of turbines are likely to be located on moors and mountains and in more remote areas than in England and Wales; and
- Some wind farms, especially in Scotland, enhance the local area by providing tracks for walkers, cyclists, horse riders and other members of the community, as well as substantial community benefit funds.

The proposed project will include for the creation of recreational amenities within the wind farm site and will provide a significant community benefit fund for the local area.

Large scale studies in United States have indicated that there is no conclusive evidence of any effect on property values located in close proximity to wind farms. A study entitled *A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States* by Lawrence Berkley National Laboratory in 2013, carried out sampling in over 51,000 homes across nine US states. The range of distances examined accounted for as far as 10 miles away (c. 16km), but also took into account 1,198 homes within 1 mile (c. 1.6km) of turbines.

Although there have been no similar studies carried out in Ireland regarding the effects of wind farms on property prices, it is a reasonable assumption, based on the available published studies, that the operation of a wind farm at the proposed location would not significantly impact on property values in the area.

The proposed project will have a neutral effect on property values during its operational phase.

Employment/Economy

Economic benefits from operational activities will include ongoing purchases of local materials, services and equipment required for the operational phase of the wind farm as well as local spend generated from technical operational staff.

The institute of Sustainable Futures (2015) estimates that the operational and maintenance job output for a wind farm is 0.3 jobs per MW of total installed capacity based on an average of 7 studies examined. SEAI's 2015 report 'A Macroeconomic Analysis of Onshore Wind Deployment to 2020' estimates 0.34 jobs per MW for operations and maintenance of new wind turbines and in the wider electricity supply sector. Although only a small proportion of these jobs are likely to be directly based in the wind farm site, it is likely that the indirect jobs the operational phase will support, such as consultants, research institutions, universities and financial services, will provide indirect jobs and benefit the wider employment profile. It is anticipated that there will be ongoing local employment on the site through the project operational phase for turbine servicing/maintenance, breakdowns/faults, inspections, substation maintenance, and maintaining the roads, drainage and other ongoing site work (2-3 full-time on-site jobs are assumed). There may occasionally be a requirement for additional people to visit site if a particular task requires it. . Some local employment or contract opportunities may develop over the lifetime of the wind farm from occasional less specialised activities.

According to the 2014 Pöyry Report, wind growth is expected to support €3.5 billion of direct investment to 2020, 1.2% of total Irish investment, and an additional €4.8 billion to 2030. The Pöyry Report was produced in 2014 and subsequent commitments in the Government's *Climate Action Plan*, published in 2019 and 2021, suggest that the investment in renewable energies, including wind, will be in excess of the above estimates.

The findings in *An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland* (IWEA, 2014) also suggests that *"a major programme of investment in wind could have a sizable positive effect on the labour market, resulting in substantial growth in employment. It would add noticeably to the GDP* [Gross Domestic Product] *and produce a significant improvement in debt/ GDP ratio by 2020"*.

The impact of the community benefit scheme is likely to significantly enhance the local economy, with potential for substantial funding for local projects in support of relevant UN Sustainable Development Goals, clubs, charities and near neighbours, which will be invested in the local area. The Renewable Energy Support Scheme also proposes a community investment opportunity although this was not realised in the first RESS scheme. The community benefit associated with the proposed project is discussed in Chapter 2 (Description of the Proposed Project). In addition, the project will require payment of rates to Donegal County Council which will provide additional revenue for their work around the county.

Positive economic effects will also be felt in the wider area due to the ongoing benefits of renewable electricity generation. The energy generated will feed directly into the national electricity transmission system, providing a sustainable electricity source and a low impact energy supply to the country's domestic and industrial consumers. This is a significant, positive long-term effect for electricity consumers.

The proposed project will have a long term moderate positive effect on employment and the local economy.

Tourism

The Fáilte Ireland Guidelines state that *"The impact upon tourism can be considered within this section through the sensitivities of hospitality, safety and pace of life. Changes in population can impact the perception of pace of life or safety in a particular location"*. The Guidelines also note that *"Impacts upon these issues in areas which rely heavily on tourism or have a particular sensitive tourism generator should be considered in this section"*.

In 2007, a collaboration between Fáilte Ireland and the Northern Ireland Tourist Board surveyed tourists' perceptions in relation to wind farms in the Irish landscape. A follow up survey in 2012, *Visitor Attitudes on the Environment: Wind Farms – Update on 2007 Research'* provided more recent information for the tourism and energy sectors. The results were positive, with 80% of tourists considering the presence of wind farms to have no impact or a positive impact on their sightseeing. In addition, when asked if further wind farm project in Ireland would influence their decision to holiday in Ireland again, over 70% of responses cited no impact or a positive impact on their return to Ireland.

Similarly, a 2016 study carried out by BiGGAR Economics '*Wind Farms and Tourist Trends in Scotland*'' examined the link, if any, between onshore wind energy development and the sustainable tourism sector in Scotland. The report did not find a direct relationship between tourism and the wind energy sector in itself; however it did conclude that the increase in wind farm development did not negatively impact employment in the sustainable tourism industry in Scotland.

As noted previously, there are a number of relevant tourism attractions and public amenities within the vicinity of the wind farm area including part of the Wild Atlantic Way route along the N56, walking/hiking trails, the Gweebarra River Estuary, and Glenveagh National Park. The proposed project will be visible from a number of these features in the area (as discussed in

Chapter 13 of this EIAR (Landscape and Visual Impact). As mentioned above, this visual impact is subjective and the proposed project is not anticipated to have a significant impact on tourism.

As part of the proposed project, it is proposed to:

- Develop a permanent public car park with seating/picnic tables at the end of the construction phase of the development; and
- Develop permanent recreational facilities including marked walking trails along the site access roads, and associated recreation and amenity signage with viewing points.

In this regard, it is considered that the proposed project will have a long-term, slight, positive effect on the tourism experience and numbers in the vicinity of the site given that the current amenity will be enhanced by the project and additional marked trails will be available to the public.

5.4.2.3 Decommissioning Phase

In terms of land use, the decommissioning of the wind farm after its operational life of 35 years will allow for the return of a portion of the lands to forestry, keeping the recreational amenity, in line with the prevailing uses adjacent to the site at that time.

Works required for decommissioning the wind farm will have similar short-term benefits (for the duration of the decommissioning works) to the local economy in terms of employment opportunities for local contractors and an influx of construction workers to the area contributing to the local economy.

The activities required to facilitate wind turbine decommissioning and removal from site will be similar to those outlined for the construction phase in terms of potential noise and air quality as well as increased construction traffic movements although these will be significantly lower than during the construction stage.

It is not anticipated that the decommissioning works will have any significant effect on local population trends, property value, tourism or the use/promotion of Irish language.

It is not envisioned that all elements of the proposed project will be removed – turbine bases in particular may be left in-situ, and simply covered in topsoil to revegetate, as this would be considered to have the least potential for environmental effect. Similarly, the substation will be retained, as it will form part of the transmission network, along with the internal access tracks which will be part of the future recreational uses and may be useful for access to other land uses (e.g. agriculture, forestry, etc.) following decommissioning of the wind farm.

5.4.3 Human Health

This assessment of the potential effect of the proposed project on human health is based on a comprehensive review of the relevant published literature on the subject. In this regard, it is important to assess the quality of available information reviewed. In general, studies which are published in peer-reviewed journals are the most authoritative. Peer-reviewed means that only those with reasonable scientific substance which meets the scientific criteria of experts in the field are published. Even within peer-reviewed journals, there are different qualities of studies. Studies which are merely based on questionnaires or other reporting of symptoms are of less value but may be useful in identifying areas for further study, particularly if they are linked with scientific measurements. Occasionally, opinion is published, without necessarily strong back-up, to stimulate discussion.

Wind and renewable energy is a subject on which there is a lot of opinion available on the internet, with wide ranging and often contradictory information. The following sections provide a summary of some of the available material in relation to potential effects of wind turbines on human health and an analysis of its scientific robustness.

5.4.3.1 Construction Phase

Air Quality and Dust Emissions

The construction of the turbine infrastructure and erection of the turbines will take place away from residential properties with at least >800m distance from the proposed turbines to all properties. Dust is typically predictable in its dispersion and studies show that the majority of dust deposition occurs close to its creation. The nature of dust creation and deposition depends on the type of works, ground conditions and weather conditions.

Good construction practice and mitigation measures in terms of dust control will minimise any potential effects and are discussed in more detail in Chapter 14 Air Quality and Climate and the CEMP (Appendix 2-2 of this EIAR). While in a construction project of this scale it is inevitable that there will be occasional dust generated, this is likely to be very localised in place and time. As detailed in Chapter 14, it is extremely unlikely that the construction activities will result in air quality standards being exceeded over any significant period of time in the environment outside of the construction site. It can, therefore, be stated with confidence that there will be no significant human health effects arising from emissions to air including dust generation.

By replacing fossil fuel burning power generation stations with clean renewable energy such as from the proposed project, there will be a positive overall effect on air quality in the country as a whole, and particularly in the regions where fossil fuel burning power stations are currently operational, as compared to a Do-Nothing scenario (i.e. where the wind farm is not built).

Health and Safety

All activities carried out by the appointed Contractor on the proposed project will be in accordance with the requirements of the *Safety, Health and Welfare at Work Act 2005* as amended and Regulations made under this Act. The CEMP sets out the Health and Safety requirements for the project including the erection of fencing, signage and notification of commencement of works to the Health and Safety Authority (HSA). This will apply to whatever final turbine dimensions are chosen from the entire proposed range of turbine dimensions.

The proposed turbine delivery route to allow for the transport of the turbines to the wind farm site will involve some works as discussed in Chapter 2 of the EIAR (Description of the Proposed Project). These works will be carried out to the relevant construction and road safety guidelines. When the turbine components are being transported, they will have a Garda escort, and will be carried out at night when there is less traffic on the road. The proposed turbine delivery works allow for the entire range of proposed turbine dimensions.

Assuming that the proper health and safety guidelines are adhered to throughout the construction phase, the potential effects here are anticipated to be short term and slight.

5.4.3.2 Operational Phase

Wind Turbine Health Effects

The term *Wind Turbine Syndrome* first appeared in 2009, when a New York Paediatrician, Dr Nina Pierpont (Pierpont, 2009), published a pamphlet she called *Wind Turbine Syndrome: A Report on a Natural Experiment*. The experiment comprised speaking on the telephone with 23 people who answered her advertisement asking if they lived near a wind turbine and if they ever felt sick. Fifteen of them said they had family members who would probably answer the question posed in the affirmative. Based on these personal assessments, Dr Pierpont claimed science proved her belief that wind turbines cause a vast array of maladies. This pamphlet was not published in a peer-reviewed journal and would be considered to more closely resemble a relatively unscientific opinion poll.

Entering the term *Wind Turbine Syndrome* into PubMed, a free resource providing access to life sciences and biomedical literature including a database which includes more than 30 million citations and abstracts of biomedical literature, there are only nine reported references[34]. Using key words *Wind Turbine Health* in the PubMed search engine, 233 articles were found[35]. This is still a relatively small number, but it is clear an increased number of medics/academics have studied this particular topic rather than attributing the term *Wind Turbine Syndrome* to their studies. A large number of these articles are concentrated on the potential effects of the sound/infrasound of the turbines which is discussed further in subsequent sections.

In terms of research on the health effects of wind turbines generally, a review of the existing literature was performed in 2011 by Knopper (Knopper, 2011). The results of this study were stated as follows:

"Conclusions of the peer reviewed literature differ in some ways from those in the popular literature. In peer reviewed studies wind turbine annoyance has been statistically associated with noise but found to be more strongly related to visual impact, attitude to wind turbines and sensitivity to noise. To date, no peer reviewed articles demonstrate a direct causal link between people living in proximity to modern wind turbines, the noise they emit and resulting physiological health effects. If anything, reported health effects are likely attributed to a number of environmental stressors that result in an annoyed/stressed state in a segment of the population. In the popular literature, self-reported health outcomes are related to distance from turbines and the claim is made that infrasound is the causative factor for the reported effects, even though sound pressure levels are not measured."

A further study was carried out by Knopper in 2014 (Knopper et al, 2014) which provides a *"bibliographic-like summary and analysis of the science around the issue* [of wind turbines and human health] *specifically in terms of noise (including audible, LFN* [low frequency noise] *and infrasound), EMF and shadow flicker"*. The study states that *"There is also a growing body of research that suggests that nocebo[36] effects may play a role in a number of self-reported health impacts related to the presence of wind turbines. Negative attitudes and worries of individuals about perceived environmental risks have been shown to be associated with adverse health-related symptoms such as headache, nausea, dizziness, agitation, and depression, even in the absence of an identifiable cause."* The study abstract states that *"Based on the findings and scientific merit of the*

[34] https://pubmed.ncbi.nlm.nih.gov/?term=Wind+Turbine+Syndrome (Accessed on 30 September 2022)
[35] https://pubmed.ncbi.nlm.nih.gov/?term=Wind+Turbine+Health (Accessed on 30 September 2022)

[36] Nocebo is defined as "*A non-existent or inactive substance or factor that causes symptoms of disease in people who believe that they have been exposed to it*" (Source: Collins English Dictionary: Accessed November 2022).

available studies, the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health."

The National Health and Medical Research Council (NHMRC) of Australia published *Wind Turbines and Health: A Rapid Review of the Evidence* in 2010 (NHMRC, 2010), which concluded that *"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."*

Professor Simon Chapman (Chapman, 2012) writing in the New Scientist Magazine in October 2012 pointed out that if wind turbines did cause medical problems, we would expect to find a relationship between prevalence of the syndrome and populations living near wind farms, however this is not the case. He stated, in fact, that it is almost the case that the opposite is true. The people who should be most affected are those who live on the land where the wind turbines are actually located but this is not described in the literature.

A 2014 study by Health Canada on the effects of wind turbine noise on health and well-being (Health Canada, 2014) had the following key findings:

- No evidence found to support a link between exposure to wind turbine noise and any of the self-reported illnesses (such as dizziness, tinnitus, migraines) and chronic conditions (such as heart disease, high blood pressure, diabetes);
- No association was found between the multiple measures of stress (such as hair cortisol, blood pressure, heart rate, self-reported stress) and exposure to wind turbine noise;
- The results of this study do not support an association between wind turbine noise and self-reported or measured sleep quality;
- An association was found between increasing levels of wind turbine noise and individuals reporting to be very or extremely annoyed. No association was found with any significant changes in reported quality of life, or with overall quality of life and satisfaction with health. This was assessed using the abbreviated version of the World Health Organization's Quality of Life Scale; and
- Calculated noise levels were found to be below levels that would be expected to directly affect health (World Health Organization— Community Noise Guidelines [1999]). This finding is consistent with self-reported and measured results of the study.

In 2015, the NHMRC in Australia published a systemic review of the health effects of wind farms (Merlin et al., 2015) which was performed by the University of Adelaide. This was an extremely thorough follow on to the *Rapid Review* referred to previously. It was completely independent with no relationship to either wind farm developers, anti-wind groups or objectors. It looked extensively at all the reported effects and systematically looked at all the evidence. The review concluded that *"The evidence considered does not support the conclusion that wind turbines have direct adverse effects on human health, as the criteria for causation have not been fulfilled"*.

There was a commentary on *Wind Turbine Noise* published in the British Medical Journal (The BMJ) in March 2012 (Hanning and Evans, 2008) which was not an evidence-based study but merely an opinion piece. The piece identified that wind turbine noise seems to affect sleep and that an independent review of evidence is necessary. Professor Simon Chapman responded in a letter published in a subsequent issue of The BMJ (Chapman, 2012) stating *"Hanning and Evans, who declare histories of anti-wind farm activity, say that a large body of evidence now exists that wind turbines within permissible distances from housing disturb sleep and impair health. They are correct about a large body of evidence, but not in their interpretation of its conclusions. There*

are 17 reviews of the evidence, nearly all with an "independent" provenance. None are referenced in the editorial. These reviews strongly state that the evidence that wind turbines themselves cause problems is poor. They conclude that:

- *Small minorities of exposed people claim to be adversely affected by turbines.*
- *Negative attitudes to turbines are more predictive of reported adverse health effects and annoyance than are objective measures of exposure.*
- *Deriving income from hosting wind turbines may have a "protective effect" against annoyance and health symptoms. Opponents claim that turbine hosts sign "gag" clauses that prevent them from complaining. I have seen contracts from different Australian firms and none say anything about gags. No contract could preclude citizens from pursuing negligence claims in common law."*

Furthermore, a critical review of the scientific literature published in the Journal of Occupational and Environmental Medicine (JOEM) in 2014 (McCunney, 2014) concluded that:

1. *"Infrasound sound near wind turbines does not exceed audibility thresholds.*
2. *Epidemiological studies have shown associations between living near wind turbines and annoyance.*
3. *Infrasound and low-frequency sound do not present unique health risks.*
4. *Annoyance seems more strongly related to individual characteristics than noise from turbines."*

A study published in Environment International Journal (Bräuner et. al, 2018) examined the association between long-term exposure to wind turbine noise and the incidence of myocardial infraction (MI). The study concluded that *"the results of this comprehensive cohort study lend little support to a causal association between outdoor long-term wind-turbine noise exposure and MI. However, there were only few cases in the highest exposure groups and our findings need reproduction."*

A study published in the Journal of American Heart Association (Bräuner et. al, 2019) investigated the association between long-term exposure to wind turbine noise and the risk of stroke and concluded that *"this comprehensive cohort study lends no support to an association between long-term WTN* [wind turbine noise] *exposure and stroke risk"*.

Another article published in the Environmental Research Journal (Poulsen et. al, 2018) examined the potential link between wind turbine noise and adverse birth outcomes and found no associations between the two.

A 2021 publication (van Kamp and van den Berg, 2021) looked at literature published between 2017 and mid 2020 on the health impacts of wind turbine sound on local residents. This covered a range of topics such as annoyance, sleep disturbance, cardiovascular disease, and metabolic effects, as well as mental and cognitive impacts. There was a link found between annoyance and the sound level of the wind turbine (though low frequency sound did not appear to affect this). There were no consistent results for the other topics (or data was not available). The distance of the proposed project, as well as the use of detailed modelling will ensure that the proposed project will not have a volume to cause annoyance. The study also showed evidence that annoyance is lower when people participate in the turbine siting process. The proposed project carried out public engagement throughout the design process, and the feedback received from this was considered when producing the final proposed layout.

Finally, a recent UK study (Qu and Tsuchiya, 2021) looking at the potential suburban health impacts associated with wind turbines found that the results of the questionnaire were heavily influenced by whether the person knew the research aims or not. Those that knew the research

aimed to assess wind farm impacts reported higher levels of health complaints than those that had the aim masked. This highlights the importance of considering good scientific data and studies.

In conclusion, there appears little scientific evidence of effects of *Wind Turbine Syndrome* and so significant health effects in this regard are not anticipated.

Noise Induced Hearing Loss

During the construction, operational and decommissioning phases of the proposed project, environmental noise levels sufficient to cause noise induced hearing loss will not occur. The detailed assessment presented in Chapter 12 (Noise and Vibration) assesses the potential for noise impacts from the proposed project and concludes that the greatest potential noise effect from the operation of the wind farm is moderate in terms of its significance and also notes that the effect is variable. It is therefore concluded that there is no risk of noise induced hearing loss due to noise from environmental exposure as a result of the proposed project.

Sleep Disturbance

In 2009, the WHO issued *Night-time Noise Guidelines for Europe* (WHO, 2009). The report stated that in two European countries studied (Switzerland and The Netherlands) almost 50% of the population are exposed to night-time noise in excess of 45dB L_{night}. It quotes some effects at quite low night-time levels and proposed an ideal noise level of 40dB L_{night} outside residences. This, however, is a yearly average. It does accept that this is essentially unachievable and suggests an interim value of 45dB L_{night} outside, again a yearly average.

The current Irish WEDGs (2006) state that *"A fixed limit of 43dB(A) will protect sleep inside properties during the night"*. The Draft 2019 WEDGs (Ireland) propose a change to the approach in applying limits on noise from wind turbines, including during night-time. This is currently the subject of consultation and is discussed in further detail in Chapter 12 (Noise and Vibration).

The WHO also carried out a review on environmental noise in 2018 (Basner and McGuire, 2018). While the review mainly concentrated on road, rail and aircraft noise, it did briefly discuss wind turbine noise and concluded that *"The results of the six identified studies that measured self-reported sleep disturbance are consistent, four of the studies found an association between wind turbine noise levels and increased sleep disturbance. However, the evidence that wind turbine noise affects sleep is still limited. This finding is supported by other recent reviews on wind turbine noise and sleep disturbance. Three of the studies referred to noise specifically in the questions which could have led to a bias in the results. Also, while the results from four out of the six studies suggest that sleep disturbance due to wind turbine may occur when noise levels are above 40 or 45 dBA, for two of the studies less than ten percent of the participants were exposed to these higher noise levels. Therefore, it is difficult to make conclusions on populations exposed to these higher levels. In addition, noise levels were calculated using different methods and different noise metrics were reported in the studies."*

In October 2018, the WHO published the *Environmental Noise Guidelines for the European Region* (WHO, 2018) as a follow on from the above and noted the following:

"For the relationship between wind turbine noise and prevalence of hypertension, three cross-sectional studies were identified, with a total of 1830 participants (van den Berg et al., 2008; Pedersen, 2011; Pedersen & Larsman, 2008; Pedersen & Persson Waye, 2004; 2007). The number of cases was not reported. All studies found a positive association between exposure to wind turbine noise and the prevalence of hypertension, but none was statistically significant. The lowest levels in

studies were either <30 or <32.5 L_{den}. No meta-analysis was performed, since too many parameters were unknown and/or unclear. Due to very serious risk of bias and imprecision in the results, this evidence was rated very low quality".

"The same studies also looked at exposure to wind turbine noise and self-reported cardiovascular disease, but none found an association. No evidence was available for other measures of cardiovascular disease. As a result, only evidence rated very low quality was available for no considerable effect of audible noise (greater than 20 Hz) from wind turbines or wind farms on self-reported cardiovascular disease".

The Guidelines also state that *"For average noise exposure, the GDG* [Guideline Development Group] *conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den} as wind turbine noise above this level is associated with adverse health effects"*. The GDG do note however that aside from a potential for annoyance, the evidence relating to any health effects associated with wind turbine noise is either absent or of poor quality. There is therefore a possibility that the effects caused by attitudes towards wind farms may be difficult to tell apart from any potential effects from wind turbine noise. The GDG also note that there are more people exposed to noise from sources such as road traffic than from wind turbines and any benefits associated with reducing exposure to wind turbine noise may be unclear. Taking account of the above, the GDG recommends that the development of any policies for wind energy development ensure that noise exposure is kept below guideline values. They note that this can be achieved via multiple methods, but they don't specify that any particular methods should be used. It is concluded that there will be no significant adverse effect on human health as a result of sleep disturbance during the operational phase of the proposed project. The most recent literature is thought to represent large modern turbines, and so there is no reason to suggest that it does not represent the full range of turbine dimensions being proposed.

Further discussion with regard to noise effects is presented in Chapter 12 (Noise and Vibration).

Infra-sound

Infra-sound is sound below the audible human frequency which is normally taken as being 20 Hz or less. Human ears cannot respond to this, however it can be associated with vibration and is sometimes an issue discussed with, for example, large tunnelling projects. Infra-sound is also an everyday event with everyday sources.

Many of the people who cite human health problems with wind turbines relate these to infra-sound and reported symptoms can include nausea, disturbance of sleep, tinnitus (ringing in the ear) as well as others. Two professionals that have studied and expressed concerns about infra-sound in relation to wind turbines are Dr Alec Salt of the Washington School of Medicine and Dr Marianna Alves Pereira, Associate Professor at Lusófona University, Portugal.

In a 2013 study by the South Australian Environment Protection Authority entitled *Infrasound levels near wind farms and in other environments*, the authors objectively measured infra-sound in a number of the different environments including urban and rural as well as in houses adjacent to windfarms and those further away. Among its conclusions were that *"Infrasound levels of between 60 and 70dB(G) commonly occur in the urban environment"* and that *"Noise generated by people and associated activities within a space was one of the most significant contributors to measured infrasound levels, with measured infrasound levels typically 10 to 15dB(G) higher when a space was occupied. Infrasound levels up to approximately 70dB(G) were measured in occupied spaces".*

When discussing the specific locations that were tested, the report stated *"At two locations, the EPA* [South Australian Environment Protection Authority] *offices and an office with a low frequency noise complaint, building air conditioning systems were identified as significant sources of infrasound. These locations exhibited some of the highest levels of infrasound measured during the study"*. For rural environments, the report concluded that while infra-sound levels were lower than urban areas, that *"Infrasound levels at houses adjacent to wind farms are no higher than those at houses located a considerable distance from wind farms"*.

Another relatively recent publication from Ministry of the Environment in the Federal State of Baden Wuerttemberg, Germany (Ratzel, 2016) states in the conclusion that *"Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound levels generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range.*

The measurement results of wind turbines also show no acoustic abnormalities for the frequency range of audible sound. Wind turbines can thus be assessed like other installations according to the specifications of the TA Lärm [noise prevention regulations]. *It can be concluded that, given the respective compliance with legal and professional technical requirements for planning and approval, harmful effects of noise from wind turbines cannot be deduced"*.

The referenced publications and studies above outline that wind farms are not a significant source of infra-sound and that traffic and everyday human activity are likely to be more relevant. It is therefore concluded that there will be no significant adverse effect on human health as a result of infra-sound during the operational phase of the proposed project.

Further discussion on infra-sound is presented in Chapter 12 (Noise and Vibration).

Electromagnetic Interference

When electric current flows, both electric and magnetic fields are produced. The electromagnetic fields (EMF) from electricity are in the extremely low frequency end of the electro-magnetic spectrum. EMF occurs in the home, in the workplace or anywhere that electricity is used. EMF is also naturally generated from earth's geomagnetic field and electric fields from storm clouds.

Guidance from the WHO states that EMF is sometimes cited for potential health effects (WHO, 2007). Concerns expressed in the past include childhood leukaemia, brain tumours and other cancers. Laboratory experiments have provided no reliable evidence that EMF are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general.

Some non-cancerous adverse health effects are also claimed to be associated with EMF. These include miscarriages, reproductive and developmental abnormalities, depression and suicide, allergy and neurological disease. However, the Health Promotion Agency in the UK stated, in November 2007, that *"there is little scientific evidence to support these claims and the current body of evidence does not show that exposure to EMF below guideline levels presents a human health hazard"*.

The aforementioned Australian NHMRC study (Merlin, 2015) concluded in relation to EMF that *"There is no direct evidence on whether there is an association between electromagnetic radiation produced by wind farms and health outcomes. Extremely low-frequency electromagnetic radiation is the only potentially important electromagnetic emission from wind turbines. Limited evidence*

suggests that the level of extremely low-frequency electromagnetic radiation close to wind farms is less than average levels measured inside and outside Australian suburban homes. There is no consistent evidence of human health effects from exposure to extremely low-frequency electromagnetic radiation at much higher levels than is present near wind farms."

EirGrid produced a publication entitled *EMF and You* in July 2014 which provides more information on EMF and electricity. This publication states that *"Recent studies conducted in the UK, France, Denmark and the US have not established associations between a home near transmission lines and childhood leukaemia"* and that *"Based on this history and its own review of research, the World Health Organization states there is no evidence to conclude that exposure to low-level EMFs is harmful to human health"*.

The proposed underground electrical cables will adhere to the international guidelines for ELF-EMF which are described by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This is a formal advisory agency to the World Health Organisation. The proposed project will also adhere to the EU guidelines for human exposure to EMF. As the ICNIRP guidelines will not be exceeded, even directly above the underground cables, there will be no associated operational effects on Human Health.

The on-site substation to be built as part of the proposed project will be located as shown in Figure 2-1 of this EIAR. The distance from the nearest sensitive receptor to this on-site substation is approximately 1.3km. It is noted that a considerable number of existing electrical substations are located much closer than 1.3km from nearby sensitive receptors. The proposed substation will be constructed in accordance with national standards for electrical infrastructure and as set out in the EirGrid publication referred to above, no health agency has concluded that exposure to EMF from power lines and other electrical sources is a cause of any long-term adverse effects on human, plant or animal health.

For these reasons, this assessment concludes that there will be no significant human health effects as a result of electromagnetic radiation.

Shadow Flicker

'Shadow flicker' is an effect that occurs when the rotating blades of a wind turbine cast a moving shadow over an observer or a building. The effect is predominantly experienced indoors where a moving shadow passes over a window in a nearby property and results in a rapid change or flicker in the incoming sunlight. Shadow flicker is predominantly an annoyance, but concerns have been raised that the flicker can trigger seizures in persons with photosensitive epilepsy.

The Wind Energy Guidance Note prepared in the UK for the Renewables Advisory Board and Department for Business, Enterprise and Regulatory Reform (BERR) in 2007 states that *"The operating frequency of a wind turbine will be relevant in determining whether or not shadow flicker can cause health effects in human beings. The National Society for Epilepsy advises that only 3.5 % of the 1 in 200 people in the UK who have epilepsy suffer from photosensitive epilepsy. The frequency at which photosensitive epilepsy may be triggered varies from person to person but generally it is between 2.5 and 30 flashes per second (hertz). Most commercial wind turbines in the UK rotate much more slowly than this, at between 0.3 and 1.0 hertz. Therefore, health effects arising from shadow flicker will not have the potential to occur unless the operating frequency of a particular turbine is between 2.5 and 30 hertz and all other pre-conditions for shadow flicker effects to occur exist." The note also states that "Shadow flicker is therefore more likely to be relevant in considering the potential effects on residential amenity [than human health]"*.

Similarly, the aforementioned Australian NHMRC study (Merlin, 2015) discusses shadow flicker and states that *"The Environment Protection and Heritage Council of Australia (EPHC; 2010) notes that the risk of seizures from modern wind turbines is negligible, given that less than 0.5% of the population are subject to epilepsy at any point in time and, of this proportion, 5% are vulnerable to strobe lighting (light flashes). In the majority of circumstances (>95% of the time), the frequency threshold for individuals susceptible to strobe lighting is >8 Hz, with the remainder affected by frequencies >2.5 Hz. The EPHC estimates that the probability of conventional horizontal-axis wind turbines causing an epileptic seizure for an individual experiencing shadow flicker is <1 in 10 million in the general population."*

Following the above information and based on the fact that there will be no shadow flicker occurrence at any sensitive receptor, it can be determined that there will be no significant effect on human health due to shadow flicker (for more information see Chapter 10 of the EIAR – Shadow Flicker). Regardless of what turbine dimensions are chosen within the proposed range, the mitigation can be applied in the same way and the effects remain the same.

Psychological Effects

The potential for adverse effects on psychological health, such as anxiety and stress, caused by concern in relation to visual appearance, noise emissions, shadow flicker and other issues, is often highlighted in relation to wind farms. The community may also experience annoyance arising from increased traffic or noise from the construction works.

The potential effects on a person's overall psychological well-being is difficult to assess as there are no direct measurements that can be used. While it is possible to predict noise emissions and shadow flicker, for example, the same scientific certainty cannot be used in predicting psychological impacts. The 2014 Health Canada report referenced in Section 5.4.2.2.1 looked at a number of measures of stress (such as hair cortisol, blood pressure, heart rate, self-reported stress) and noted no association with exposure to wind turbine noise.

The potential degree of psychological impact can be both positive and negative. There can be a positive impact, whereby people may look forward to better employment opportunities generated by a major infrastructure project in a rural area or the benefits that may be gained from the Community Benefit Funds. In terms of negative impacts, this can be where somebody is annoyed by for example, the visual appearance of the wind turbines. This annoyance is not a medical health impact, as such. If a person were to develop a psychological illness, such as anxiety or depression, this would be a medical health impact.

In this case, it is useful to look at experience from other operational wind farms to determine if significant psychological effects are reported and published. If this was the case, it would be expected to find recorded evidence of increased levels of depression or anxiety in the vicinity of other wind farms, however there are no such findings in the peer-reviewed literature referenced above.

On that basis, it is considered that no significant adverse effects on psychological health will occur as a result of the proposed project.

Health Benefits

Aside from the potential socio-economic benefits previously discussed, there are significant environmental benefits to the proposed project. The current and historical practice of fossil fuel combustion with the associated release of a range of pollutants including particulate matter, oxides of nitrogen, sulphur dioxide, carbon dioxide and many others is well

documented. The release of these pollutants from the power generation sector is also a major contributor to global warming and the resulting changing effects on our climate.

The phasing out of coal, gas and peat burning power stations in Ireland is a key step in achieving Ireland's 2030 decarbonisation ambition as set out in the Climate Action Plan and the placement of fossil fuels in electricity generation by clean renewable wind energy will have significant benefits for air quality and slowing down global warming.

The contribution of the proposed project to a decrease in reliance on fossil fuel combustion will have a moderate to significant positive long-term effect on the health and well-being of the general population.

Residential Amenity

Residential amenity relates to the human experience of a person'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 at the residence.

The land use/activities on the proposed wind farm site are primarily commercial forestry, with some areas of open peatland that is extensively grazed. The surrounding landscape is a mixture of forestry, agricultural land and peat bog. The nearest residential receptors are over 800m from the proposed turbine locations.

The nearest settlements are Doochary, Lettermacaward and Glenties, which are located 2.1km north, 850m west and 3.5km south of the site of the proposed wind farm respectively and 2.3km north, 3.4km west and 6.2km south of nearest turbine, respectively. A larger settlement Dungloe town (An Clochán Liath), is located c. 10km northwest of the site of the proposed wind farm.

The surrounding area includes the N56 National Road and the R250, R252 and R254 Regional Roads. As such, there is a current and historical context for agricultural activity in the area in terms of forestry and transportation.

Extensive consideration has been given to the layout of the site and the positions of the turbines in ensuring sufficient set-back distances from sensitive receptors and adjustment for noise, shadow flicker, visual impact and telecommunication impacts. These considerations during the design, planning and EIA phase, in accordance with the relevant guidelines, are designed to minimise the potential effects on residential amenity from the proposed project. The potential effects on human beings at their residences are assessed in the following chapters; Chapter 10 (Shadow Flicker), Chapter 11 (Material Assets: Aviation and Telecommunication), Chapter 12 (Noise and Vibration), Chapter 13 (Landscape and Visual Impact Assessment), Chapter 14 (Air Quality and Climate) and Chapter 16 (Traffic and Transport).

Based on a combined consideration of the above factors in determining the potential impacts on residential amenity, it is considered that there will be a slight negative effect on residential amenity which will be short-term for the construction phase and long-term for the operational phase. For the small number of the nearest noise sensitive locations, as described in Chapter 12 (Noise and Vibration), the significance of the effect may be considered as moderate and variable in the worst-case noise conditions. (i.e. a particular wind speed, direction, absence of screening, etc. as described in Chapter 12 (Noise and Vibration).

5.4.3.3 Decommissioning Phase

The decommissioning work will have similar works to the construction phase, albeit on a smaller scale. All of the same mitigation measures will be robustly implemented and the guidance adhered to, thereby ensuring that there will be no significant effects to human health for the decommissioning phase. There will be less groundworks required as the site roads are likely to be left in situ to be used for forestry extraction, and turbine foundations and hardstands will be covered in topsoil and seeded over. Therefore, the potential dust emissions and potential health and safety effects will be reduced significantly when compared to the construction phase. Overall, there will be a short-term slight negative effect to human health in the decommissioning phase.

5.4.4 Major Accidents/Disasters

The vulnerability of the project to risk of major accidents and/or disasters, such as extreme flooding or peat/soil instability, is discussed primarily in Chapter 8 (Land, Soils and Geology) and Chapter 9 (Hydrology and Hydrogeology) which found that the project is not at significant risk in this regard. The potential for climate change to impact future flood events is considered as part of the site-specific Flood Risk Assessment (FRA) in Chapter 9 (Hydrology and Hydrogeology), which found that the proposed infrastructure will not be significantly affected by climate change. On the contrary it will help to reduce carbon emissions, thereby helping to reduce climate change effects globally.

In the context of potential human health risk from major accidents/disasters, potential risks as set out in Section 2.11.1 of Chapter 2 (Description of the Proposed Project) are presented by turbine/substation fires, explosions or turbine collapse. There are no dwellings located within 800m of the proposed turbines or substation locations, therefore the risk to residential receptors from fires, explosions or turbine collapse is not considered significant. The proposed tip height of the turbines is between 185-200m, therefore all residential dwellings are significantly removed from any area of a potential turbine collapse.

The Draft 2019 WEDGs refer to the very remote possibility of injury to people (or animals) from flying fragments of ice or from a damaged blade but note that most blades are composite structures with no bolts or separate components and that most turbines are fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades and prevent start-up. This is anticipated to be the case for the proposed project (and the full turbine range being considered).

Neither the draft 2019 WEDGs or the current 2006 WEDGs refer to the likelihood of fires from turbines and it is considered that the potential risk of a fire is very low. The risk of turbine fire or collapse is very low on the basis of comprehensive turbine base design considerations, safety checks throughout the turbine installation process and turbine suppliers' many years of experience in developing and innovating safety in the wind energy industry. The turbines will be fitted with lightning conductors to minimise the potential risk of lightning induced fires.

The proposed project will not come under the *Control of Major Accident Hazards (COMAH) Regulations*, as such, there is no potential for the proposed project or any associated activities to cause a risk to human health in this regard. Additionally, there are no Upper or Lower Tier COMAH establishments located in proximity of the proposed wind farm site, or within County

Donegal, therefore there is no risk posed to the wind farm site from such an establishment and associated activities[37].

It is therefore considered that the potential for a significant effect on the local population and human health from a major accident or disaster is low.

5.5 MITIGATION MEASURES

5.5.1 Construction Phase

Best practice construction methodology and measures to minimise impacts from excavation works, as described in Chapter 8 (Land, Soils and Geology), will keep the project area to a minimum and reduce land use changes.

The proposed project is not anticipated to have a significant effect on the local or regional population, therefore no mitigation measures in respect of population trend impacts are required.

From an economic perspective, the proposed project will provide employment opportunities to the local community and wider region during construction, operations and decommissioning. The project, primarily at construction stage, is also likely to increase spend in local businesses as persons involved in the project stay locally or purchase goods. Overall, there will be a positive effect on the local economy and no mitigation measures are required.

The project will employ all of the latest and relevant guidelines and legislation (See CEMP in Appendix 2-2 in terms of health and safety both for works within the wind farm site as well as for works outside the main wind farm such as those on the TDR. The required levels of safety (e.g during road works) will be maintained for all road users as well as pedestrians. The wind farm site itself will not be open to the public until after the construction phase of the project. Appropriate health and safety measures as described in the CEMP (Appendix 2-2) will be taken for all works areas during the construction phase in the interest of worker safety also. Should any public health advice be in place during the construction phase (such as the recent Covid-19 public restrictions) these will be implemented on site.

5.5.2 Operational Phase

Fáilte Ireland has been consulted to identify any potential concerns for adverse tourism effects however they did not respond. It is noted however that Fáilte Ireland have a guidance document for considering the potential effects of projects on tourism and this guidance document has been considered in the completion of this assessment. A Recreation Development Plan for provision of amenity facilities at the site has been developed and is included as Drawing 10798-2070 in Appendix 1-1. This will create recreational opportunities for the area, encouraging people to be active outdoors, and to come to the area, thereby using local businesses.

Mitigation by design has been utilised in the design of this project to assure minimal effects to Population and Human Health. Where required, specific mitigation measures for other environmental factors discussed previously which may interact with human health, such as

[37] No COMAH Establishments (Upper or Lower Tier) were identified within Co. Donegal - https://www.hsa.ie/eng/your_industry/chemicals/legislation_enforcement/comah/list_of_establishments/ (Accessed 15 August 2022)

landscape and visual effects, shadow flicker, air quality, water quality, noise & vibration and transport, are discussed in the relevant chapters of this EIAR. A cross reference of environmental factors is also presented in Chapter 17 (Interactions of the Foregoing).

5.5.3 Decommissioning Phase

Internal access roads, substation and wind turbine bases will be retained in place after decommissioning of the wind turbines to maintain access for forestry and recreation, minimise disruption to the electricity grid infrastructure and reduce the effect of construction activities (such as noise, air quality and traffic movements) on the local population associated with their removal. Turbine hardstandings will be covered with topsoil and revegetated.

No mitigation is proposed for the decommissioning phase in respect of effects on population trends, property value or tourism.

5.6 RESIDUAL EFFECTS

5.6.1 Construction Phase

The Cloghercor Wind Farm will have a slight positive residual effect on the local population through an influx of construction workers in the short-term. This influx is likely to cause a slight increase in local population over a short period of time resulting in a boost to the local economy through accommodation and spend in local shops and restaurants. There will be a short term slight negative effect as a result of the construction phase traffic and associated noise. There will be a long-term slight to moderate neutral effect on land use.

5.6.2 Operational Phase

The proposed project will provide clean energy from a renewable resource and help to achieve targets in national energy and climate change policies. This is a direct positive long-term residual effect for the country which will benefit the local population and communities.

The establishment of a Community Benefit Fund is considered to be a long-term positive effect on the local community in general. This in turn would have a positive effect on the individuals living in this community and have a positive effect on their individual psychological health through the development of community led projects and maximising the level of local involvement in terms of influencing how the funds are spent.

Overall, it is considered likely that there will be a long-term, slight, positive effect on the local population and human health as a result of the proposed project.

Based on the cumulative effect assessments carried out for shadow flicker, noise, traffic and visual effect, it is considered that there will not be any significant effects on the local population or human health during the operational phase of the proposed project following the implementation of the mitigation measures as set out in the relevant chapters.

5.6.3 Decommissioning Phase

It is considered that there will be a short-term, imperceptible, negative effect associated with the works required to decommission the wind turbines at the end of their operational lifetime.

5.7 CUMULATIVE EFFECTS

In the assessment of cumulative effects, any other existing, permitted or proposed developments in the surrounding area have been considered where they have the potential to generate in-combination or cumulative effects with the proposed project. The potential for cumulative effects on the local population and human health, in particular noise, shadow flicker, traffic and visual effects are discussed in the relevant chapters.

There is limited / no potential for an operational phase cumulative effect on noise, shadow flicker and visual effects associated with wind farms within the study area as the nearest existing or permitted wind farm identified is Loughderryduff Wind Farm, located c. 5km southwest of the proposed wind farm site. With the shortest turbine to turbine distance between the Loughderryduff wind farm and the proposed project approximately 8.5km.

In addition, there have been several applications submitted over the last number of years in Donegal and the surrounding counties for wind farm development. These have been outlined in Table 4-1 and Figure 4-1 of Chapter 4 and indicate those applications located in Donegal that are connected to the grid and the scale of generation.

Other developments proposed in the study area are relatively small, comprising mostly residential one-off houses and agricultural sheds/activity. There is also a significant level of ongoing forestry activity locally. All of these developments/activities are not anticipated to have a significant cumulative effect on population and human health due to their small scales.

Forestry replanting lands which were also considered were found to also be not relevant as they will be located at a significant distance from the proposed wind farm (i.e. in another county and >100km from the wind farm site).

In terms of traffic, the potential for cumulative effects will occur primarily during the construction phase where construction traffic associated with the proposed project could overlap with construction or operations of other projects, including commercial forestry operations, which are currently permitted but not yet constructed, as identified in Chapter 16 (Traffic and Transport).

Overall, it is considered that there are no significant cumulative effects from the proposed project on population, human health, socio-economics, employment, tourism, land-use and health and safety.

5.8 CONCLUSION

This chapter has assessed the potential effects on population, human health, socio-economics, employment, tourism, land-use and health and safety. The proposed project is not anticipated to have any significant effects on population, socio-economics, employment, tourism, land-use and health and safety.

There is currently no credible evidence to link wind turbines to adverse health effects. Emission limits, such as for noise or dust, are set to protect the most vulnerable in a community rather than the robust. Compliance with the limits set out in best practice guidelines (described in the relevant chapters on noise and vibration, air quality, shadow flicker) will ensure that individuals and communities are protected. Design stage considerations, such as turbine locations, and the mitigation measures outlined in Section 5.5 and in specific technical chapters will be put in place to ensure that the emissions and effects from the proposed project are in

compliance with the standards to ensure that there will be no significant adverse effects on health, even amongst the most vulnerable.

Following consideration of the residual effects as set out in Section 5.6, it is considered that the proposed project will not result in a significant negative effect on population and human health in the local and regional area.

References:

Basner and McGuire, *WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep* Int. J. Environ. Res. Public Health. 2018 Mar; 15(3): 519 (2018)

Bräuner et. al, *Long-term wind turbine noise exposure and incidence of myocardial infarction in the Danish nurse cohort. Environment International Journal, Vol. 121 Part 1* (December, 2018)

Bräuner et. al, *Association Between Long-Term Exposure to Wind Turbine Noise and the Risk of Stroke: Data From the Danish Nurse Cohort.* Journal of American Heart Association, Vol. 8 Issue 14 (July, 2019)

CEBR, *The effect of wind farms on house prices* (March 2014)

Chapman, *The sickening truth about wind farm syndrome* New Scientist (2012)

Chapman, *Wind Turbine Noise* BMJ 2012;344:e3366 (2012)

ClimateXChange, *The impact of wind turbines on house prices in Scotland* (October 2016)

Central Statistics Office – 2016 and 2011 Census and associated data

DoCCAE, *Code of Practice for Wind Energy Development in Ireland Guidelines for Community Engagement* (December 2016)

Evans, *Infrasound levels near Windfarms and other environments* (2013)

Fáilte Ireland, *EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects*

Fáilte Ireland website – https://www.failteireland.ie/

Hanning and Evans, *Wind Turbine Noise* BMJ 2012;344:e1527 (2012)

Health Canada, *Wind Turbine Noise and Health Study: Key Findings* (2014)

IEMA, *Health in Environmental Impact Assessment - A Primer for a Proportionate Approach* (2017);

Institute of Public Health Ireland, *Health Impact Assessment* (2009)

IWEA, *Life-cycle of an Onshore Wind Farm* (March 2019)

IWEA, *An Enterprising Wind: An economic analysis of the job creation potential of the wind sector in Ireland* (2014)

IWEA, *Good Neighbour – IWEA Best Practice Principles in Community Engagement & Community Commitment* (March 2013)

Knopper LD and Ollson CA, *Health effects and wind turbines: a review of the literature* Environ Health. 2011; 10:78. Published 2011 Sep 14. doi:10.1186/1476-069X-10-78

Lenus, *Health Profile 2015 Donegal* (2015)

McCunney, *Wind Turbines and Health. A critical review of the Scientific Literature* Massachusetts Institute of Technology Nov 2014. Journal of Occupational and Environmental Medicine Vol 56, No. 11 (2014)

Merlin, T. et al, *Systematic review of the human health effects of wind farms*, National Health and Medical Research Council, Canberra (2015)

National Health and Medical Research Council (Australia), *Wind Turbines and Health: A Rapid Review of the Evidence* (July 2010)

OSI – Mapping and aerial photography

Pierpont, *Wind Turbine Syndrome: A Report on a Natural Experiment* (2009)

Poulsen et. al, Pregnancy exposure to wind turbine noise and adverse birth outcomes: a nationwide cohort study. Environmental Research Journal, Volume 167 (November 2018)

Pöyry, *The Value of Wind Energy to Ireland - A Report to Irish Wind Energy Association* (March 2014)

Ratzel, *Low-frequency noise incl. infrasound from wind turbines and other sources.* State of Baden Wuertmberg (2016)

Sport Ireland Outdoors website (walking trails) - https://www.sportireland.ie/outdoors

University of St. Andrews, Fife and The Macaulay Institute, Aberdeen, *Green on Green: Public Perceptions of Wind Power in Scotland and Ireland - Journal of Environmental Planning and Management* (November 2005)

US Environmental Protection Agency, *Health Impact Assessment Resource and Tool Compilation* (September 2016);

World Health Organisation, *Electromagnetic Fields and Public Health* (2007)

World Health Organisation, *Environmental Noise Guidelines for the European Region* (2018)

World Health Organisation, *Health in Impact Assessments: Opportunities not to be Missed* (2014)

World Health Organisation, *Night-time Noise Guidelines for Europe* (2009)