5. POPULATION AND HUMAN HEALTH

5.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) assesses the potential effects of the proposed Lyrenacarriga Wind Farm (the 'Proposed Development') on population and human health, and has been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA), in particular the '*Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'* (EPA, August 2017). The full description of the Proposed Development is provided in Chapter 4 of this EIAR.

One of the principal concerns in the development process is that human beings, as individuals or communities, should experience no significant diminution in their quality of life from the direct or indirect impacts arising from the construction, operation and decommissioning of a development. Ultimately, all the impacts of a development have the potential to impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the EIAR include population, human health, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values, shadow flicker, noise and health and safety. Shadow flicker is addressed separately in Chapter 6.

There are 51 dwellings located within one kilometre of the proposed turbine locations (plus one application for a dwelling, currently at Planning stage). The closest occupied dwelling is located approximately 700 metres from the nearest proposed turbine location. The proposed development achieves a minimum set back distance of four times the turbine tip height plus an additional 100 metres between proposed turbine locations and any residential property.

5.1.1 Statement of Authority

This section of the EIAR has been prepared by Eoin O'Sullivan and reviewed by Michael Watson, both of MKO. Eoin is an experienced geo-environmental scientist and has over ten years' experience in the design, implementation and interpretation of all phases of geo-environmental and geotechnical site investigations. Eoin also has extensive experience in the preparation of population and human health assessments and reports for EIAs. Eoin is also proficient in undertaking detailed quantitative risk assessments for the protection of controlled waters and human health. Eoin holds an MSc in Environmental Engineering and is a Chartered Member of the Chartered Institute of Water and Environmental Management (CWEM) and Chartered Environmentalist (CEnv) with the Society of Environment. Michael Waston has over seventeen years' experience in the environmental sector and had worked for the Geological Survey of Ireland and then a prominent private environmental & hydrogeological consultancy prior to joining MKO in 2014. Michael completed an MA in Environmental Management at NUI, Maynooth in 1999. Michael is a professional geologist (PGeo) and full member of IEMA (MIEMA) as well as a Chartered Environmentalist (CEnv).

5.2 Population

5.2.1 Receiving Environment

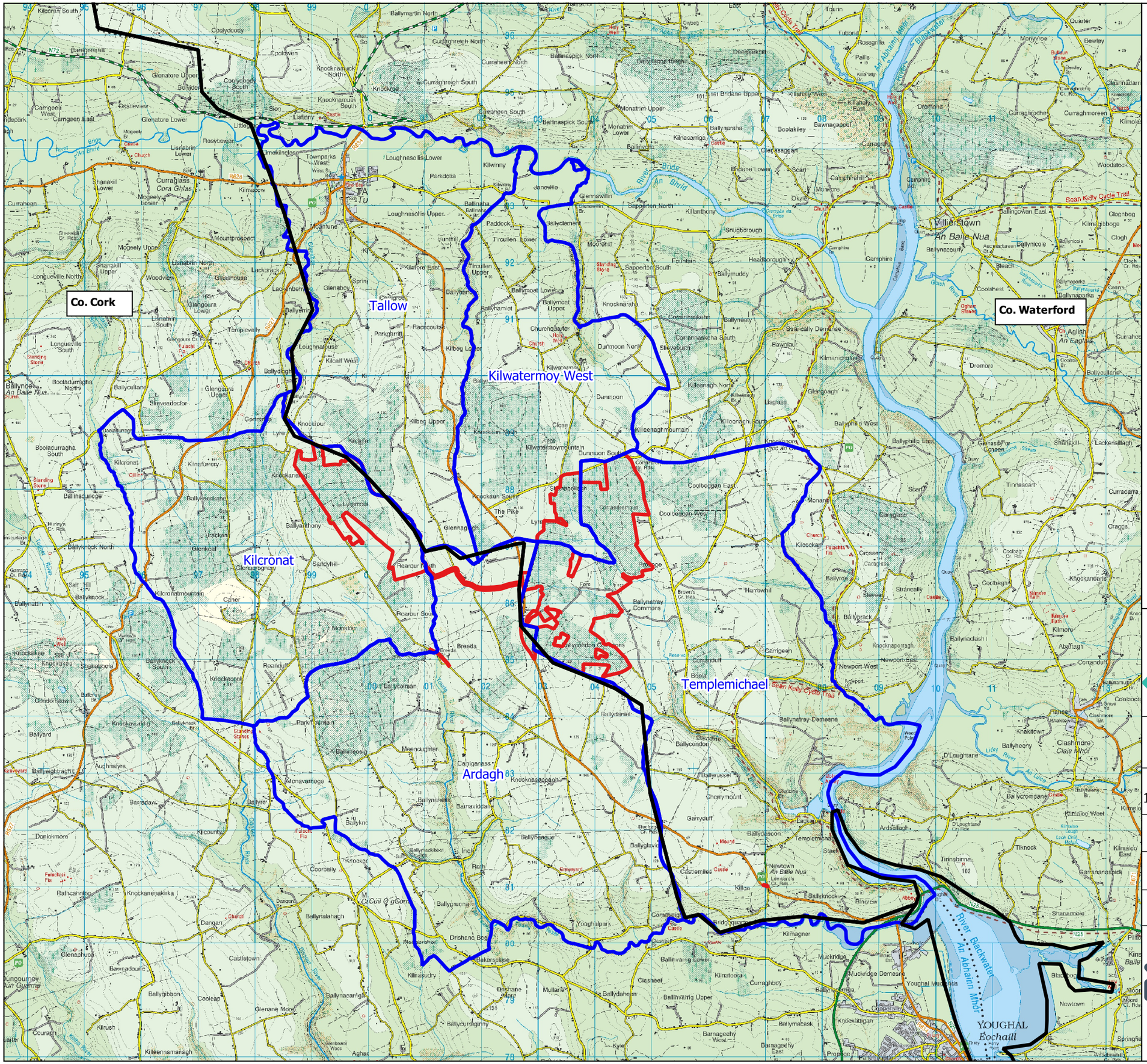
Information regarding population and general socio-economic data were sourced from the Central Statistics Office (CSO), the Cork County Development Plan 2014– 2020, Waterford County Development Plan 2011– 2017 (as extended) and Fáilte Ireland. The study included an examination of the population and employment characteristics of the area. This information was sourced from the Census of Ireland 2016, which is the most recent census for which a complete dataset is available, also the Census of Ireland 2011, the Census of Agriculture 2010 and from the CSO website, www.cso.ie.

Census information is divided into State, Provincial, County, Major Town and District Electoral Division (DED) level.

The site of the proposed development is located in a number of townlands as listed in Table 1.1 of Section 1.1 of this EIAR. The proposed wind farm site is located approximately 5 kilometres southeast of Tallow, Co. Waterford and approximately 15 kilometres northwest of Youghal Co. Cork. The site, which straddles the county boundary between Co. Waterford and Co. Cork, comprises lands at Lyrenacarriga, Ballycondon Commons, Kilcalf Mountain and Lyremountain. The site location is shown in Figure 1-1 of Chapter 1 of this EIAR.

The Study Area for the Population section of this EIAR is defined in terms of the District Electoral Divisions (DEDs) in which the proposed wind farm site is located, as well as adjacent DEDs which have the potential be affected by the proposed development. The site of the proposed wind farm development lies within the Kilconat, Tallow, Kilwatermoy West, Ardagh and Templemichael DEDs as shown in Figure 5-1. Adjacent DEDs include Kilcockan, Kilwatermoy East and Curraghlass DED. All 8 no. DEDs will collectively be referred to hereafter as the Population Study Area (Study Area) for this section of the assessment.

The Study Area has a combined population of 3,445 persons, as of 2016 (the latest Census data available), and comprises a total land area of 17,710 hectares or 177.1 square kilometres (km^2). (Source: CSO Census of the Population 2016).



Map Legend

- EIAR Site Boundary
- District Electoral Division Boundary/ Population Study Area
- Cork-Waterford county border

Drawing Title

Population Study Area

Project Title

170749- Lyrenacarriga Wind Farm, Co. Cork & Co. Waterford

Drawn By	Checked By
Karen Mulryan	Lorraine Meehan
Project No. 170749	Drawing No. Figure 5-1
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5.2.2 Population Trends

In the four years between the 2011 and the 2016 Census, the population of Ireland increased by 3.8%. During this time, the population of County Cork grew by 4.4% to 417,211 persons and County Waterford by 2.1% to 116,176. Other population statistics for the State, Counties Waterford and Cork and the Study Area have been obtained from the Central Statistics Office (CSO) and are presented in Table 5-1.

Table 5-1 Population 2011 – 2016 (Source: CSO)

Area	Population Change		% Population Change
	2011	2016	2011 - 2016
State	4,588,252	4,761,865	3.8
County Cork	399,802	417,211	4.4
County Waterford	113,795	116,176	2.1
Study Area	3,376	3,445	2.0

The data presented in Table 5-1 shows that the population of the Study Area increased by 2.0% between 2011 and 2016. This rate of population growth is lower than that recorded at State and County level. When the population data is examined in closer detail, it shows that the rate of population increase within the Study Area has been unevenly spread through the District Electoral Divisions (DEDs). The highest rate of population increases between 2011 and 2016 occurred within Kilwatermoy East DED, which experienced a 16.2% population increase. In comparison, the population of Templemichael DED decreased by 4.8% during the same period.

Of the DEDs that make up the Study Area for this assessment, the highest population was recorded in Tallow DED, with 1,262 persons recorded during the 2016 Census. The lowest population was recorded in Kilwatermoy East DED, with 122 persons recorded during the 2016 Census.

5.2.3 Population Density

The population densities recorded within the State, Counties Waterford and Cork and the Study Area during the 2016 Census are shown in Table 5-2.

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

Area	Population Density (Persons per square kilometre)	
	2011	2016
State	65.57	68.06
County Cork	54.68	57.06
County Waterford	61.51	62.8
Study Area	19.06	19.45

The population density of the Study Area recorded during the 2016 Census was 19.45 persons per square kilometre. This figure is significantly lower than the national population densities of 68.06 persons per square kilometre and county population densities of 57.06 and 62.8 persons per square kilometre.

Similar to the trends observed in population, the population density recorded across the Study Area varies between DEDs. Kilcronat DED has the lowest population density, at 8.75 persons per square kilometre, while Tallow DED has the highest population density, at 62.2 persons per square kilometre.

5.2.4 Household Statistics

The number of households and average household size recorded within the State, Counties Waterford and Cork and the Study Area during the 2011 and 2016 Censuses are shown in Table 5-3.

Table 5-3 Number of Household and Average Household Size 2011 – 2-016 (Source: CSO)

Area	2011		2016	
	No. of House-holds	Avg. Size (persons)	No. of House-holds	Avg. Size (persons)
State	1,654,208	2.8	1,697,665	2.8
County Cork	140,856	2.8	146,442	2.8
County Waterford	42,335	2.7	43,549	2.6
Study Area	1,235	2.8	1,252	2.8

In general, the figures in Table 5-3 show that while the number of households within the State, County and the 8 no. DEDs around the site of the wind farm has increased slightly, the average number of people per household generally stayed the same, i.e. there are more households and the same amount of people per house, with the exception of County Waterford which showed a decrease in the average number of people per household. Average household size recorded within the Study Area during the 2011 and 2016 Censuses are in line with that observed at State level during the same time periods. Similar to the trends observed above, the average household size recorded across the Study Area varies between DEDs. Kilcronat DED had the highest, with 3.3 and 3.1 persons per household recorded in 2011 and 2016 respectively. Whereas Kilcockan DED recorded the lowest, with 2.5 and 2.4 persons per household recorded in 2011 and 2016, respectively.

5.2.5 Age Structure

Table 5-4 presents the percentages of the State, County Waterford, County Cork and Study Area population within different age groups as defined by the Central Statistics Office during the 2016 Census. This data is also displayed in Figure 5-2.

Table 5-4 Population per Age Category in 2016 (Source: CSO)

Area	Age Category				
	0 – 14	15 – 24	25 - 44	45 - 64	65 +
State	21.1%	12.1%	29.5%	23.8%	13.4%
County Cork	22.9%	11.2%	28.4%	24.6%	13.0%
County Waerford	21.1%	11.9%	26.9%	25.1%	15.0%
Study Area	22.4%	10.3%	25.8%	26.0%	15.4%

The proportion of the DED Study Area population within each age category is broadly similar to those recorded at national and County level for most categories. Within the Study Area, the highest population percentage occurs within the 45-64 age category.

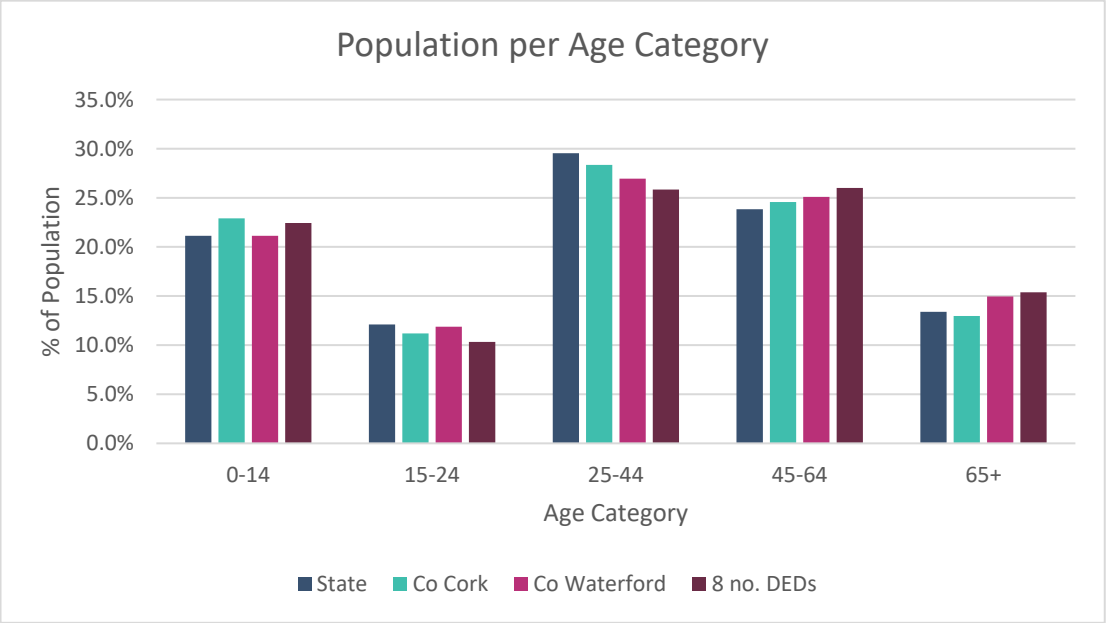

Figure 5-2 Population per Age Category in 2016 (Source: CSO)

5.2.6 Employment and Economic Activity

5.2.6.1 Economic Status

The labour force consists of those who are able to work, i.e. those who are aged 15+, out of full-time education and not performing duties that prevent them from working. In 2016, there were 3,755,313 persons in the labour force in Ireland. Table 5-5 shows the percentage of the total population aged 15+ who were in the labour force during the 2016 Census. This figure is further broken down into the percentages that were at work, seeking first time employment or unemployed. It also shows the percentage of the total population aged 15+ who were not in the labour force, i.e. those who were students, retired, unable to work or performing home duties.

Table 5-5 Economic Status of the Total Population Aged 15+ in 2016 (Source: CSO)

	Status	Republic of Ireland	County Cork	County Waterford	Study Area
% of population aged 15+ who are in the labour force		**61.4%**	**61.6%**	**58.8%**	**60.5%**
% which are:	At work	87.7%	90.8%	84.6%	88.7%
	First time job seeker	1.4%	0.9%	1.6%	1.2%
	Unemployed	11.5%	8.3%	13.9%	10.1%
% of population aged 15+ who are not in the labour force		**38.6%**	**38.4%**	**41.2%**	**39.5%**
% which are:	Student	29.4%	29.1%	27.3%	23.2%
	Home duties	21.1%	22.7%	20.2%	27.0%
	Retired	37.6%	36.9%	40.1%	39.1%
	Unable to work	10.9%	10.5%	11.1%	9.9%
	Other	1.0%	0.8%	1.2%	0.8%

Overall, the principal economic status of those living in the DED Study Area is similar to that recorded at national and County level, with between 0-3% average difference apparent. Of those who were not in the labour force during the 2016 Census, the highest percentage of the population in the 8 no. DEDs was in the 'Retired' category, which is in line with the figures recorded at national and County level.

5.2.6.2 Employment and Investment Potential in the Irish Wind Energy Industry

5.2.6.2.1 *Background*

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

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

More recently, a report published in 2014 by Siemens entitled *'An Enterprising Wind - An economic analysis of the job creation potential of the wind sector in Ireland'*, also in conjunction with the Irish Wind Energy Association (IWEA), concluded that, *"a major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment"*. The results of the research indicate that the majority of jobs created as a result of wind energy

development in Ireland are likely to be in the industry category, followed by grid jobs and finally potential manufacturing jobs. The creation of jobs would be as a result of a major programme of investment in wind energy.

5.2.6.2.2 Energy Targets

The Climate Action Plan 2019 (CAP) was published on the 1st August 2019 by the Department of Communications, Climate Action and Environment. The CAP sets out an ambitious course of action over the coming years to address the impacts which climate may have on Irelands environment, society, economic and natural resources. The CAP includes a commitment that 70% of Ireland's electricity needs will come from renewable sources by 2030. It is envisaged that wind energy will provide the largest source of renewable energy in achieving this target.

5.2.6.2.3 Employment Potential

The Deloitte report (2009) estimated at the time of its publication that the Island of Ireland's installed wind energy capacity would need to reach 7,800 Megawatts (MW) by 2020, in order to meet the Government's renewable energy targets. Based on these estimates, the Deloitte report stated that the Irish wind energy sector to 2020 would be capable of supporting more than 10,760 jobs through direct and indirect involvement in the sector. This number includes construction, operation and maintenance of all wind farms and assumes a steady growth in the industry over the period to 2020. It also encompasses planning and financing of wind farms, and support services such as administration, payroll and marketing/communications. There are also further employment opportunities available in other areas of the wind energy sector relating to policy, Research and Development, support services and other, which total to 935 jobs across Ireland.

Of the 10,760 jobs estimated to be created through the development of the wind energy sector, the Deloitte report states the majority of these would be provided within the construction industry:

> *"The wind sector offers great opportunities to a sector such as construction, which is currently facing downturn and rising unemployment. It is estimated that approximately 7,258 jobs will be supported by the construction element of wind farms."*

The Deloitte study on employment and investment potential assumed that there would be a steady growth in the amount of wind power rolled out between 2009 and 2020. The report states:

> *"It is crucial that the industry expands at a sustainable rate. If Ireland's increase in installed capacity is rolled out at a steady growth rate over the next eleven years then Irish companies will have sufficient time to adapt and build up their companies in order to cope with the increasing number of MW being added every year."*

As of April 2020, there were 5,030 Megawatts (MW) of wind energy capacity installed on the island of Ireland[1]. Of this, 3,748 MW was installed in the Republic of Ireland, with 1,282 MW installed in Northern Ireland. The majority of the Republic of Ireland's installed wind energy capacity is located in Counties Donegal, Cork and Kerry.

5.2.6.2.4 Economic Value

The Deloitte report states that the construction and development of wind energy projects across the island of Ireland would involve approximately €14.75 billion of investment from 2009 up to 2020, €5.1 billion of which would be retained in the Irish economy (€4.3 billion invested in the Republic of Ireland and €0.8 billion in Northern Ireland).

[1] https://www.iwea.com/about-wind/facts-stats

The report also states that increasing the share of our energy from renewable sources will deliver significant benefits for the electricity customer, the local economy and society. It estimates that between 25 and 30% of capital investment is retained in the local economy. This typically flows to companies in construction, legal, finance and other professional services. The report states:

> *".. the framework acknowledges the need to put the energy/climate change agenda at the heart of Ireland's economic renewal. Every new wind farm development provides a substantial contribution to the local and national economy through job creation, authority rates, land rents and increased demand for local support services. More wind on the system will also result in lower and more stable energy prices for consumers while helping us achieve our energy and emissions targets."*

A recent report by Baringa has analysed the financial impact for end consumers of the deployment of wind generation in Ireland over the period 2000-2020 (Cost-benefit analysis of wind energy in Ireland 2000-2020, January 2019). The report calculates how the costs and benefits for consumers would have differed if no wind farms had been built. The analysis indicated that the deployment of 4.1 Gigawatts (GW) of wind generation capacity in Ireland between 2000 and 2020 (2018-2020 results being projective) will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year since 2000. Further cost benefit analysis noted that wind energy has delivered €2.3 billion in savings in the wholesale electricity market. As such, the economic benefit of renewable energy to consumers is greater than what would have been if Ireland did not invest in wind power.

5.2.7 Land Use

Current land-use on the subject site comprises coniferous forestry and agriculture. Land-use in the wider landscape comprises a mix of agriculture, low density housing and commercial forestry.

A complete land-use dataset was not available from the Census of Agriculture 2010 for Templemichael DED. Therefore, this section of the report reviews the land-use changes in the remaining 7 no. DEDs only, using the datasets from 2010 Census of Agriculture.

The total area of farmland within the 7 DEDs around the main wind farm site measures approximately 10,601 hectares, comprising 74% of the Study Area, according to the CSO Census of Agriculture 2010. There are 225 farms located within the 7 DEDs, with an average farm size of 47.1 hectares. This is slightly larger than the average farm size for Co. Cork at 38.1 hectares and Co. Waterford at 45.6 hectares.

Within the 7 DEDs, farming employs 477 people, and the majority of farms are family-owned and run. Table 5-6 shows the breakdown of farmed lands within the 7 DEDs. Pasture accounts for the largest proportion of farmland, followed by silage.

Table 5-6 Farm Size and Classification within the Study Area in 2010 (Source: CSO)

Characteristic	Value
Size of 7 DEDs	14,263 hectares
Total Area Farmed within 7 DEDs	10,601 hectares
Farmland as % of 7 DEDs	74%
Breakdown of Farmed Land	**Area (hectares)**
Total Pasture	5,683 ha

Characteristic	Value
Total Silage	2,541 ha
Grazing	1,619 ha
Total Hay	1,160 ha
Total Potatoes	455 ha
Total Cereals	305 ha
Total Crops	13 ha

5.2.7.1 Equine Industry

All stud farms and equestrian facilities located within 10km of the proposed development have been included in the assessment. The closest stud farm/equestrian facility is located approximately 1,000 metres from the nearest proposed turbine location. The stud farms/equestrian facility and distances are shown in Table 5-7.

Table 5-7 Stud Farms/Equestrian Facilities within 5km of a Turbine Location

Facility	Distance to nearest Turbine (m)
The Old Road Stud, Tallow, Co. Waterford	1,000
Bridge Stud, Tallow, Co. Waterford	6,000
The Beeches Study, Knocknamuck, Tallow, Co. Waterford	7,600

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

Horses in Stables

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

Breeding Mares

A study by Le Blanc et al (1991) and summarised by Marshall Day studied the effects of simulated aircraft noise over 100 dB and visual stimuli on pregnant mares. The study focused on pregnancy success, behaviour, cardiac function, hormonal production and rate of habitation. Le Blanc concluded the following:

Le Blanc et al (1991) found that birth success of pregnant mares was not affected by F-14 jet aircraft noise. While the 'fright-flight' reaction was initially observed, the mares did adapt to the noise.

Racehorses

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

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

5.2.7.1.2 *Guidance*

In the absence of national policy or guidance in relation of the development of wind farms near stud farms/equestrian centres, MKO have reviewed the British Horse Society's *'Advice on Wind Turbines and Horses – Guidance for Planners and Developers'*. A copy of the guidance document is included in Appendix 5-1 of this EIAR.

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

The BHS strongly recommends that the views and concerns of local equestrians should be recognised and taken into account when determining separation distances and that normally a minimum separation distance of 200m or three times blade tip height (whichever is greater) will be required between a turbine and any route used by horses or a business with horses.

As mentioned previously, the closest stud farm/equestrian facility is located approximately 1,000 metres from the nearest proposed Lyrenacarriga turbine location and is therefore at a distance of five times the British Horse Society's recommended minimum separation distance of 200 metres as noted above. It also exceeds the 450 metres separation distance (based on three times the turbine blade tip height of 150 metres).

5.2.8 Services

The proposed wind farm site is located approximately 5 kilometres southeast of Tallow, Co. Waterford and approximately 15 kilometres to the northwest of Youghal, Co. Cork, in which the main services are located. Additionally, the nearby settlement of Inch lies approximately 3.8 kilometres south of the proposed development; where local amenities including a community centre, church and shop are located.

5.2.9 Education

The closest primary school to the Proposed Development site is Knockanore National School, Knockanore, located approximately 1.6 kilometres northeast of the site. The nearest secondary schools are located in Lismore and Youghal, which lie approximately nine kilometres and 15 kilometers to the northeast and southeast of the site respectively. The third-level institution of University College Cork (UCC) is located approximately 40 kilometres southwest of the site.

5.2.9.1 Access and Public Transport

The site is accessed via local roads from the R634 Regional Road, which travels in a northwest-southeast direction between Tallow and Youghal and the R627 Regional Road, which travels in northeast-southwest direction between Tallow and Midleton.

There are Bus Eireann direct connections from Youghal to Waterford, Dungarvin, Midleton and Cork from which most destinations may be reached. The nearest train station to the proposed development site is in Youghal, located approximately 15 kilometres southeast of the proposed wind farm site.

5.2.9.2 Amenities and Community Facilities

Most of the amenities and community facilities, including GAA and other sports clubs, youth clubs and recreational areas, available in the area are in the nearby settlements of Tallow, Co. Waterford and Youghal, Co. Cork.

The varied environment of this area of Counties Cork and Waterford provides many opportunities for walking and cycling. The Blackwater Way walking route extends along some local roads and tracks in this part of the county and passes within approximately 12 kilometres of Tallow, smaller local walks such as the Youghal Sli and Moanbaun Wood – Nature trail can be found 8 kilometres south of the site and 9 kilometres west of the site respectively.

Community Benefit proposals, which would enhance local amenities and community facilities, are described in Section 4.5 of this EIAR, in Chapter 4: Description of the Proposed Development.

5.3 Tourism

5.3.1 Tourism Numbers and Revenue

Tourism is one of the major contributors to the national economy and is a significant source of full time and seasonal employment. During 2018 (the latest period for which complete figures are available), total tourism revenue generated in Ireland was approximately €9.4 billion, an increase on the €8.8 billion revenue recorded in 2017. Overseas tourist visits to Ireland in 2018 grew by 6.5% to 9.6 million *('Tourism Facts 2018'*, Fáilte Ireland, September 2019). Preliminary figures for 2019 indicate that the total overseas revenue generated by tourists coming to Ireland was 5.17 billion, down 0.9% on 2018. The total tourism revenue for 2019 has not been finalised (*Preliminary Key Tourism Facts 2019 Fáilte Ireland, August 2020*).

Ireland is divided into eight tourism regions. Table 5-8 shows the total revenue and breakdown of overseas tourist numbers to each region in Ireland during 2018 (*'Tourism Facts 2018, Fáilte Ireland, July 2019*).

Table 5-8 Overseas Tourists Revenue and Numbers 2018 (Source: Failte Ireland)

Region	Total Revenue (€m)	Total Number of Overseas Tourists by Region (000s)
Dublin	€2,095	6,309
Mid-East/Midlands	€393	1,030
South-East	€261	1,028
South-West	€987	2,512

Region	Total Revenue (€m)	Total Number of Overseas Tourists by Region (000s)
Mid-West	€511	1,497
West	€727	1,963
Border	€244	752
Total	€5,218	15,091

The proposed wind farm site is located in both the South West and South East regions. The South West region which comprises Counties Cork and Kerry, benefited from approximately 17% of the total number of overseas tourists to the country and approximately 19% of the associated tourism income generated in Ireland in 2018. The South East region which comprises Counties Carlow, Kilkenny, Waterford and Wexford, benefited from approximately 7% of the total number of overseas tourists to the country and approximately 5% of the associated tourism income generated in Ireland in 2018.

5.3.2 Tourist Attractions

There are no key identified tourist attractions pertaining specifically to the site of the proposed development itself.

5.3.2.1 County Cork

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

- The Blackwater Valley - a walking, cycling, fishing destination and other outdoor activities, 10km north of the development site.
- The Bandon and Lee River Valley – important recreational amenity and fisheries areas;
- Mountain ranges including: the Slieve Miskish and Caha Mountains, the Galtee Mountains, the Shehy Mountains and the Ballyhoura Area – important centres for walking, cycling and adventure related activities.
- The Coastline – Over 1,100kms of scenic coastline and peninsulas. Marine related activities including some fine blue flag beaches.
- The Gaeltacht areas which are of significant cultural heritage value and frequently visited by tourists;
- The West Cork Peninsulas (Beara, Mizen, Sheeps Head) – with their unique visual amenity and landscape character offer potential for walking and cycling and other outdoor activities.
- West Cork Islands and all the other uninhabited islands along the County's coast;
- Cork has rich fertile agricultural land and many bogs and peatlands with a higher than national average land mass of forest and woodland area;
- Cork City and Harbour – the potential for Spike Island and Fort Camden to become internationally recognized tourist attractions.

Figure 5-3 below shows the diversity and spread of tourism assets in County Cork as identified in the Cork County Development Plan (CDP) 2014.

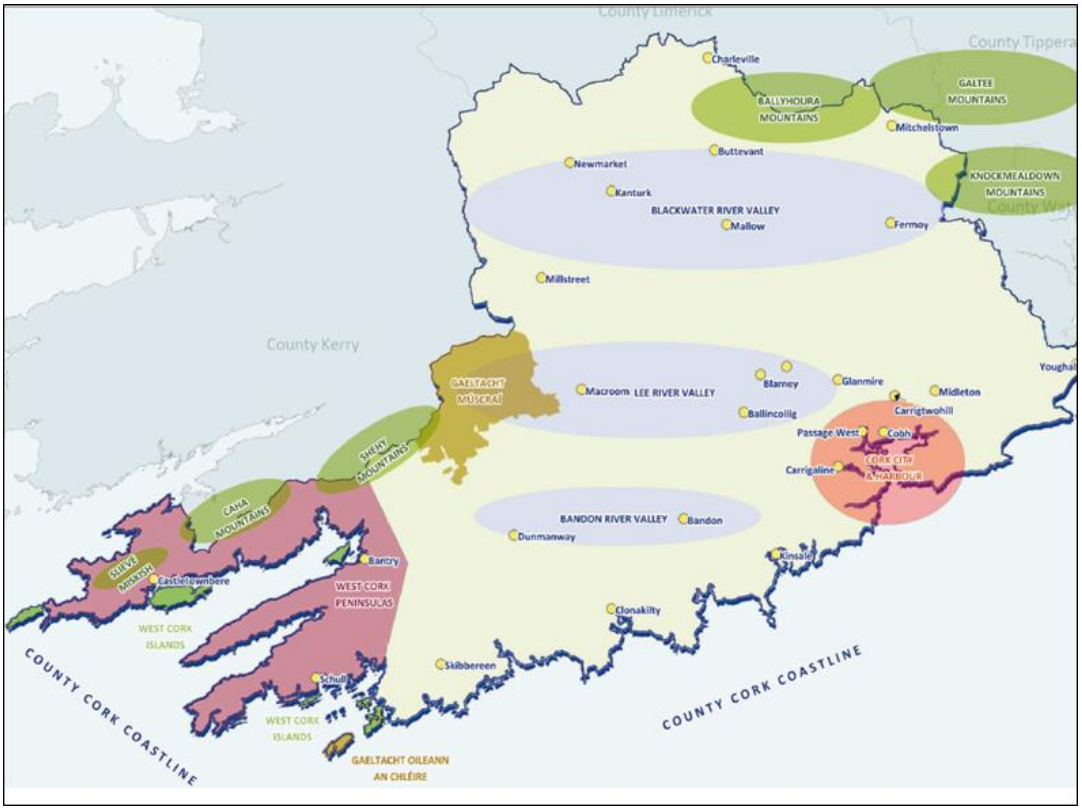

Figure 5-3 Tourism Assets in Cork (Source CDP 2014)

The proposed development site is not located within any of the strategic tourism areas identified in the Cork CDP nor does it impact on any sites of existing tourism attractions.

5.3.2.2 County Waterford

Waterford's key tourist attractions include the following:

- The Comeragh Mountains, 25km northeast of the development site.
- The Copper Coast UNESCO Global Geopark, c.31km northeast of the development site.
- The Blackwater Valley - a walking, cycling, fishing destination and other outdoor activities, 10km north of the development site.
- Waterford Town: Waterford Town itself contains a wealth of tourist attractions such as: the Viking Triangle, House of Waterford Crystal, Reginald's Tower, Medieval Museum, Cathedral of the Most Holy Trinity, Mount Congreve stately home, King of the Viking virtual reality adventure, Lafcadio Hearn Japanese Gardens, Theatre Royal.

The proposed development site is not located within any key tourist attraction locations in Co. Waterford.

5.3.3 Tourist Attitudes to Wind Farms

5.3.3.1 Scottish Tourism Survey 2016

BiGGAR Economics undertook an independent study in 2016, entitled '*Wind Farms and Tourism Trends in Scotland*', to understand the relationship, if any, that exists between the development of onshore wind energy and the sustainable tourism sector in Scotland. In recent years the onshore wind sector and sustainable tourism sector have grown significantly in Scotland. However, it could be argued that if there was any relationship between the growth of onshore wind energy and tourism, it would be

at a more local level. This study therefore considered the evidence at a local authority level and in the immediate vicinity of constructed wind farms.

Eight local authorities had seen a faster increase in wind energy deployment than the Scottish average. Of these, five also saw a larger increase in sustainable tourism employment than the Scottish average, while only three saw less growth than the Scottish average. The analysis presented in this report shows that, at the Local Authority level, the development of onshore wind energy does not have a detrimental impact on the tourism sector. This found that in the majority of cases (66%) sustainable tourism employment performed better in areas surrounding wind farms than in the wider local authority area. There was no pattern emerging that would suggest that onshore wind farm development has had a detrimental impact on the tourism sector, even at the very local level.

Overall, the conclusion of this study is that published national statistics on employment in sustainable tourism demonstrate that there is no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level, nor in the areas immediately surrounding wind farm development. However the report also concluded that *'Although this study does not suggest that there is any direct relationship between tourism sector growth and wind farm development, it does show that wind farms do not cause a decrease in tourism employment either at a local or a national level.'*

5.3.3.2 Fáilte Ireland Surveys 2007 and 2012

In 2007, Fáilte Ireland in association with the Northern Ireland Tourist Board carried out a survey of domestic and overseas holidaymakers to Ireland in order to determine their attitudes to wind farms. The purpose of the survey was to assess whether or not the development of wind farms impacts on the enjoyment of the Irish scenery by holidaymakers. The survey involved face-to-face interviews with 1,300 tourists (25% domestic and 75% overseas). The results of the survey are presented in the Fáilte Ireland Newsletter 2008/No.3 entitled '*Visitor Attitudes on the Environment: Wind Farms'*.

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

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

With regard to the perceived impact of wind farms on sightseeing, the Fáilte Ireland report states:

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

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

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

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

The report goes on to state that while there is a generally positive disposition among tourists towards wind development in Ireland, it is important also to take account of the views of the one in seven tourists who are negatively disposed towards wind farms. This requires good planning on the part of the wind farm developer as well as the Local Authority. Good planning has been an integral component of the proposed development throughout the site design and assessment processes. Reference has been had to the Department of the Environment, Heritage and Local Government's '*Planning Guidelines on Wind Energy Development'* throughout all stages, including pre-planning consultation and scoping.

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

Further details regarding the general public perception of wind energy, including those living in the vicinity of a wind farm, are presented in Section 5.4 below.

5.4 Public Perception of Wind Energy

5.4.1 Sustainable Energy Ireland Survey 2003

5.4.1.1 Background

The results of a national survey entitled *'Attitudes Towards the Development of Wind Farms in Ireland'* were published by the Sustainable Energy Authority of Ireland (SEAI) in 2003. A catchment area survey was also carried out by SEAI (formerly SEI) in order to focus specifically on people living with a wind farm in their locality or in areas where wind farms are planned.

5.4.1.2 Findings

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

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

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

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

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

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

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

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

5.4.1.3 Conclusions

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

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

5.4.1.4 Survey Update 2017

Additionally, a survey carried out by Interactions in October 2017, published by the SEAI, show 47% of Irish adults polled said they were are strongly in favour of wind power in Ireland while a further 38%

favour it. Overall, this is a 4% increase in favourable attitudes towards wind power compared with similar research in 2013.

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

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

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

5.4.2.1 Background

A survey of the public perception of wind power in Scotland and Ireland was carried out in 2003/2004 by researchers at the School of Geography & Geosciences, University of St. Andrews, Fife and The Macaulay Institute, Aberdeen ('Green on Green: Public Perceptions of Wind Power in Scotland and Ireland', Journal of Environmental Planning and Management, November 2005). The aims of the study were to ascertain the extent to which people support or oppose wind power, to investigate the reasons for these attitudes and to establish how public attitudes relate to factors such as personal experience of operational wind farms and their proximity to them.

5.4.2.2 Study Area

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

5.4.2.3 Findings

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

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

> *"These results support earlier work which has found that opposition to wind farms arises in part from exaggerated perceptions of likely impact, and that the experience of living near a wind farm frequently dispels these fears. Prior to construction, locals typically expect the*

landscape impacts to be negative, whereas, once in operation, may people regard them as an attractive addition."

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

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

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

5.4.2.4 Conclusions

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

5.4.3 IWEA Interactions Opinion Poll on Wind Energy

Published in January 2020, IWEA undertook a national opinion poll on Wind Energy November 2019 with the objective to "*measure and track public perceptions and attitudes around wind energy amongst Irish adults*." Between November 20th – 30th 2019, a nationally represented sample of 1,019 adults and a booster sample of 200 rural residents participated in an online survey. The 2019 results indicate that 79% of both the nationally represented sample and rural sample either strongly favour or favour wind power while 16% of both samples neither favour or oppose it. Amongst those in favour of wind power, the majority cited environmental and climate concerns as their main reasons for supporting such developments. Other reasons cited for supporting wind energy developments include: "economic benefits," "reliable/efficient," "positive experience with wind energy" and recognise it as a "safe resource." When questioned about wind developments in their local area, 55% of nationally represented sample favour or tend to favour such proposals and 51% of the rural population reported the same. Reasons cited for supporting wind developments in their local area include: "good for the environment," "social responsibility," "create jobs," "good for the community." In the same survey, 30 to 31% neither favour/opposed, 6 to 7% tended to oppose and 9 to 11% strongly opposed.

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

5.5 Health Impacts of Wind Farms

5.5.1 Health Impact Studies

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

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

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

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

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

2. ***'Wind Turbine Sound and Health Effects – An Expert Panel Review', American Wind Energy Association and Canadian Wind Energy Association, December 2009***

This expert panel undertook extensive review, analysis and discussion of the large body of peer-reviewed literature on sound and health effects in general, and on sound produced by wind turbines in particular. The panel assessed the plausible biological effects of exposure to wind turbine sound. Following review, analysis, and discussion of current knowledge, the panel reached consensus on the following conclusions:

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

The report found, amongst other things, that:

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

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

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

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

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

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

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

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

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

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

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

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

CAHA notes that:

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

This, it states, is in contrast to the health impacts of fossil fuel energy generation.

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

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

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

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

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

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

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

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

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

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

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

- Measurements of low-frequency sound, infrasound, tonal sound emission, and amplitude-modulated sound show that infrasound is emitted by wind turbines. The levels of infrasound at customary distances to homes are typically well below audibility thresholds.
- No cohort or case–control studies were located in this updated review of the peer-reviewed literature. Nevertheless, among the cross-sectional studies of better quality, no

clear or consistent association is seen between wind turbine noise and any reported disease or other indicator of harm to human health.
- Components of wind turbine sound, including infrasound and low frequency sound, have not been shown to present unique health risks to people living near wind turbines.
- Annoyance associated with living near wind turbines is a complex phenomenon related to personal factors. Noise from turbines plays a minor role in comparison with other factors in leading people to report annoyance in the context of wind turbines.

A further 25 reviews of the scientific evidence that universally conclude that exposure to wind farms and the sound emanating from wind farms does not trigger adverse health effects, were compiled in September 2015 by Professor Simon Chapman, of the School of Public Health and Sydney University Medical School, Australia, and is included as Appendix 5-2 of this EIAR. Another recent publication by Chapman and Crichton (2017) entitled 'Wind turbine syndrome; A communicated disease' critically discusses why certain health impacts might often be incorrectly attributed to wind turbines.

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

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

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

The HSE position paper determines that current scientific evidence on adverse impacts of wind farms on health is weak or absent. Further research and investigative processes are required at a larger scale in order to be more informative for identifying potential health effects of exposure to wind turbine effects. They advise developers on making use of the Draft Wind Energy Development Guidelines (2006), as a means of setting noise limits and set back distances from the nearest dwellings.

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

The WHO Environmental Noise Guidelines provide recommendations for protecting human health from exposure to environmental noise originating from various sources such as transportation noise, wind turbine noise and leisure noise. The Guideline Development Group (GDG) defined priority health outcomes and from this were able to produce guideline exposure levels for noise exposure.

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

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

That being said, the GDG recommends renewable energy policies include provisions to ensure noise levels from wind farm developments do not rise above the guideline values for average noise exposure.

The GDG also provides a conditional recommendation for the implementation of suitable measures to reduce noise exposure. The GDG concludes that *'No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another.'*

Further details on assessment of the potential noise impacts of are presented in Chapter 13 of this EIAR

5.5.2 Turbine Safety

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

The adopted 2006 Guidelines and the Draft 2019 Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The build-up of ice on turbines is unlikely to present problems. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to resuming operation.

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

5.5.3 Electromagnetic Interference

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

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

The ESB document 'EMF & You' (ESB, 2017) provides further practical information on EMF (https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0).. A copy of this document is provided as Appendix 5-3 of this EIAR.

Further details on the potential impacts of electromagnetic interference to telecommunications and aviation are presented in Section 15.2 of this EIAR.

5.5.4 Assessment of Effects on Human Health

As set out in the Department of Housing, Planning, Community and Local Government Key Issues Consultation Paper on the Transposition of the EIA Directive 2017 and the guidance listed in Section 1.7.2 of Chapter 1: Introduction, the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters.

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

Chapters 9 Land, Soils & Geology, Chapter 10 Hydrology & Hydrogeology, Chapter 11 Air & Climate and Chapter 12 Noise & Vibration provide an assessment of the effects of the proposed development on these areas of consideration. There is the potential for negative effects on human health during the wind farm construction phase related to potential emissions to air of dust, potential emissions to land and water of hydrocarbons and noise emissions. The assessments however show that the residual impacts are not significant and will not lead to significant effects on any environmental media. On this basis the potential for negative health effects associated with the proposed development is negligible.

The proposed project is for the development of a renewable energy project, a wind farm, capable of offsetting carbon emissions associated with the burning of fossil fuels. During the operational stage the wind farm will have a long term, slight, positive effect on air quality as set out in Chapter 11 which will contribute to positive effects on human health.

As set out in Chapter 10, potential health effects are associated with negative impacts on public and private water supplies and potential flooding. There are two public surface water supplies downstream of the proposed development site, the Tallow Public Water Supply (3100PUB1096) and the Youghal Public Water Supply (0500PUB2510), please see Chapter 10 Hydrology & Hydrogeology: Section 10.3.7 for details. A comprehensive drainage design and surface water management plan and drainage plan has been prepared for the Proposed Development and this will ensure that surface water runoff from the developed areas of the site will be of a high quality and will therefore not impact on the quality of downstream rivers. Detailed drainage management design and pollution prevention measures proposed during the construction phase are presented in Chapter 10 and in Section 4.6 of Chapter 4 of this EIAR. These detailed proposals are best in class and in line with current best practice approaches for surface water quality protection on wind farm and forestry sites. The proposed site design and mitigation measures outlined in Chapter 10 ensures that the potential for impacts on the water environment are not significant. No impacts on local water supplies are anticipated.

The Flood Risk Assessment included as Appendix 10-1, has also shown that the risk of the proposed wind farm contributing to downstream flooding is also very low.

5.5.5 Vulnerability of the Project to Natural Disaster

As outlined in Section 5.5.4 above a wind farm is not a recognised source of pollution. Should a major accident or natural disaster occur the potential sources of pollution onsite during both the construction and operational phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health such as bulk storage of hydrocarbons or chemicals, storage of wastes etc. are limited.

There is limited potential for significant natural disasters to occur at the Lyrenacarriga Wind Farm site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to flooding and fire. The risk of flooding is addressed in Chapter 10. It is considered that the risk of significant fire occurring, affecting the wind farm and causing the

wind farm to have significant environmental effects is limited. As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is addressed in Section 5.5.2.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on and off the site of the accident. The wind farm site is not regulated or connected to or close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO sites and so there is no potential effects from this source.

5.6 Property Values

The largest study of the impact of wind farms on property values has been carried out in the United States. '*The Impact of Wind Power Projects on Residential Property Values in the United States: A multi-Site Hedonic Analysis*', December 2009, was carried out by the Lawrence Berkley National Laboratory (LBNL) for the U.S Department of Energy. This study collected data on almost 7,500 sales of single-family homes situated within ten miles of 24 existing wind farms in nine different American states over a period of approximately ten years. The conclusions of the study are drawn from eight different pricing models including repeat sales and volume sales models. Each of the homes included in the study was visited to demonstrate the degree to which the wind facility was visible at the time of the sale, and the conclusions of the report state that "The result is the most comprehensive and data rich analysis to date on the potential impacts of wind energy projects on nearby property values."

The main conclusion of this study is as follows:

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

This study has been recently updated by LBNL who published a further paper entitled "*A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States*", in August 2013. This study analysed more than 50,000 home sales near 67 wind farms in 27 counties across nine U.S. states, yet was unable to uncover any impacts to nearby home property values. The homes were all within 10 miles of the wind energy facilities - about 1,100 homes were within 1 mile, with 331 within half a mile. The report is therefore based on a very large sample and represents an extremely robust assessment of the impacts of wind farm development on property prices. It concludes that:

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

Both of these LBNL studies note that their results don't mean that there will never be a case of an individual home whose value goes down due to its proximity to a wind farm – however if these situations do exist, they're rare enough to be statistically insignificant. Therefore, although there have been claims of significant property value impacts near operating wind turbines that regularly surface in the press or in local communities, strong evidence to support those claims has failed to materialise in all of the major U.S. studies conducted thus far.

A further study was commissioned by RenewableUK and carried out by the Centre for Economics and Business Research (Cebr) in March 2014. Its main conclusions are:

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

A relatively new study issued in October 2016 *'Impact of wind Turbines on House Prices in Scotland'* (2016) was published by Climate Exchange. Climate Exchange is Scotland's independent centre of expertise on climate change which exists to support the Scottish Governments policy development on climate and the transition to a low carbon economy. A copy of the report is included as Appendix 5-4 of this EIAR.

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

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

Although there have been no empirical studies carried out in Ireland on the impacts of wind farms on property prices, it is a reasonable assumption based on the available international literature and evidence, that the provision of a wind farm at the proposed location would not impact on the property values in the area.

5.7 Residential Amenity

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

The proposed wind farm site is located on a site currently used for forestry; therefore a certain level of industrial activity and traffic movements are associated with the site, which will assist in the assimilation of the proposed development into the receiving environment. There are no occupied properties located within approximately 700 metres of a proposed turbine location.

When considering the amenity of residents in the context of a proposed wind farm, there are three main potential impacts of relevance: 1) Shadow Flicker, 2) Noise, and 3) Visual Amenity. Shadow flicker and noise are quantifiable aspects of residential amenity while visual amenity is more subjective. Detailed shadow flicker and noise modelling have been completed as part of this EIAR; Chapter 6 refers to shadow flicker modelling, Chapter 13 addresses noise. A comprehensive landscape and visual impact assessment has also been carried out, as presented in Chapter 12 of this EIAR. Impacts on population and human health during the construction, operational and decommissioning phases of the proposed development are assessed in relation to each of these key issues and other environmental factors such as noise, traffic and dust; see Impacts in Section 5.8 below. The impact on residential amenity is then derived from an overall judgement of the combination of impacts due to shadow flicker, changes to land-use and visual amenity, noise, traffic, dust and general disturbance.

5.8 Likely Significant Impacts and Associated Mitigation Measures

5.8.1 'Do-Nothing' Scenario

If the proposed Project was not developed, the site will continue to function as it does at present, with no changes made to the current land-use of commercial forestry and agriculture.

If the proposed development were not to proceed, the opportunity to capture part of County Cork and County Waterford's valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

5.8.2 Construction Phase

5.8.2.1 Health and Safety

Pre-Mitigation Impacts

Construction of the proposed development will necessitate the presence of a construction site. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a short-term potential significant negative impact.

A site-specific Emergency Response Plan (ERP) will be developed prior to the construction of the facility and will include details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP in terms of health and safety will require updating and submissions from the various contractors and suppliers on appointment as the proposed project progresses.

The Environmental Manager will be responsible for any corrective actions required as a result of an incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

Proposed Mitigation Measures

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

- Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended;
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and
- Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006).

A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared at the procurement stage and developed further at construction stage.

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

Public safety will be addressed by restricting site access during construction. Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate warning signs will be posted, directing all visitors to the site manager. Appropriate warning measures including 'goalposts' will be used as appropriate to prevent contact with any overhead lines that traverse the site.

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

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

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

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

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

Residual Impact

Short-term potential slight negative impact

Significance of Effects

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

5.8.2.2 Employment and Investment

The design, construction and operation of the proposed wind farm will provide employment for technical consultants, contractors and maintenance staff. Up to 100 jobs could be created during the construction, operation and maintenance phases of the proposed development. The construction phase of the proposed development will last between approximately 18 – 24 months. The majority of construction workers and materials will be sourced locally where possible, thereby helping to sustain employment in the construction trade. This will have a short-term significant positive impact.

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

The proposed development will result in an influx of skilled people into the area, bringing specialist skills for both the construction and operational phases that could result in the transfer of these skills into the local workforce, thereby having a long-term positive impact on the local skills base. Up-skilling and training of local staff in the particular requirements of the wind energy industry is likely to lead to additional opportunities for those staff as additional wind farms are constructed in Ireland. This will have a long-term moderate positive indirect impact. According to the Irish Wind Energy Association there were over 3,400 jobs directly related to wind energy in Ireland in 2016, a figure which is projected to grow to over 8,000 by 2020.

Rates payments for the proposed wind farm will contribute significant funds to Waterford and Cork County Council's, which will be redirected to the provision of public services within both Counties. These services include provisions such as road upkeep, fire services, environmental protection, street lighting, footpath maintenance etc. along with other community and cultural support initiatives.

Proposed Community Benefit Scheme

Should Lyrencarriga Wind Farm be consented, it has the potential to provide significant additional investment into community projects that will benefit local residents and businesses. Following the publication of the Department of Communications, Climate Action & Environment's (DCCAE) Renewable Energy Support Scheme (RESS) and the terms of conditions of the first auction under the scheme, RESS1 which took place this year (July 2020), it is anticipated that based on the requirement for all wind energy projects to contribute €2 per MWh of output, a community fund in the region of €6,000 per MW of installed capacity per annum could be available from the proposed wind farm.

This means that a wind farm at Lyrenacarriga of 60 MW to 85 MW capacity could result in a fund upward of €360,000 per year for the local community, subject to the final installed capacity (MW) and output (MWh) of the wind farm. This represents a dependable source of income for the communities local to Lyrenacarriga.

RWE Renewables Ireland supports the development of a funding process that puts decision-making on what funds are spent where in the hands of local people. The flexibility of the investment that could come from Lyrenacarriga Wind Farm would mean that a panel of local community representatives

would decide how to invest the income in a variety of projects that will benefit residents, local businesses and the community as a whole including creating job opportunities and skills development, tourism initiatives and area regeneration projects.

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Potential community shared ownership

In addition, a further potential income stream could come via RWE Renewables Ireland offering the local community the opportunity to participate in a community shared ownership scheme whereby they invest in the wind farm in return for a share of future revenue.

Supply chain opportunities & jobs

During the construction phase of the wind farm, there will be supply chain opportunities for local businesses leading to an increase in local investment and job opportunities. Prior to construction starting, RWE Renewables Ireland will award the principal contract for Civil Balance of Plant supply and installation of the turbines, and the Electrical Balance of Plant contract. Once these main contracts have been placed, there will be potential opportunities for supply chain companies in the region to tender for subcontracts. The types of businesses that could benefit from this expenditure is wide ranging, and is likely to include traffic management; materials supply; plant hire; fencing, fuel, security, waste management, signing and lighting, telecommunications, drainage, catering and hotel and B&B businesses.

5.8.2.3 Population

Those working on the construction phase of the proposed development will travel daily to the site from the wider area. The construction phase will have no impact on the population of the area in terms of changes to population trends or density, household size or age structure.

5.8.2.4 Land-use

The existing land-uses of commercial forestry and agriculture will continue at the proposed development site, around the footprint of the proposed wind farm. The total footprint of the proposed development site measures approximately 23.3 hectares or just 3% of the total site area, and therefore there is no significant loss of land for forestry and agriculture.

5.8.2.5 Tourism and Amenity

Given that there are currently no tourism attractions specifically pertaining to the proposed development site there are no impacts associated with the construction phase of the proposed development. With regard to amenity use around the site, some traffic management safety measures may be in place, which temporarily affect the use of local roads. These measures will be short-term in duration and result in a slight, negative impact to motorists and cyclists. See Traffic impacts below for further details on proposed mitigation measures.

5.8.2.6 Noise

Pre-Mitigation Impacts

There will be an increase in noise levels in the vicinity of the proposed development site and at the two haul route works locations during the construction phase, as a result of heavy machinery and construction work. These impacts will be short-term in duration. The noisiest construction activities associated with wind farm development are excavation and pouring of the turbine bases, substation foundations and the extraction of stone from the borrow pit. Excavation of a base can typically be completed in one to two days however, and the main concrete pours are usually conducted in one continuous pour, which is done within a matter of hours.

Construction noise at any given noise sensitive location will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the proposed development are further described in Chapter 13 of this EIAR.

Proposed Mitigation Measures

Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed development in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 13-3 using methods outlined in British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs weekdays and between 7:00hrs and 14:00hrs on Saturdays. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, rotor/tower deliveries) it could occasionally be necessary to work out of these hours.

Where rock breaking is employed in relation to the proposed borrow pit locations, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities:

- Rock breaking to occur at times permitted by the Planning Authority only.
- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency.
- Ensure all leaks in air lines are sealed.

- Use a dampened bit to eliminate ringing.
- Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured.
- Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

Depending on the hardcore volume requirements, blasting may also be used as a more effective rock extraction method, capable of producing significant volumes of rock in a matter of milliseconds. Blasting, if required, will only be carried out after notifying local residents.

The potential noise and vibration impacts associated with the rock extraction measures are assessed in Chapter 13 (see Sections 13.6.2.3 and 13.6.2.8 and 9) of this EIAR.

Residual Impact

Temporary to Short-term slight to moderate negative impact

Significance of Effects

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

5.8.2.7 Dust

Pre-Mitigation Impacts

Potential dust emission sources during the construction phase of the proposed development include tree felling, upgrading of existing access tracks and construction of new access roads, turbine foundations and substation. The entry and exit of construction vehicles from the site may result in the transfer of mud to the public road, particularly if the weather is wet. This may cause nuisance to residents and other road users. These impacts will not be significant and will be relatively short-term in duration.

Proposed Mitigation Measures

The majority of aggregate material for the construction of roads and turbine bases will be sourced from the proposed borrow pits located within the proposed wind farm site, therefore limiting the distance needed to transport this material to the required locations. Should additional aggregate material be required, the material will be sourced from local quarries within the local area surrounding the site. Further details regarding potential quarry locations are provided in Section 4.3.3.4 in Chapter 4 of this EIAR. Truck wheels will be washed to remove mud and dirt before leaving the site. All plant and materials vehicles shall be stored in the compound area or other dedicated areas. Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. Construction traffic will be restricted to defined routes and a speed limit will be implemented.

In periods of extended dry weather, dust suppression may be necessary during tree felling, along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and the temporary site compound to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise. Aggregate materials for the construction of the cabling route will be

sourced locally to reduce the amount of emissions associated with vehicle movements. Potential dust emissions during the construction period will not be significant and will be relatively short-term in duration.

Residual Impact

Short-term imperceptible negative impact

Significance of Effects

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

5.8.2.8 Traffic

Pre-Mitigation Impacts

The construction phase of the proposed development will last for approximately 18 to 24 months. Turbines will be delivered to the site of the proposed development from Waterford Harbour via the N25 through Youghal and the R634 Regional Route. Turbine delivery access to the eastern cluster will be via an access junction on the R634 Regional Road. Turbine delivery access to the western cluster will via an access junction on the local road to the west of the site.

Non-turbine construction traffic will access the eastern cluster via the entrance off the R634 Regional Road and an additional entrance off the L2003 at the north of the site. Non-turbine construction traffic will access the western cluster via the entrance off the local road to the west of the site. The proposed turbine delivery and construction traffic routes to the site are shown in Figure 15-1 in Chapter 15 of this EIAR.

Non-turbine construction traffic will comprise Heavy Goods Vehicles (HGV) and Light Goods Vehicles (LGV) involved in the delivery of construction materials and plant machinery to the site and the export of excess construction materials and plant machinery from the site. A complete Traffic and Transportation Assessment (TTA) of the proposed development has been carried out by Alan Lipscombe Traffic and Transport Consultants. The full results of the TTA are presented in Section 15.1 of this EIAR.

The types of vehicles that will be required to negotiate the local network represent abnormal size loads and a detailed assessment of the geometry of the proposed route was therefore undertaken. This will have a short-term slight negative impact.

The proposed connection to the National Grid will comprise a proposed 110kV substation located within the site boundary which will connect into the overhead 110kV line which traverses the site. Thus, there will be no additional impacts to local road users and residents as a result of construction of this connection.

It is proposed to connect the two clusters of turbines via an underground medium voltage internal collector cable of approximately 3.3 km in length – the proposed route of the cable is primarily located within private agricultural land with a short section (approx. 620m in length) located within the public road corridor (Refer to Section 4.8.5 of this EIAR for further detail . The works at this location will be temporary in duration and subject to the same health and safety requirements as outlined above. The works have been assessed as part of the traffic assessment in Chapter 15 of this EIAR and will not give rise to significant effects on road users.

Two works locations are proposed on the turbine delivery route to accommodate delivery of the turbines to the site; they comprise a small area of hardsurfacing at Lombards Crossroads on the R634

Regional Road, and the construction of a new section of access road measuring 300 metres adjacent to the local road L7806 near Breeda Bridge. These works are described in Section 4.4.3 of Chapter 4 of this EIAR. The works at these locations will be temporary in duration and subject to the same health and safety requirements as outlined above. The works have been assessed as part of the traffic assessment in Chapter 15 of this EIAR, and will not give rise to significant effects on road users.

Proposed Mitigation Measures

The majority of aggregate materials for the construction of any additional site tracks will be obtained from the proposed borrow pit located within the main site of the proposed development. This will significantly reduce the travel time and distances travelled by delivery and construction vehicles who would otherwise have had to leave site. Should some aggregate material need to be sourced outside the site, local quarries in proximity to the site will be utilised to minimise the distance travelled by aggregate delivery vehicles. Further details are provided in Section 4.3.3.4 of Chapter 4.

- A traffic management plan an outline of which is presented in the CEMP in Appendix 4-4 of the EIAR will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed wind farm. The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.
- A competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.
- Reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the cable works. The details of this will be agreed with the roads authority in advance of works taking place.
- Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places.
- Liaison with the Waterford County Council Road Section, Cork County Road Section and An Garda Siochana, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required.

Residual Impact

Short-term imperceptible negative impact

Significance of Effects

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

5.8.3 Operational Phase

The effects set out below relate to the operational phase of the proposed wind farm.

5.8.3.1 Health and Safety

Pre-Mitigation Impact

It is not anticipated that the operation of the wind farm will present a danger to the public and livestock. Rigorous safety checks are conducted on the turbines during design, construction,

commissioning and operation to ensure the risks posed to staff, landowners and general public are negligible.

Proposed Mitigation Measures

Notwithstanding the above, the following mitigation measures will be implemented during the operation of the proposed development to ensure that ensure the risks posed to staff, landowners and general public remain negligible throughout the operational life of the wind farm.

Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.

Signs will be erected at suitable locations such as, amenity access points and carparks, setting out the conditions of public access under the relevant legislation and providing normal hours (and out of hours) contact details. Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed or are becoming hidden by vegetation or foliage, with prompt action taken as necessary.

Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include:

- Buried cable route markers at 50m (maximum) intervals and change of cable route direction;
- Directions to relevant turbines at junctions;
- "No access to Unauthorised Personnel" at appropriate locations;
- Speed limits signs at site entrance and junctions;
- "Warning these Premises are alarmed" at appropriate locations;
- "Danger HV" at appropriate locations;
- "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance;
- "No unauthorised vehicles beyond this point" at specific site entrances; and
- Other operational signage required as per site-specific hazards.

An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operational phase and will provide for access for emergency services at all times.

The components of a wind turbine are designed to last up to 30 years and are equipped with several safety devices to ensure safe operation during their lifetime. During the operation of the wind farm, regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site's health and safety requirements. Furthermore, turbines have a direct communications link with remote monitoring centres (both in Eirgrid and the Turbine Manufacturer). Faults signals from sensors are communicated to, and managed by, these monitoring centres and alerts can be raised to appointed Operation and Maintenance crews who can assess and address any issues in advance of or as they arise.

Residual Impact

With the implementation of the above mitigation measures, there will be a long-term, imperceptible residual impact on health and safety during the operational life of the proposed development

Significance of Effects

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

5.8.3.2 Employment and Investment

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

5.8.3.3 Population

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

5.8.3.4 Land-use

The footprint of the proposed development site, including turbines, roads etc., will occupy only a small percentage of the total Study Area defined for the purposes of this EIAR. The main land-use of commercial forestry and agriculture on the site of the proposed development will continue to co-exist with the proposed wind farm. The proposed development will have no impact on other land-uses within the wider area.

5.8.3.5 Noise

A baseline assessment of the existing background noise conditions was carried out, the results of which are presented in Chapter 13 of the EIAR. A noise assessment of the operational phase of the proposed development has also been carried out through modelling of the development using noise prediction software. The predicted noise levels for the proposed development have been compared with the existing background noise levels and the best practice guidance levels for noise emissions from wind farms.

Details of the noise assessment carried out by AWN Consulting are presented in Chapter 13 of the EIAR. The noise assessment determined that the predicted operational noise effect at the closest noise sensitive receptors to the site is of a moderate, negative, long-term nature. It is noted that this effect considers the periods of greatest potential effect prior to mitigation, i.e. the worst-case scenario. For the majority of locations assessed, operation of the proposed turbines will have a slight, negative, long-term effect. The noise assessment notes that these effects should be considered in terms that the effect is variable, and that this assessment considers periods of the greatest potential effect.

As stated in the noise assessment in Chapter 13, it has been demonstrated that the relevant national guidance in relation to noise associated with proposed wind turbines can be satisfied, therefore the predicted impact associated with the operational turbines is long term and not significant.

5.8.3.6 Traffic

One to two service technicians may have to attend to the site of the proposed wind farm on a weekly basis during the operational phase of the project. A Traffic and Transportation Assessment (TTA) of the proposed development has been completed by Alan Lipscombe Traffic and Transport Consultants, the results of which are presented in Section 15.1 of this EIAR. The TTA found that there will be a long-term imperceptible negative impact on traffic created during the operational phase of the proposed wind farm.

5.8.3.7 Renewable Energy Production and Reduction in Greenhouse Gas Emissions

Emissions from energy production accounted for 20.5% of Ireland's greenhouse gas emissions in 2016 (*'Ireland's Final Greenhouse Gas Emissions in 2016'*, EPA (April 2018)). The National Climate Change Strategy 2007 – 2012 stated that electricity generation from renewable sources provides the most effective way of reducing the contribution of power generation to Ireland's greenhouse gas emissions. The proposed development will offer significant benefits in terms of renewable energy production and reductions in greenhouse gas emissions. In this regard, it will have a long-term significant positive impact. In total, it is estimated that 2,409,510 tonnes of carbon dioxide will be displaced over the proposed thirty-year lifetime of the wind farm. Please refer to the carbon calculation assessment in Chapter 11 Air & Climate.

5.8.3.8 Tourism

Pre-Mitigation Impacts

Currently there are no dedicated amenity walkways within the development area. The proposed development site is not currently used for tourism purposes or located in close proximity to any key tourist attractions.

Proposed Mitigation Impacts

None required.

Significance of Effects

The proposed development will have no impact on tourism in the wider area.

5.8.3.9 Interference with Communication Systems

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The alternating current, electrical generating and transformer equipment associated with wind turbines, like all electrical equipment, also generates its own electromagnetic fields, and this can interfere with broadcast communications. The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path. This interference can be overcome by the installation of deflectors or repeaters.

As part of the scoping and consultation exercise undertaken by MKO, the national and regional broadcasters and fixed and mobile phone operators were contacted with regard to potential interference from the proposed wind farm. Full details are provided in Section 2.6 of the EIAR (in Chapter 2: Background to the Proposed Development) and Section 15.2 of the EIAR (in Chapter 15: Material Assets – Telecommunications and Aviation). Copies of scoping replies received are presented in Appendix 2-1 of the EIAR.

Of the scoping responses received from telephone, broadband and other telecommunications operators, those who highlighted an initial potential interference risk are addressed in Section 15.2.4 in Chapter 15 Material Assets. These potential risks were factored into the preliminary site design so as to avoid siting any turbines within the relevant telecoms link zones. The final proposed turbine layout does not overlap with any of the telecoms links or clearance zones requested by operators. The

remaining consultees who responded to scoping operate links either outside the proposed development site, and therefore not subject to any interference risk, or do not operate any links in the area.

In June 2018, a scoping response was received from the Irish Aviation Authority which set out lighting requirements for turbines. Further detail in regard to aviation, is addressed in Chapter 15 Material Assets. The proposed development will comply with all turbine lightning requirements of the Irish Aviation Authority.

The proposed wind farm will therefore have no impact on telecommunications or aviation communications.

5.8.3.10 Residential Amenity

Pre-Mitigation Impacts

Potential impacts on residential amenity during the operational phase of the proposed wind farm could arise primarily due to noise, shadow flicker or changes to visual amenity. Detailed noise and shadow flicker modelling have been carried out as part of this EIAR (Refer to Chapters 6 and 13 for further detail), which shows that the proposed development will be capable of meeting all required guidelines in relation to noise thresholds and the shadow flicker thresholds set out in the current adopted 2006 DoEHLG Wind Energy Guidelines. The proposed development will also be capable of meeting the requirements of any future update of these guidelines.

The visual impact of the proposed development is addressed comprehensively in Chapter 12 of this EIAR. The proposed development has been designed to maximise turbine separation distances to dwellings in the area, with no turbines located within approximately 700 metres of an occupied dwelling. An assessment of roadside screening was carried out for roads within 5 kilometres of the proposed turbine locations, with both the methodology and findings of this described in Section 12.9.4.3 of this EIAR. The assessment found that the proposed development will have no significant impact on existing visual amenity at dwellings due to the separation distance of all the residential properties and the level of existing screening in the area.

Proposed Mitigation Measures

There are no turbines proposed within approximately 700 metres of any occupied dwellings. All mitigation as outlined under noise and vibration, dust, traffic, visual amenity and telecommunications in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the proposed development works, including along the proposed turbine and construction materials haul route.

Residual Impact

The proposed development will have an imperceptible impact on residential amenity.

Significance of Effects

Based on the assessment above there will be no significant effects on residential amenity.

5.8.4 Decommissioning Phase

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to re-powering planning permission being obtained, or the site may be

decommissioned fully. The substation will remain in place as it will be under the ownership of the ESB/EirGrid.

The works required during the decommissioning phase are described in Section 4.10 in Chapter 4 of this EIAR. Any impact and consequential effect that occurs during the decommissioning phase will be similar to that which occurs during the construction phase, however to a lesser extent.

5.8.5 Cumulative Effects

For the assessment of cumulative impacts, any other existing, permitted or proposed developments (wind energy or otherwise) have been considered where they have the potential to generate an in-combination or cumulative impact with the proposed Lyrenacarriga Wind Farm. Further information on projects considered as part of the cumulative assessment are given in Section 2.8 of this EIAR. The impacts with the potential to have cumulative impacts on population and human health, in particular noise, shadow flicker, air & climate, traffic & transport, and visual impacts are addressed in the relevant chapters. No significant cumulative effects on population and human health as a result of the proposed development in combination with any other existing or permitted development have been identified. Please refer to the below sections for further details.

5.8.5.1 Employment and Economic Activity

There are 1 no. permitted wind farm and 3 no. existing wind farms sites located within 20 kilometres of the proposed wind farm site. These projects will contribute to short term employment during their construction stages and provide the potential for long-term employment resulting from maintenance operations. This results in a long-term moderate positive impact.

The commercial forestry activities on the site of the proposed wind farm provides between 3-6 months of employment, either for harvesting or replanting per year. These activities can continue while the proposed wind farm is under construction and operating, resulting in a long-term moderate positive cumulative impact.

5.8.5.2 Tourism

Impacts

As standalone project or cumulatively, the construction phase of the project will have a short-term slight to moderate negative impact on tourism due to nuisance from construction traffic.

Proposed Mitigation Measures

Phased development will be employed to allow for construction traffic to be managed and to minimise the volume of construction traffic using the road network at any one time. Construction and operational traffic will be manged by the Traffic Management Co-ordinator.

Residual Impact

Short term slight negative impact

Significance of Effects

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

5.8.5.3 Health and Safety

The proposed wind farm will have no impacts in terms of health and safety. There is no credible scientific evidence to link wind turbines with adverse health impacts.

5.8.5.4 Property Values

As noted in Section 5.6 above, the conclusions from available international literature indicate that property values are not impacted by the positioning of wind farms near houses. It is on this basis that it can be concluded that there would be a long-term imperceptible cumulative impact from the proposed development and other wind farm developments in the area.

5.8.5.5 Services

Potential cumulative impact through injection of money into local services though short and long-term employment and a community benefit fund. This is expected to be a long-term positive cumulative impact.

5.8.5.6 Residential Amenity

Pre-Mitigation Impacts

If all permitted and proposed projects as described in the cumulative assessment in Chapter 2 are constructed at the same time, resulting cumulative negative impact to occur on residential amenity, in relation to noise and vibration, dust, traffic, telecommunications and visual amenity.

Proposed Mitigation Measures

There are no turbines as part of the proposed development that will be located within 700 metres of any occupied dwellings. Any mitigation measures outlined under noise and vibration, dust, shadow flicker, traffic, residential amenity and telecommunications in this EIAR will be implemented in order to reduce insofar as possible impacts on residential amenity at properties located in the vicinity of the proposed development works, including along the proposed turbine and construction materials haul route. It is assumed also that all mitigation measures in relation to the other cumulative projects will also be implemented.

Residual Impact

The proposed development will have a short-term, slight negative effect on residential amenity during construction works. During the operational phase, noise and shadow flicker from the proposed and permitted projects will be limited to below guideline levels.

Significance of Effects

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