Chapter 14 Air and Climate

Ballycar Wind Farm

Ballycar Green Energy

January 2024

14. Air and Climate

14.1 Introduction

This chapter describes the likely significant effects the construction, operation and decommissioning of the proposed development will have on air quality and climate. For a full description of the proposed development, refer to **Chapter 2 Description of the Proposed Development** of this EIAR.

14.1.1 Competency of Assessor

This chapter was prepared by Kieran Barry BEng (Civil/Structural Engineering), PhD (Environmental Protection), MIEnvSc. Kieran is an experienced Environmental Consultant at Malachy Walsh and Partners (MWP), having worked for 7 years in the environmental sector. Kieran works on a variety of infrastructure projects conducting environmental assessments and supporting the delivery of a number of environmental deliverables including Environmental Impact Assessment (EIA) Screening Reports, feasibility and constraints studies, route option assessments and Environmental Impact Assessment Reports (EIAR).

This assessment has been reviewed by Olivia Holmes. Olivia is a Chartered Engineer and Chartered Environmental Practitioner with over twenty years' experience in Environmental Engineering focussing primarily on Environmental Impact Assessment (EIA), Appropriate Assessment (AA) and planning. She has prepared and reviewed a number of chapters for EIARs over her career, for a broad range of projects.

14.1.2 Guidelines and Legislation

The assessment has been prepared in accordance with the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA 2022), as well as guidelines and legislation outlined in **Section 14.1.2.1** to **Section 14.1.2.3**.

14.1.2.1 Air Quality

The statutory ambient air quality standards in Ireland are set out in the Ambient Air Quality Standards Regulations 2022, which incorporate the ambient air quality limits set out in Directive 2008/50/EC of the European Parliament and of the Council (21st May 2008) on ambient air quality and cleaner air for Europe (hereafter referred to as the CAFÉ Directive) (as amended by Directive EU 2015/1480), for a range of air pollutants. These are discussed further in **Section 14.2.4.5.**

In addition to the specific statutory air quality standards, the assessment has been prepared in accordance with national guidelines, where available, in addition to international standards and guidelines. These are summarised below:

- Clean Air Strategy (Government of Ireland 2023);
- Air quality assessment of proposed national roads – Standard' and 'Air quality assessment of specified infrastructure projects – overarching technical document' (TII, 2022);
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011);
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (TII 2009);

- UK Department of Environment Food and Rural Affairs (DEFRA) Part IV of the Environment Act 1995: Local Air Quality Management, LAQM.TG (16) (DEFRA 2018);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) – LA 105 Air Quality (UKHA 2019); and
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2005 (WHO 2005).

14.1.2.2 Climate

This assessment has been prepared in accordance with national guidelines, where available, in addition to international standards and guidelines relating to the assessment of Greenhouse Gas (GHG) emissions and associated climatic impact. References to legislation include amendments thereto. These are summarised below:

- DCCAE (2017) National Adaption Plan;
- DCCAE (2023) Climate Action Plan 2023;
- Department of Transport, Tourism and Sport (DTTAS) (2019) Transport – Climate Change Sectoral Adaption Plan;
- Climate Action and Low Carbon Development (Amendment) Act 2021 (No.46 of 2015) (hereafter referred to as the 2021 Climate Act);
- Clare County Council's Climate Change Adaption Strategy 2019-2024;
- Clare County Development Plan 2023-2029;
- European Commission (EC) (2014) 2030 Climate and Energy Policy Framework;
- Transport Infrastructure Ireland (TII) (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;
- UKHA (2019) Design Manual for Roads and Bridges: A 114 – Climate;
- European Green Deal (EC, 2022);
- Kyoto Protocol (United Nations Framework Convention on Climate Change(UNFCC, 1997);
- Paris Agreement (UNFCC, 2015);
- The Climate Action and Low Carbon Development (Amendment) Act 2021;
- Climate Action Plan 2023 (CAP) (DCCAE, 2022);
- Glasgow Climate Pact (COP26);
- Summary of Global Climate Action at COP 27 (UNFCC, 2022).

14.1.2.3 Local Policy and Guidelines

The current Clare County Council Climate Change Adaptation Strategy 2019-2024 outlines the Proposed Adaptation Strategy that Clare County Council will implement to adapt to the effects of climate and to safeguard the biophysical infrastructure and well-being of the people and communities of County Clare.

The key adaption objectives and related actions in terms of renewable energy are as follows:

Objective 2: To promote County Clare as a Low Carbon County and support the development of low carbon and green technology businesses and industries throughout the County.

<u>Action No.5</u>

'Support on-land and off-shore renewable energy production by a range of appropriate technologies'

<u>Action No.6 (a)</u>

'As a means of de-carbonising the economic and social sectors, thus reducing greenhouse gases, we will support the increased use of renewable energy in the commercial and agricultural sectors'

Objective 4: To promote and facilitate the provision of high quality, secure, efficient, and renewable energy sources along with appropriate storage facilities in order to assist in the creation of a low carbon County Clare.

<u>Action No.1 (a)</u>

'Encourage proposals for renewable energy developments and ancillary facilities in order to meet national, regional; and county renewable energy targets, and to facilitate a reduction in CO_2 emissions and the promotion of a low carbon economy through Planning Policy and land use objectives.'

<u>Action No.1 (b)</u>

'Through land use policy and objectives, support and facilitate the development of new alternatives and technological advances in relation to renewable energy production and storage.'

Objective 5: To support the Strategic Integrated Framework Plan for the Shannon Estuary in order to harness the significant energy resources of the Shannon Estuary.

<u>Action No.1</u>

'Work to promote and harness the potential of the Shannon Estuary for the sustainable development of renewable energy sources to assist in meeting renewable energy targets.'

14.2 Methodology

The methodology accords with guidance and best practice outlined in Sections 14.2.3.1 to Section 14.2.3.3.

The existing air quality was characterised at a local level to establish a baseline. The nature, scale and duration of the construction works was examined and its potential to significantly effect local air quality assessed. Mitigation measures are described to minimise the potential effects.

As part of this assessment, the local climate was characterised based on 30 year averages measured at a representative weather observatory. The compatibility of the proposed project with the 2023 national Climate Action Plan (CAP) was examined. Climate is a global rather than a national consideration, therefore current reports on the state of the climate have been summarised.

14.2.1 Scope of Assessment

The aim of this assessment is to consider whether the proposed development including wind turbines, grid connection route (GCR) and associated site infrastructure would be likely to result in significant air quality and climate effects. The cumulative effect of the proposed development in combination with neighbouring existing and permitted developments is then assessed to determine any likely cumulative significant air quality and climate effects.

The potential effects of the decommissioning phase will be of similar magnitude, if not slightly less, than the construction phase. Therefore, the outcome of the construction phase assessment should be taken as representative of the decommissioning phase effects.

There will be approximately 15.97 ha of trees felled to facilitate wind farm infrastructure (See **Chapter 2** for full details).

The felled trees will be re-planted elsewhere; this will ensure no net loss of carbon sequestering trees. However, the potential effect of the early felling of the trees on carbon sequestration has been assessed. Once constructed, there will be no air emissions from the wind farm development.

14.2.2 Assessment Criteria

14.2.2.1 Air Quality

In the EU, Directives set down Air Quality Standards to protect health, vegetation, and ecosystems. The Ambient Air Quality and Cleaner Air for Europe (CAFÉ) Directive (2008/50/EC) (as amended by Directive EU 2015/1480) was published in May 2008 and was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

There will be some pollutants named in the CAFÉ directive arising from plant and machinery exhaust emissions associated with the construction of the proposed development. These include carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter (PM_{10}). However, these emissions will not exceed the limit values set out in the CAFÉ Directive 2008/50/EC (as amended by Directive EU 2015/1480) (**Appendix 14A**). Any adverse effects from these emissions are therefore likely to be insignificant.

Dust

There is greater potential for temporary disturbance to nearby receptors to occur as a result of fugitive dust from the excavation and transport of soil and materials during construction.

Transport Infrastructure Ireland (TII) published new guidance in 2022 for assessing dust effects at a local level from road construction 'Air quality assessment of proposed national roads – Standard' (TII, 2022A) and 'Air quality assessment of specified infrastructure projects – overarching technical document' (TII,2022B). The assessment of dust has been carried out in accordance with same. The TII Guidance in relation to dust is in accordance with the latest 2014 IAQM Guidelines on construction dust assessments, Guidance on the assessment of dust from demolition and construction.

This assessment of dust effects therefore focuses on identifying the existing baseline levels of PM10 and PM2.5 in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the effect of the construction phase of the proposed development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities with the proposed development based on the guidance issued by the IAQM (2014).

Traffic

TII guidance documents (TII, 2022A/2022B) state that the following scoping criteria shall be used to determine whether the air quality impacts of a project can be scoped out or require an assessment based on changes between 'Do-Something' traffic scenario (with the proposed development) compared to the 'Do-Minimum' traffic scenario (without the proposed development):

- Road alignment will change by 5m or more;
- Annual average daily traffic (AADT) flows will change by 1,000 or more; or
- Heavy duty vehicle (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- Daily average speed change by 10 kph or more;
- Peak hour speed will change by 20kph or more.

If the above criteria are not met, then a quantitative assessment of construction traffic can be scoped out and the effects are considered to be not significant. The construction stage traffic, as described in **Chapter 15 Material Assets**, and

Appendix 15C, Traffic and Transport Assessment, is below the above criteria and therefore no further detailed impact assessment is required.

14.2.2.2 Climate

In order to demonstrate that the carbon savings associated with the proposed renewable energy development will significantly out-weigh any potential carbon losses, a methodology made available by the Scottish Government (2019) in tabular spreadsheet format titled '*Calculating carbon savings from wind farms on Scottish peatlands'* was applied to this development.

This 'carbon calculator' is the Scottish Government's tool developed to support the process of determining the carbon effect of wind farm developments in Scotland. The purpose of the tool is to assess, in a comprehensive and consistent way, the carbon effect of wind farm developments. This is done by comparing the carbon costs of wind farm developments with the carbon savings attributable to the wind farm.

As there is no comparable Irish version, it is considered appropriate to adopt the Scottish methodology which has been tried and tested and subject to audit by the Scottish Environmental Protection Agency. This is accepted as best practice in Ireland and therefore this method has been adopted for this assessment to determine the potential carbon savings and losses from the proposed development, refer to **Section 14.4.3.3.**

It is important to note that there is no peat within the development footprint and therefore, no peat will be removed or disturbed as part of the development. Only elements of the carbon calculator tool relating to the manufacture (lifecycle) of the wind turbines and the felling of forestry have been used to estimate the carbon savings associated with the wind farm.

14.2.3 Statement on Limitations and Difficulties Encountered

It is not possible to quantify exactly what effect the proposed development will have on Climate Change and Air Quality beyond the site boundary. However, it has been possible to determine the potential significance of the effects. It is universally accepted that replacing fossil fuel generated electricity with wind generation and other forms of renewable electricity has a positive rather than adverse effect nationally and globally on air quality and climate. The information provided in this chapter is considered appropriate to enable an informed decision to be made on the potential effects of the proposed development on air quality and climate.

14.3 Existing Environment

The proposed wind farm is situated in a rural area of south County Clare in the Electoral Divisions of Cloontra and Ballycannon. The site is approximately 3km northwest of Limerick City and suburbs, 6.7km east southeast of Sixmilebridge and 3km northwest of Ardnacrusha, at its closest point. Woodcock Hill lies approximately 2.2km southwest of the proposed development. (**Figure 14-1**).

The proposed wind farm site is located within the townlands of Glennagross, Cappateemore East, Ballycannan West, Ballycannan East, Ballycar South, Ballycar North and consists of coniferous forests, transitional woodland scrub and agricultural land.

In addition to the proposed development as described, there is a proposed underground connection between T1 and the proposed 110kV substation which will be located northwest of T1. The underground connection from T1 is routed along existing forestry tracks and through conifer forestry to the north west of the wind farm site and connects to the proposed 110kV substation. From the proposed 110kV substation, an underground cable is routed in a north west direction where it connects to the existing 110 kV overhead line. The proposed 110kV grid route is approximately 1.5km in length. 1.0km of the 110kV grid route is proposed within existing forestry tracks, with the remaining 0.5km routed through conifer forestry. It also crosses a 3m wide local public road. A new unbound stone access track will be constructed over the 110kV grid route within private lands to allow access for future maintenance.

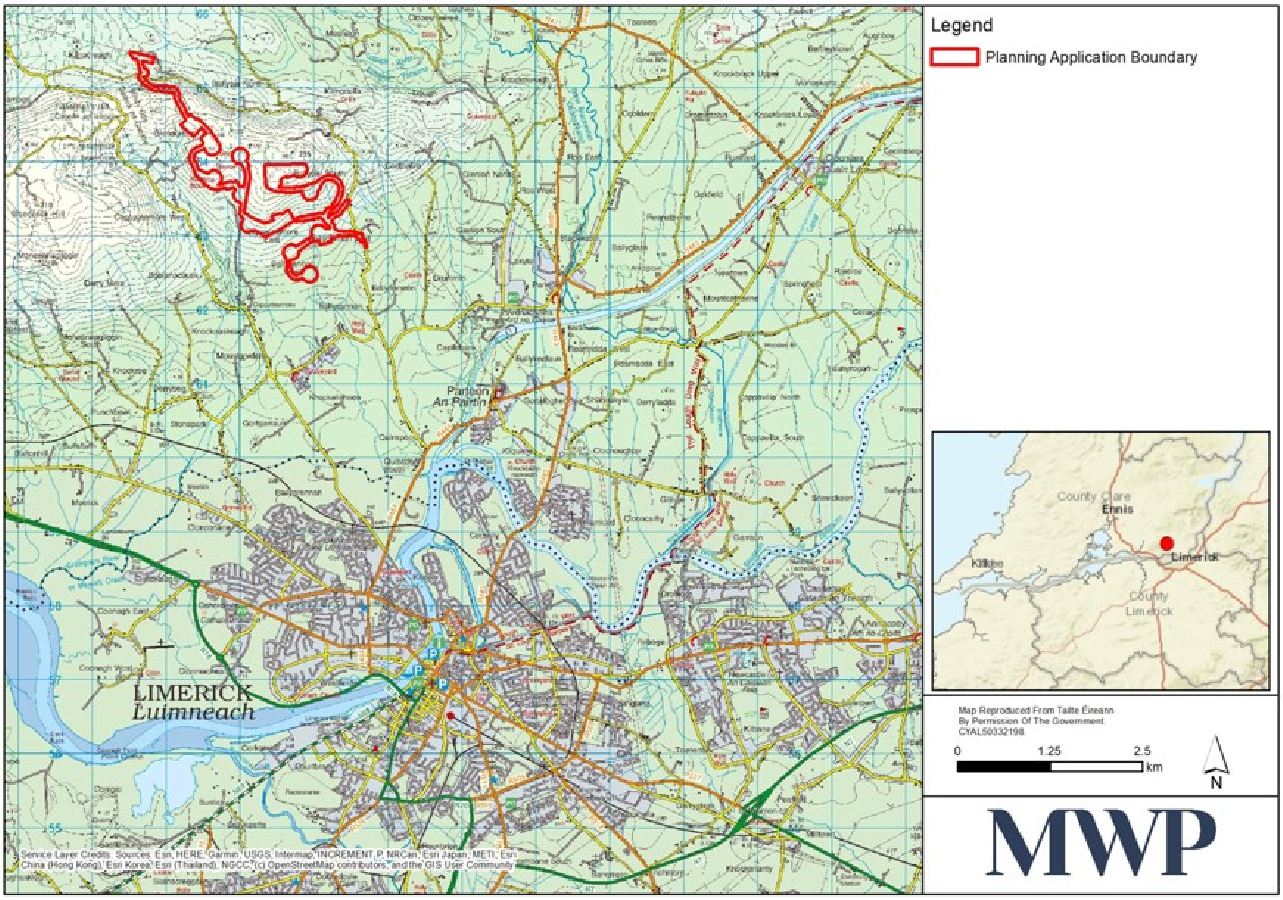

Figure 14-1: Site Location

There are several large urban centres within 25km of the proposed development site, the largest of which is Limerick City and suburbs which lies approximately 3km to the southwest (population 102,287, CSO 2022). The town of Sixmilebridge (population 2,832, CSO 2022) lies approximately 6.7 km west southwest and the town of Ennis (population 27,293, CSO 2022) is located approximately 25 km to the northwest. Along with local traffic (CO2, NOx), agricultural practices on nearby farmland (CH_4) and forestry operations (CO_2, Nox) i.e. machinery used for tree felling, these urban centres are the largest nearby potential sources of pollution.

Representative Environmental Protection Agency (EPA) ambient air quality data has been used to characterize the existing air quality in the area.

14.3.1 EPA Monitoring Data

The Environmental Protection Agency's (EPA) Air Quality Index for Health (AQIH) is a number from one to ten that describes the current air quality in a region. There are six regions as follows: Dublin, Cork, Large Towns (>15,000 population), Small Towns (5,000 – 15,000 population), Rural East and Rural West.

The AQIH is based on measurements of five air pollutants all of which can harm health. The five pollutants are:

- Ozone gas;
- Nitrogen dioxide gas;
- Sulphur dioxide gas;
- PM2.5 particles; and
- PM10 particles.

The AQIH is calculated on an hourly basis using representative sampling from each region. Each region is ranked 1 – 10, with 1 being 'Good' and 10 being 'Very Poor' based on the worst-case pollutant in that region. A ranking of 10 means the air quality is 'Very Poor' and a ranking of 1 – 3 inclusive means that the air quality is 'Good'.

There is no accompanying health message for at risk groups and the general population in areas classed as Good. Outdoor activities can be enjoyed as usual.

In areas of Fair to Poor air quality i.e. AQIH ranking 4 to 10, certain types of outdoor activity should be restricted or avoided for at risk individuals and the general population depending on the AQIH ranking.

The index was accessed via the EPA's website (https://gis.epa.ie/EPAMaps/) on 4th January 2024. The air quality for the region of the proposed development (Rural West AQIH Region 6) is currently ranked as '1 - Good'.

The nearest air quality station to the site is at Henry Street, Limerick City. This station monitors Nitrogen Dioxide (NO_2), Ozone (O_3), and Particulate Matter (PM10, PM 2.5) and is located in an Urban Area. Sulphur dioxide is not monitored at the location. The average concentrations, recorded on 4th January 2024, for a 24 hour period are as follows: NO_2 – 27.87 µg/m³, O_3 – 16.98 µg/m³, PM10 – 10.93 µg/m³ and PM2.5 – 5.52 µg/m³.

The Limerick station updates every 8 to 24 hours with the calculated Air Quality Index for Health (AQIH). As shown in **Figure 14-2**, on 4th January 2024, the air quality index characterised by this station was classified as 'Good'.

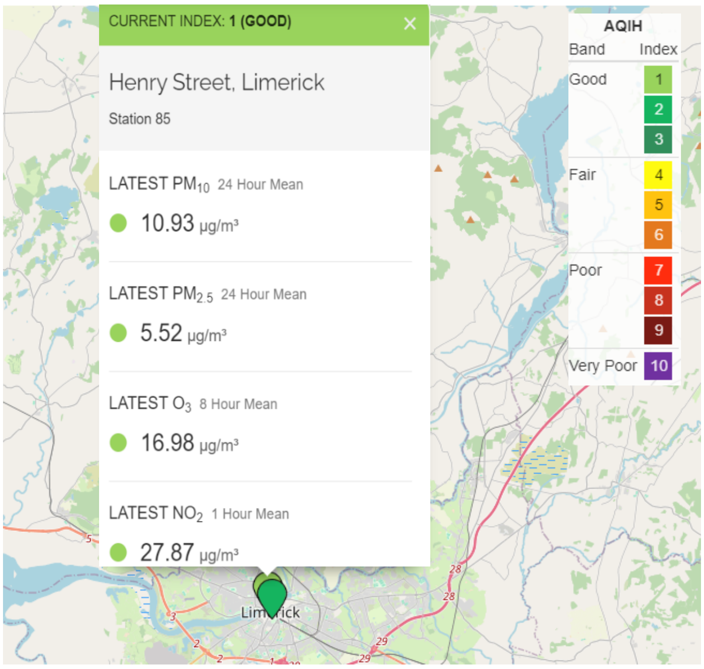

Figure 14-2: Existing Air Quality Index for Health (AQIH) (www.epa.ie)

In terms of annual air quality data, monitoring programmes have been undertaken in recent years by the EPA. The most recent annual report on air quality, Air Quality Monitoring Report (EPA 2022), details the range and scope of monitoring undertaken throughout Ireland. As part of the implementation of the Air Quality Standards Regulations (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The rural area which the proposed development is located is classed as Zone D.

Annual mean values for O_3, NO_2, SO_2, PM2.5 and PM 10 for Zone D areas for the period 2017 to 2022 are shown in **Table 14-1**.

Table 14-1: EPA Annual Monitoring Data

Averaging Period	Year 2017, 2018, 2019, 2021, 2022
Annual Mean 0_3	51 µg/m^3 to 75 µg/m^3
Annual Mean NO_2	2 µg/m^3 to 17 µg/m^3
Annual Mean SO_2	0.7 µg/m^3 to 11.8 µg/m^3
Annual Mean $PM_{2.5}$	4 µg/m^3 to 23 µg/m^3
Annual Mean PM_{10}	7 µg/m^3 to 28 µg/m^3

In summary, existing baseline levels of O_3, NO_2, SO_2, PM2.5 and PM 10 are well below ambient air quality limit values in the vicinity of the proposed development.

14.3.2 Dust Sensitivity of the Receiving Environment

In line with IAQM Guidelines, the sensitivity of the area must first be assessed. Both receptor sensitivity and proximity to proposed construction works areas are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity, while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity.

In terms of receptor sensitivity to dust soiling, the nearest receptor to the dust prevailing construction works is c.418m, refer to **Figure 14-1**. The worst-case sensitivity of the area to dust soiling is therefore considered to be **low** are per **Table 14-2**.

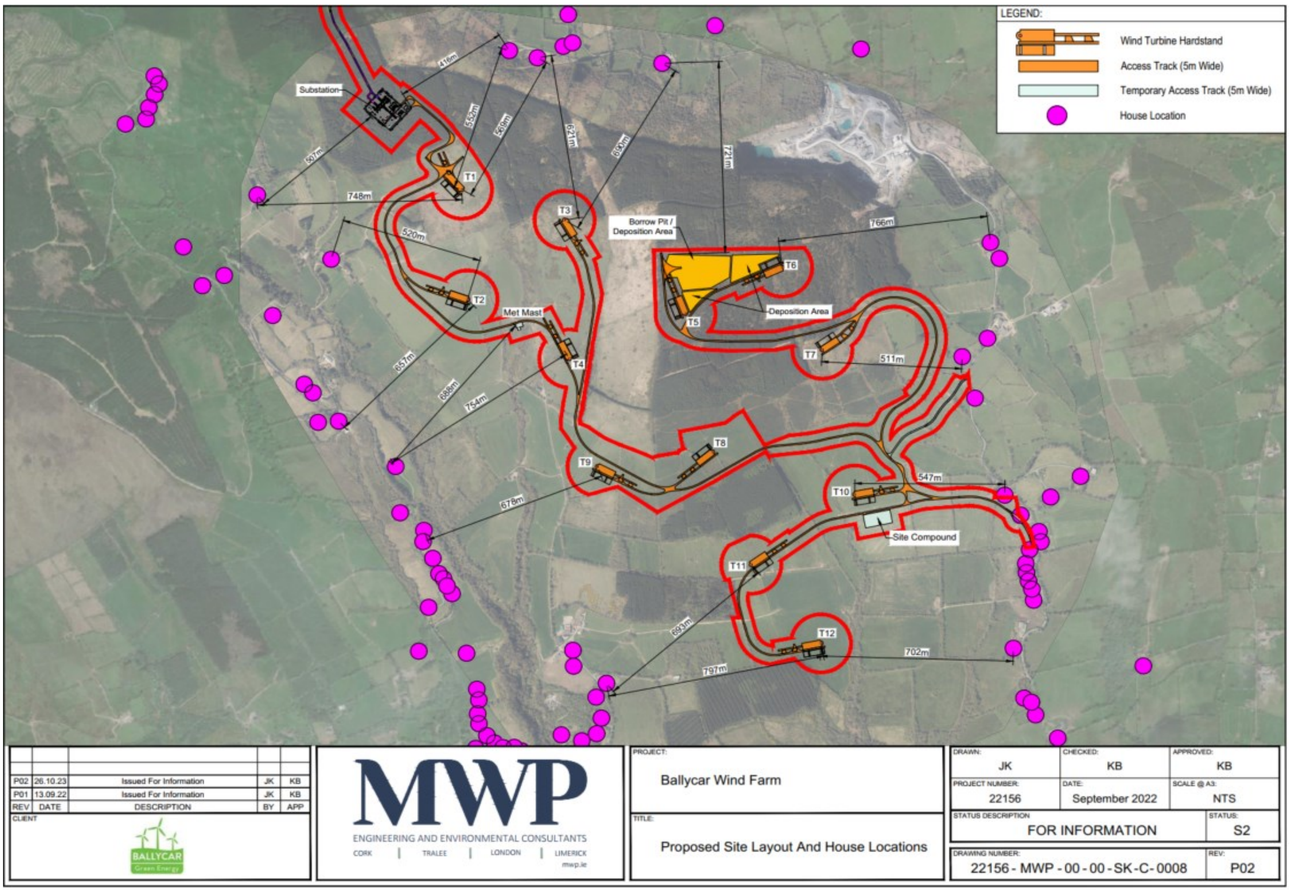

Figure 14-3: Wind Farm Infrastructure and Nearest Dwellings

Table 14-2: Sensitivity of the Area to Dust Soil Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from source (m)			
		<20	<50	<100	<200
High	>100	High	High	Low	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

In addition to sensitivity to dust soiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected within various distance bands from the construction works. The annual mean PM_{10} concentration for Zone D was 7 µg/m^3 to 28 µg/m^3, refer to **Table 14-1**. Taking a conservative approach, the value of 28 µg/m^3 is taken as the Annual Mean PM_{10} concentration. Given annual mean PM10 concentration and the distance of works to the nearest receptor (c.418m), the worst-case sensitivity of the area to human health impacts is considered to be **low** as per **Table 14-3**.

Table 14-3: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	>24µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	<32 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

The IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to ecological impacts from dust. The criteria take into consideration whether the receiving environment is classified as a Special Area of Conservation (SAC), a Special Protected Area (SPA), a Natura Heritage Area (NHA) or a proposed Natural Heritage Area (pNHA) as dictated by the EU Habitats Directive or whether the site is a local natura reserve or home to a sensitive plant or animal species. The proposed development site is not located in the immediate vicinity of any such designated site and due to intervening separation distances, the sensitivity of the area to ecological impacts can be considered low as per **Table 14-4**.

Table 14-4: Sensitivity of the Area to Ecological Impacts

Sensitivity of Area	Distance from the Source (m)	
	<20	<50
High	Medium	Medium
Medium	Medium	Low
Low	Low	Low

14.3.3 Global Climate

Climate change is considered in a global rather than local context. Every year, the World Meteorological Organisation (WMO) issues a Report on the State of the Global Climate. It is based on data provided by National Meteorological and Hydrological Services and other national and international organisations. Some of the key messages in the latest available annual report, 'Provisional State of the Global Climate 2023' are as follows:

- Observed concentrations of the three main greenhouse gases – carbon dioxide, methane, and nitrous oxide – reached record high levels in 2022, the latest year for which consolidated global values are available. Real-time data from specific locations show that levels of the three greenhouse gases continued to increase in 2023.
- The global mean near-surface temperature in 2023 (to October) was around 1.40 (± 0.12) °C above the 1850–1900 average. Based on the data to October, it is virtually certain that 2023 will be the warmest year in the 174-year observational record, surpassing the previous joint warmest years, 2016 at 1.29 (± 0.12) °C above the 1850–1900 average and 2020 at 1.27 (±0.13) °C.
- Record monthly global temperatures have been observed for the ocean – from April through to October – and, starting slightly later, the land – from July through to October.
- June, July, August, September and October 2023 each surpassed the previous record for the respective month by a wide margin in all datasets used by WMO for the climate report. July is typically the warmest month of the year globally, and thus July 2023 became the all-time warmest month on record.
- Global average sea-surface temperatures (SSTs) were at a record observed high for the time of year, starting in the late Northern Hemisphere spring. April through September (the latest month for which we have data) were all at a record warm high, and the records for July, August and September were each broken by a large margin (around 0.21 to 0.27 °C). Exceptional warmth was recorded in the eastern North Atlantic, the Gulf of Mexico and the Caribbean, and large areas of the Southern Ocean, with widespread marine heatwaves.
- Ocean heat content reached its highest level in 2022, the latest available full year of data in the 65-year observational record.
- It is expected that warming will continue – a change which is irreversible on centennial to millennial timescales. All data sets agree that ocean warming rates show a particularly strong increase in the past two decades.
- In 2023, global mean sea level reached a record high in the satellite record (since 1993), reflecting continued ocean warming as well as the melting of glaciers and ice sheets. The rate of global mean sea level rise in the past ten years (2013–2022) is more than twice the rate of sea level rise in the first decade of the satellite record (1993–2002).
- Antarctic sea-ice extent reached an absolute record low for the satellite era (1979 to present) in February. Ice extent was at a record low for the time of year from June onwards. The annual maximum in September was 16.96 million km^2, roughly 1.5 million km^2 below the 1991–2020 average and 1 million km^2 below the previous record low maximum, from 1986.
- Arctic sea-ice extent remained well below normal, with the annual maximum and minimum sea ice extents being the fifth and sixth lowest on record respectively.

- Glaciers in western North America and the European Alps experienced an extreme melt season. In Switzerland, glaciers have lost around 10% of their remaining volume in the past two years.
- Extreme weather and climate events had major impacts on all inhabited continents. These included major floods, tropical cyclones, extreme heat and drought, and associated wildfires.
- Flooding associated with extreme rainfall from Mediterranean Cyclone Daniel affected Greece, Bulgaria, Turkey, and Libya, with particularly heavy loss of life in Libya in September.
- Tropical Cyclone Freddy in February and March was one of the world's longest-lived tropical cyclones with major impacts on Madagascar, Mozambique and Malawi. Tropical Cyclone Mocha, in May, was one of the most intense cyclones ever observed in the Bay of Bengal.
- Extreme heat affected many parts of the world. Some of the most significant were in southern Europe and North Africa, especially in the second half of July where severe and exceptionally persistent heat occurred. Temperatures in Italy reached 48.2 °C, and record-high temperatures were reported in Tunis (Tunisia) 49.0 °C, Agadir (Morocco) 50.4 °C and Algiers (Algeria) 49.2 °C.
- Canada's wildfire season was well beyond any previously recorded. The total area burned nationally as of October 15th was 18.5 million hectares, more than six times the 10-year average (2013–2022). The fires also led to severe smoke pollution, particularly in the heavily populated areas of eastern Canada and the north-eastern United States. The deadliest single wildfire of the year was in Hawaii, with at least 99 deaths reported – the deadliest wildfire in the USA for more than 100 years.
- Five consecutive seasons of drought in the Greater Horn of Africa was followed by floods, triggering even more displacements. The drought reduced the capacity of the soil to absorb water, which increased flood risk when the Gu rains arrived in April and May.
- Long-term drought intensified in many parts of Central America and South America. In northern Argentina and Uruguay, rainfall from January to August was 20 to 50% below average, leading to crop losses and low water storage levels.

14.3.3.1 IPPC: AR6 Synthesis Report – Climate Change 2023

The Synthesis Report (SYR) of the IPCC Sixth Assessment Report (AR6) summarises the state of knowledge of climate change, its widespread impacts and risks, and climate change mitigation and adaption. It integrates the main findings of the Sixth Assessment Report (AR6) based on contributions from the three Working Groups[1], and the three Special Reports[2].

The report recognises the interdependence of climate, ecosystems and biodiversity, and human societies. It recognises the value of diverse forms of knowledge and the close linkages between climate change adaption, mitigation, ecosystem health, human well-being and sustainable development. The report reflects the increasing diversity of actors involved in climate action.

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[1] The three Working Group contributions to AR6 are: AR6 Climate Change 2021: The Physical Science Basis; AR6 Climate Change 2022: Impacts, Adaption and Vulnerability; and AR6 Climate Change 2022: Mitigation of Climate Change. Their assessments cover scientific literature accepted for publication respectively by 31 January 2021, 1 September 2021 and 11 October 2021.

[2] . The three Special Reports are: Global Warming of 1.5° (2018): an IPPC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty; Climate Change and Land (2019): an IPPC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems; and The Ocean and Cryosphere in a Changing Climate (2019). The Special Reports cover scientific literature accepted for publication respectively by 15 May 2018, 7 April 2019, and 15 May 2019.

Some key findings[3] of the report are as follows and are categorised next, under 'Current Status and Trends, Future Climate Change, Risks and Long-Term Responses, Responses in the Near Term'. Each finding is grounded in an evaluation of underlying evidence and agreement.

A. Current Status and Trends

Observed Warning and its Causes

- A.1 Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 temperatures in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption, and production across regions, between and within countries, and among individuals (*high confidence*).

Observed Changes and Impacts

- A.2 Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people (*high confidence*). Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected (*high confidence*).

Current Progress in Adaption and Gaps and Challenges

- A.3 Adaption planning and implementation has progressed across all sectors and regions, with documented benefits and varying effectiveness. Despite progress, adaption gaps exist, and will continue to grow at current rates of implementation. Hard and soft limits to adaption have been reached in some ecosystems and regions. Maladaptation is happening in some sectors and regions. Current global financial flows for adaption are insufficient for, and constrain implementation of adaption options, especially in developing countries (*high confidence*).

Current Progress in Adaption and Gaps and Challenges

- A.4 Policies and laws addressing mitigation have consistently expanded since AR5. Global GHG emissions in 2030 implied by nationally determined contributions (NDCs) announced by October 2021 make it likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. There are gaps between projected emissions from implemented policies and those from NDCs. Finance flows fall short of the levels needed to meet climate goals across all sectors and regions (*high confidence*).

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[3] The IPCC calibrated language uses five qualifiers to express a level of confidence: very low, low, medium, high and very high, and typeset in italics, for example *medium confidence*. The following terms are used to indicate the assessed likelihood of an outcome or a result: virtually certain 99-100% probability, very likely 90-100%, likely 66-100%, more likely than not >50-100%, about as likely as not 33-66%, unlikely 0-33%, very unlikely 0-10%, exceptionally unlikely 0-1%. Additional terms (extremely likely 95-100%; more likely than not >50-100%; and extremely unlikely 0-5%) are also used when appropriate. Assessed likelihood is typeset in italics, e.g., *very likely*. This is consistent with AR5 and the other AR6 Reports.

B. Future Climate Change, Risks and Long-Term Responses

Future Climate Change

- **B.1** Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5ºC in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards (*high confidence*). Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within two decades, and also to discernible changes in atmospheric composition within a few years (*high confidence*).

Climate Change Impacts and Climate-Related Risks

- **B.2** For any given warning level, many climate-related risks are higher than assessed in AR5, and project long-term impacts are up to multiple times higher than currently observed (*high confidence*). Risks and projected adverse impacts, and related losses and damages from climate change escalate with every increment of global warming (*very high confidence*). Climatic and non-climatic risks will increasingly interact, creating compound and cascading risks that are more complex and difficult to manage (*high confidence*).

Likelihood and Risks of Unavoidable, Irreversible or Abrupt Changes

- **B.3** Some future changes are unavoidable and/or irreversible but can be limited by deep, rapid and sustained global greenhouse emissions reduction. The likelihood of abrupt and/or irreversible changes increases with higher global warming levels. Similarly, the probability of low-likelihood outcomes associated with potentially very large adverse impacts increases with higher global warming levels (*high confidence*).

Adaptation Options and their Limits in a Warmer World

- **B.4** Adaption options that are feasible and effective today will become constrained and less effective with increasing global warming. With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaption limits. Maladaptation can be avoided by flexible, multi-sectoral, inclusive, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems (*high confidence*).

Carbon Budgets and Net Zero Emissions

- **B.5** Limiting human-caused global warming requires net zero CO_2 emissions. Cumulative carbon emissions until the time of reaching net-zero CO_2 emissions and the level of greenhouse gas emission reductions this decade, largely determine whether warming can be limited to 1.5ºC or 2ºC (*high confidence*). Projected CO_2 emissions from existing fossil fuel infrastructure without additional abatement would exceed the remaining carbon budget for 1.5ºC (50%) (*high confidence*).

Mitigation Pathways

- **B.6** All global modelled pathways that limit warming to 1.5ºC (>50%) with no or limited overshoot, and those that limit warming to 2ºC (>67%), involve rapid and deep and, in most cases, immediate greenhouse emissions reductions in all sectors this decade. Global net zero CO_2 emissions are reached for these pathway categories, in the early 2050s and around the early 2070s, respectively (*high confidence*).

Overshoot: Exceeding a Warming Level and Returning

- **B.7** If warming exceeds a specified level such as 1.5ºC, it could gradually be reduced again by achieving and sustaining net adverse global CO_2 emissions. This would require additional deployment of carbon dioxide removal, compared to pathways without overshoot, leading to greater feasibility and sustainability concerns. Overshoot entails adverse impacts, some irreversible, and additional risks for human and natural systems, all growing with the magnitude and duration of overshoot (*high confidence*).

C. Responses in the Near Term

Urgency of Near-Term Integrated Climate Action

- C.1 Climate change is a threat to human well-being and planetary health (*very high confidence*). There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all (*very high confidence*). Climate resilient development integrates adaptation and mitigation to advance sustainable development for all and is enabled by increased international cooperation, including improved access to adequate financial resources, particularly for vulnerable regions, sectors and groups, and inclusive governance and coordinated policies (*high confidence*). The choices and actions implemented in this decade will have impacts now and for thousands of years (*high confidence*).

The Benefits of Near-Term Action

- C.2 Deep, rapid and sustained mitigation and accelerated implementation of adaption actions in this decade would reduce projected losses and damages for humans and ecosystems (*very high confidence*), and deliver many co-benefits, especially for air quality and health (*high confidence*). Delayed mitigation and adaptation action would lock-in high emissions infrastructure, raise risks of stranded assets and cost-escalation, reduce feasibility, and increase losses and damages (*high confidence*). Near-term actions involve high up-front investments and potentially disruptive changes that can be lessened by a range of enabling policies (*high confidence).*

Mitigation and Adaption Options across Systems

- C.3 Rapid and far-reaching transitions across all sectors and systems are necessary to achieve deep and sustained emissions reductions and secure a liveable and sustainable future for all. These system transitions involve a significant upscaling of a wide portfolio of mitigation and adaption options. Feasible, effective, and low-cost options for mitigation and adaptation are already available, with differences across systems and regions (*high confidence*).
- C.4 Accelerated and equitable action in mitigating and adapting to climate change impacts is critical to sustainable development. Mitigation and adaptation actions have more synergies than trade-offs with Sustainable Development Goals. Synergies and trade-offs depend on context and scale of implementation (*high confidence*).
- C.5 Prioritising equity, climate justice, social justice, inclusion and just transition processes can enable adaptation and ambitious mitigation actions and climate resilient development. Adaptation outcomes are enhanced by increased support to regions and people with the highest vulnerability to climatic hazards. Integrating climate adaptation into social protection programs improves resilience. Many options are available for reducing emission-intensive consumption, including through behavioural and lifestyle changes, with co-benefits for social well-being (*high confidence*).
- C.6 Effective climate action is enabled by political commitment, well-aligned multilevel governance, institutional frameworks, laws, policies and strategies and enhanced access to finance and technology. Clear goals, coordination across multiple policy domains, and inclusive governance processes facilitate effective climate action. Regulatory and economic instruments can support deep emissions reductions and climate resilience if scaled up and applied widely. Climate resilient development, benefits from drawing on diverse knowledge (*high confidence*).
- C.7 Finance, technology, and international cooperation are critical enablers for accelerated climate action. If climate goals are to be achieved, both adaptation and mitigation financing would need to increase many-fold. There is sufficient global capital to close the global investment gaps but there are barriers to redirect capital to climate action. Enhancing technology innovation systems is key to accelerate the widespread adoption of technologies and practices. Enhancing international cooperation is possible through multiple channels.

14.3.3.2 US National Oceanic and Atmospheric Assoc. (NOAA) Monthly Report November 2023

Key highlights from the latest available Global Climate Report (November 2023), published by the US National Oceanic and Atmospheric Assocation are presented below:

- The November global surface temperature was 1.44°C (2.59°F) above the 20th-century average of 12.9°C (55.2°F), making it the warmest November on record. This was 0.38°C (0.68°F) above the previous record from November 2015. November 2023 marked the 47th-consecutive November and the 537th-consecutive month with temperatures at least nominally above the 20th-century average.
- November saw a record-high monthly global ocean surface temperature for the eighth consecutive month. El Niño conditions that emerged in June continued into November, and according to NOAA's Climate Prediction Center there is a 60% chance that El Niño will continue through April–June 2024.
- The Northern Hemisphere had its warmest November on record at 2.07°C (3.73°F) above average. Both land and ocean temperatures were at record-highs for the Northern Hemisphere this November. The Arctic region had its second-warmest November on record.
- November 2023 in the Southern Hemisphere also ranked warmest on record at 0.81°C (1.46°F) above average. While the average ocean-only temperature for November in the Southern Hemisphere ranked highest on record this November, the land-only temperature tied 2016 for the eighth highest on record. Meanwhile, the Antarctic region tied 1959 for its sixth-coolest November.
- Temperatures were above average throughout most of South America, northern, western, and central North America, Africa, western and southern Europe, western, central, and southern Asia, Oceania, and the Arctic. Parts of northern North America, northern and central South America, Africa, and eastern and southern Asia experienced record-warm temperatures this month. Sea surface temperatures were above average across much of the northern and western Pacific as well as the central and southern Atlantic and the western Indian Oceans. Record-warm temperatures covered nearly 13% of the world's surface this November, which was the highest percentage for November since the start of records in 1951.Temperatures were near to cooler than average across much of Antarctica as well as across parts of eastern North America, northern Europe, southern South America, and central-eastern Asia. Sea surface temperatures were near to below average over parts of the southeastern Pacific Ocean, the eastern Indian Ocean, and the northern Atlantic Ocean. Less than 1% of the world's surface had a record-cold November.
- South America, Africa, and Asia each had their warmest November on record.
- Above-average November precipitation was observed across parts of Europe, western Canada, southeastern South America, eastern Africa, southern India, and northern and eastern Asia. Meanwhile, drier-than-average conditions were present across much of the U.S. as well as across parts of Africa, Japan, and western Australia.

14.3.3.3 United in Science Report 2023

The United in Science 2023 report, is compiled by the World Meteorological Organisation (WMO), on behalf of the United Nations Secretary-General to bring together the latest climate science related updates from groups of key global partner organisations including WMO, Global Carbon Project (GCP), Intergovernmental Panel on Climate Change (IPCC), United Nations Environment Programme (UNEP), World Health Organization (WHO), the Met Office (United Kingdom, UK), the jointly sponsored WMO/Intergovernmental Oceanographic Commission (IOC) of UNESCO/International Science Council (ISC), and World Climate Research Programme (WCRP). It presents the very latest scientific data and findings related to climate change to inform global policy and action. Key messages in the report include:

State of the Science

- Total carbon dioxide (CO2) emissions from fossil fuels and land use change remained high in 2022 and the first half of 2023. Fossil fuel CO2 emissions increased 1% globally in 2022 compared to 2021, and global average concentrations continued rising through 2022 and the first half of 2023.

- The years from 2015 to 2022 were the eight warmest on record, and the chance of at least one year exceeding the warmest year on record in the next five years is 98%.
- It is estimated that current mitigation policies will lead to global warming of around 2.8°C over this century compared to pre-industrial levels. Immediate and unprecedented reductions in greenhouse gas (GHG) emissions are needed to achieve the goals of the Paris Agreement.

SDG 2 Zero Hunger

Projections estimate that nearly 670 million people may still face hunger in 2030, in part due to more frequent and intense extreme weather events that are disrupting each pillar of food security (availability, access, utilization and stability).

- Weather-, climate- and water-related sciences underpin services that enable farmers to make climate-informed decisions that enhance food and nutrition security.
- To effectively support the achievement of SDG 2, global investments are needed in weather-, climate- and water-related sciences and services along agrifood value chains.

SDG 3 Good Health and Well-being

- Transdisciplinary research is fundamental to analysing, monitoring and addressing climate-sensitive health risks and climate impacts on the health sector.
- Climate change and extreme events are projected to significantly increase ill health and premature deaths, as well as population exposure to heatwaves and heat-related morbidity and mortality.
- Scaling up investments in climate-resilient and low-carbon health systems, and progress towards universal health coverage are critical for the achievement of SDG 3.

SDG 6 Clean Water and Sanitation

Climate change is exacerbating water-related hazards and altering the Earth's water cycle, making it increasingly difficult to achieve SDG 6.

- More than 60% of countries face challenges due to inadequate and declining hydrological monitoring capabilities.
- More scientific collaboration, financial investments and data and information exchange will be key for policymakers to make informed decisions to accelerate implementation of SDG 6.

SDG 7 Affordable and Clean Energy

- Extreme weather events and anthropogenic climate change threaten the achievement of SDG 7 by changing energy supply capability and demand profiles, making the clean energy transition more unpredictable and potentially more expensive.
- More timely and accurate weather-, climate- and water-related data, science and services will improve energy planning and operations.
- Challenges remain in uneven and/or low data quality and limited availability and affordability of data and services.

SDG 11 Sustainable Cities and Communities

Cities are responsible for a high proportion of global greenhouse gas (GHG) emissions and are highly vulnerable to the impacts of climate change and extreme weather events, which threaten the achievement of SDG 11.

- Integrated urban weather, climate, water and environmental services, grounded in best-available science, are helping cities to achieve SDG 11.
- Observations, high-resolution forecasting models and multi-hazard early warning systems are the fundamental basis for integrated urban services.

SDG 13 Climate Action

- The accumulation of heat in the climate system resulting from human emissions of greenhouse gases (GHGs) has caused widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere, which threaten to reverse progress towards achieving all the SDGs.
- Weather-, climate- and water-related science underpin ambitious climate action and the mobilization of climate finance, particularly in lower-income countries.
- Stakeholder engagement, through means such as citizen science, provides an opportunity to strengthen weather-, climate- and water-related sciences to advance progress towards achieving SDG 13.

SDG 14 Life Below Water

- Climate- and human-related impacts are threatening our oceans, affecting marine ecosystems and the communities that rely on them for food and livelihood security.
- Climate- related ocean science enhances our understanding of climate impacts on the ocean and contributes to strategies for sustainably managing and protecting marine ecosystems.
- The United Nations Decade of Ocean Science for Sustainable Development provides an unprecedented opportunity to mobilize the scientific community and accelerate ocean-related science.

SDG 17 Partnerships for the Goals

- Half of countries report not having multi-hazard early warning systems (MHEWSs) in place and, where they do exist, there are significant gaps in coverage.
- Weather-, climate- and water-related sciences underpin effective MHEWSs by enhancing the physical understanding of hazards, growing the understanding of the associated risks and impacts, and enabling the detection, monitoring and forecasting of hazards.
- Partnerships across diverse stakeholders, including the weather-, climate- and water-related science communities, are essential to deliver Early Warnings for All and achieve the SDGs.

14.3.3.4 Local Climate

There are a total of 25 synoptic stations located throughout Ireland. These stations are operated by Met Éireann. The parameters measured and recorded at these stations include rainfall, temperature, wind speed and direction, relative humidity, solar radiation, clouds, atmospheric pressure, sunshine hours, evaporation, and visibility. The nearest synoptic station to the proposed development site is Shannon Airport. The climate at the proposed development site is best represented by data collected at this station. The average monthly precipitation, rainfall, and wind speeds for the 30-year period between 1991 and 2020 are summarised in Table 14-5.

Table 14-5: Shannon Airport 1991-2020 Averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean temperature	6.1	6.3	7.5	9.6	12	14.5	16	15.8	14.1	11.2	8.3	6.4	10.7
SUNSHINE (hours)													
mean daily duration	1.7	2.4	3.6	5.4	5.9	5.5	4.4	4.6	3.9	3	2.1	1.5	3.7
RAINFALL (mm)													
mean monthly total	103.8	86.7	75.8	62.3	63.1	69.6	75.8	87.6	77.4	95.5	106.6	115.4	1019.7
greatest daily total	38.2	33.8	34.8	40.2	25.0	45.3	39.5	51.0	52.3	36.9	29.4	33.5	52.3
WIND (knots)													
mean monthly speed	10	10.1	9.6	9.2	9	8.5	8.4	8.3	8.4	8.9	9.1	9.7	9.1
max. gust	75	86	63	66	52	51	52	61	58	66	69	83	86
WEATHER (mean no. of days with..)													
snow or sleet	1.5	1.8	1.2	0.3	0	0	0	0	0	0	0.1	1	5.9
hail	3.1	3.4	2.8	2	0.7	0	0	0.1	0.1	0.5	1	2.3	16
thunder	0.9	0.4	0.3	0.3	0.5	0.4	0.7	0.5	0.2	0.3	0.3	0.4	5.2
fog	3.4	2.2	2.4	1.8	1.3	1	0.9	1.6	2.8	3.1	4	3.8	28.3

14.4 Likely Significant Effects of the Proposed Development

14.4.1 Do Nothing

If the proposed development were not to proceed, an opportunity to offset Greenhouse Gas Emissions (GHG) from fossil fuel based energy sources would be lost. The potential for Ireland to reach its renewable energy targets set out in the National Climate Action Plan 2023 and to contribute to climate change mitigation would be reduced.

Emissions of CO_2, NO_x and SO_2 from coal, oil and gas fired power plants that would otherwise have been displaced will continue, resulting in a continued deterioration in air quality.

Poor air quality in our urban centres is a growing concern. As stated on the EPA's website: '*The WHO estimates show that more than 400,000 premature deaths are attributable to poor air quality in Europe annually. In Ireland, the number of premature deaths attributable to poor air quality is estimated at 1,180 people and is mainly due to cardiovascular disease*'. The World Health Organisation (WHO) has described air pollution as the '*single biggest environmental health risk*'.

In a Do Nothing scenario, there would be an adverse, moderate, long term effect should the proposed development not proceed, as emissions associated with the burning of fossil fuels will continue.

Table 14-6: Do Nothing Assessment of Air Quality and Climate Effects

Effect: Dust, Particulates and GHG Emissions						
	Quality of Effect	Significance	Spatial Extent	Duration	Other Relevant Criteria	Likelihood
Whole Wind Farm Development	Adverse	Moderate	Extensive	Long- term	Indirect	Likely

14.4.2 Construction Phase

During the construction phase there will be emissions from vehicle exhausts. The movement of machinery, construction vehicles and the use of generators during the construction phase will generate exhaust fumes containing predominantly carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM_{10}).

There will be dust generated from moving and transporting soil and materials in and around the construction site and on public roads. Weather conditions will play an important role in the quantity of dust generated. The potential for fugitive dust emissions is greatest during periods of prolonged dry weather.

14.4.2.1 Air Quality – Dust Emissions

In terms of air quality, the greatest likelihood of effects during the construction stage will be from dust emissions associated with the construction works. The key works likely to be associated with dust emissions include earthworks and excavation activities, construction of hardstanding areas and movement of vehicles on and off site. Dust emissions during the demolition phase will be lower than the construction phase given that there is no requirement for excavations.

Earthworks

Earthworks will primarily involve excavation, haulage, tipping, landscaping and stockpiling. The dust emission magnitude from earthworks can be classified as small, medium or large and are described as follows:

- Large: Total site area > 10,000m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8m in height, total material moved >100,000 tonnes;
- Medium: Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4-8m in height, total material moved 20,000 – 100,000 tonnes; and
- Small: Total site area >2,500m^2, soil type with large grain size (e.g. sand), < heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months.

The dust magnitude for the proposed earthwork activities can be classified as Large due to the proposed development site area >10,000m^2. Combining this classification with the previously established sensitivity of the area to dust soiling, ecological and human health effects (low sensitivity respectively), an overall Low risk of temporary dust soiling impacts, Low risk of ecological effects and Low risk of temporary human health effects is reached, as per **Table 14-7**.

Table 14-7: Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Construction

Dust emission magnitudes from the construction of buildings can be classified as small, medium and large and are described as follows:

- Large: Total building volume >100,000m^3, on-site concrete batching, sandblasting.
- Medium: Total building volume 25,000m^3-100,000m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching; and
- Small: Total building volume <25,0000m^3, construction material with low likelihood of dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as Large given that the volume of material exceeds 100,000m^3. Combining this classification with the previously established sensitivity of the area to dust soiling, ecological and human health effects (low sensitivity respectively), an overall Low risk of temporary dust soiling impacts, Low risk of ecological effects and Low risk of temporary human health effects is reached, as per **Table 14-8**.

Table 14-8: Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

Trackout refers to the movement of dust and dirt from a construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. The factors which determine the magnitude of dust emissions are vehicle size, vehicle speed, vehicle numbers, geology and duration. Dust emission magnitudes from trackout can be classified as small, medium or large and have been described as follows:

- Large: >50 HGV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- Medium: 10-50 HDV (>3/5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- Small: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

During construction, the primary source of dust emissions with potential to impact sensitive receptors will be movement of vehicles on and off site. Materials with the highest potential for dust emissions will be concrete and aggregates for the construction of hardstanding areas and access tracks. However, only ready-mix concrete will be used on site and all concrete will be delivered in enclosed trucks which will reduce the potential for dust emissions.

The max amount of daily outward HGV movements from the proposed development will be 126, refer to **Appendix 15C**, **Traffic and Transport Assessment**. In a worst case scenario, the dust magnitude from the proposed development is therefore categorised as Large. Combining this classification with the previously established sensitivity of the area to dust soiling, ecological and human health effects (low sensitivity respectively), an overall Low risk of temporary dust soiling impacts, Low risk of ecological effects and Low risk of temporary human health effects is reached, as per **Table 14-9**.

Table 14-9: Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Demolition

- Large: Total building volume >50,000m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level;
- Medium: Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level; and
- Small: Total building volume <20.000m^3, construction material with low volume for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

The dismantling and removal of wind turbines is a specialist operation, which will be undertaken by the turbine supplier that completed the installation where possible. Turbine dismantling will be undertaken in reverse order to methodology employed during their construction.

On the dismantling of turbines, it is not intended to remove the concrete foundation from the ground. It is considered that foundation removal would be the least preferred option in terms of effects to the environment. The turbine foundations will therefore be backfilled and covered with soil material. As there is no usable soil or overburden material on the site after construction, this material will be sourced locally and imported to site on heavy good vehicles. The imported soil will be spread and graded over the foundation using a tracked excavator and revegetation enhanced by spreading of an appropriate seed mix to assist in revegetation.

The exact details of the decommissioning phase will be detailed as part of a Decomissioning Plan which will be finalised with the local authority prior to decommissioning. Taking a conservative approach, the demolition phase dust magnitude is taken as Large for the purposes of this assessment.

Combining this classification with the previously established sensitivity of the area to dust soiling, ecological and human health effects (low sensitivity respectively), an overall Low risk of temporary dust soiling impacts, Low risk of ecological effects and Low risk of temporary human health effects is reached, as per **Table 14-10**.

Table 14-10: Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

The Dust Risk Summary Table for the proposed development is shown in **Table 14-11**.

Table 14-11: Proposed Development Dust Risk Summary Table

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Low Risk	Low Risk	Low Risk
Human Health	Low Risk	Low Risk	Low Risk	Low Risk
Ecological	Low Risk	Low Risk	Low Risk	Low Risk

Having assessed the proposed development dust effects using IAQM guidance methodology, the dust emission magnitude is considered low risk across all construction and demolition activities. Therefore, in the absence of mitigation measures, dust from the proposed development will have an **adverse, not significant, temporary** effect on dust sensitive receptors.

14.4.2.2 Vehicle Emissions

Traffic levels, summarised in **Chapter 15 Material Assets** of this **EIAR** and **Appendix 15C Traffic and Transport Assessment**, during the construction phase are below the TII criteria (refer to **Section 14.2.2.1)** and therefore a quantitative assessment of construction traffic was not required.

Exhaust emissions from construction and delivery vehicles during the construction period of 18 months therefore are unlikely to have an adverse effect on local air quality and will not have a significant effect on local, regional or national Air Quality Standards given the scale of the high levels of dispersion, and the limited duration of works.

Overall, there will be no significant effect on air quality and climate at sensitive receptors for the short term duration of the construction phase.

14.4.3 Operational Phase

14.4.3.1 Compatibility with Climate Policy and Targets

In terms of local policy, the 2023-2029 Clare County Development Plan states that Clare County Council will facilitate the development of energy sources which will achieve low carbon outputs.

In recognition of the need to limit global temperatures, the Paris Agreement came into existence in 2015. It follows on from the Kyoto Protocol with the intention of accelerating progress towards decarbonisation, climate resilient and sustainable societies. The primary aim of the Paris Agreement is to limit global temperature rise to well below 2 degrees Celsius.

To align with the goals of the Paris Agreement, one of the main aims of the Climate Action Plan 2023 is for 80% of electricity in Ireland to come from renewable resources by 2030.

The proposed development is aligned with current energy and climate policy, aims and objectives, which primarily seek to increase the production of electricity from renewable sources.

14.4.3.2 2023 Climate Action Plan

The current national Climate Action Plan (2023) sets out a detailed sectoral roadmap designed to deliver a 51% reduction in greenhouse gas (GHG) emissions by 2030. The GHG reduction target will require significant reductions from all sectors including the renewable energy sector. By its very nature, the proposed development will contribute to achieving this target and move Ireland one step closer towards decarbonisation and ultimately a net zero GHG emissions society.

The proposed development is fully compatible with the provisions relating to renewable energy set out in the CAP, summarised as follows:

- The project will contribute to the CAPs objectives to achieve a 51% reduction in Ireland's overall GHG emissions from 2021 to 2030, and to achieving net-zero emissions no later than 2050.
- The project will contribute to the CAPs objectives to decarbonise the electricity sector by taking advantage of our significant renewable energy resources.
- The project will contribute to the CAPs objectives to increase the share of electricity demand generated from renewable sources to up to 80%.
- The project will contribute to the objectives of the CAP to expand and reinforce the grid through the addition of a substation and associated gridlines.

The project will lead to a reduction in greenhouse gas emissions by using a least cost technology recognised in the CAP. The development will provide approximately 141,912 MWh per year of renewable electricity to the national grid.

14.4.3.3 Carbon Savings and Losses from the Wind Farm

Once operational, the electricity generated by the wind farm will displace electricity that would otherwise have been produced by burning fossil fuels. This will also displace the associated greenhouse gas emissions. However, there will be some carbon losses due to the manufacturing process of the wind turbines.

In order to demonstrate that the carbon savings will significantly outweigh any potential carbon losses, a methodology made available by the Scottish Government in an excel worksheet titled '*Calculating carbon savings from wind farms on Scottish peatlands*' was applied to this development.

As discussed earlier, this is an established methodology which has been approved by the Scottish government and Scottish Environmental Protection Agency (EPA). Submissions made by developers using this tool are regularly audited by the Scottish EPA. In the absence of an Irish equivalent, it is considered appropriate to use this tool for the proposed development.

Clear felling of forestry is required to facilitate a number of turbine access tracks, substation and grid connection. These trees may be felled earlier than originally planned as a result of the proposed development. The carbon losses over the lifetime of the development are calculated from the area to be felled and the average carbon that would have been sequestered annually. Any felled forestry will be replanted resulting in no overall net loss.

The theoretical worst case carbon losses due to the proposed development are presented in Table 14-12. The results are a theoretical worst case and the actual results are expected to be much lower than those calculated.

Table 14-12: CO2 Losses due to the Proposed Development

Source	CO_2 Losses (tonnes CO_2 equivalent)
Losses due to turbine manufacture, construction & decommissioning	44,844
Losses due to felling forestry	7,379
Total	**52,223**

The calculations show 52,223 tonnes of CO_2 equivalent losses over the 35-year life span; 44,844 tonnes CO_2 equivalent or 86% of the losses come from the turbine life cycle. The early felling of the forestry accounts for 7,379 tonnes CO_2 equivalent losses or 14% of the total.

The calculation spreadsheet uses counterfactual emission factors to calculate the payback period. There is no clear guidance on the appropriate emission factors to use in Ireland. A grid mix emission factor of 0.375 t CO_2 MWh-1 sourced from the SEAI document '*Energy Related CO2 emissions in Ireland 2005 to 2018*' was used as the counterfactual emission factor. This resulted in a payback time of 1 year (Refer to Volume III, Appendix 14B). Therefore, for the remaining 34 years of operation, the proposed development will be directly responsible for significant carbon savings.

Once operational, there will be no direct emissions to the atmosphere from the development. The carbon calculations demonstrate that significant CO_2 will be offset by the proposed development and will further assist Irelands CO_2 reduction commitments under the Paris Agreement and Ireland's Climate Action Plan 2023. The electricity generated will assist to displace electricity otherwise generated from coal, oil and gas fired power plants, thus reducing emissions from these power plants.

In the context of the proposed project, there will be a **long-term**, **significant**, **positive** effect.

Table 14-13: Operational Phase Carbon Savings

Effect: Carbon Savings						
	Quality of Effect	Significance	Spatial Extent	Duration	Other Relevant Criteria	Likelihood
Whole Wind Farm Development	Positive	Significant	National	Long- term	Indirect	Likely

14.4.4 Decommissioning Phase

The scale of works involved during the decommissioning phase will primarily involve the dismantling and removal of the wind farm infrastructure off-site and the dust generating activities will be greatly reduced when compared to the construction phase. Similarly, emissions from plant and machinery exhausts will be lower than anticipated for the construction phase. Where possible materials will be recovered and recycled, minimizing the energy required for disposal.

14.4.5 Cumulative Effects

Most planning applications in the region relate to small scale residential infrastructure plans and are listed in **Section 2.3.21 of Chapter 2** of this EIAR.

Wind farm projects within 25km of the proposed development include:

- Limerick Blow Moulding, Parteen (single turbine) (existing) (permission for retention and changing of position granted);
- Vistakon (single turbine) (existing);
- Castlewaller (Permitted but not constructed);
- Carrownagowan (Permitted, under Judicial Review);
- Carrownagowan Wind Farm Grid Connection (Submitted);
- Fahy Beg (Refused, Appealed to An Bord Pleanála).

The closest permitted (approved) but not yet constructed wind farm of significant scale to the proposed development (Carrownagowan) is at a distance of approximately 12km. Fahy Beg Wind Farm (current being Appealed to ABP) is located approximately 8.5km to the north east.

The nearest proposed solar farms are Drummin Solar Farm (c.2km south east) and Ballyglass Solar Farm (c.5km east).

In relation to dust emissions, the renewable projects are sufficient distance from the proposed development so that cumulative dust effects are not anticipated.

There is a quarry located to the north east of the proposed development which has been granted permission for an extension of the extraction area, details of which are below:

- Planning Reference no: 18818 for development which will consist of quarrying an area consisting of 10 hectares located adjacent to the existing working quarry including extraction of rock by blasting means down to 150mOD; Extracted rock will be processed at the existing working quarry; Landscaping of the quarry during the operational phase and restoration of the quarry on completion of extraction; All associated ancillary facilities/works; The applicant is seeking a 16 year permission as part of the application. The application is accompanied by an Environmental Impacts Assessment Report (EIAR).

The plans and project outlined have been put through a rigorous design process for obtaining planning permission, where relevant mitigation measures have been incorporated in to the EIAR to ensure that there will be no adverse effects on air/climate. In addition, the following planning conditions have been imposed by Clare County Council as part of the application for the quarry extension, to control dust emissions:

Condition 10

- a) Dust levels at the site boundary shall not exceed 350 milligrams per square metre per day averaged over continuous periods of 30 days (Bergerhoff Gauge). Monitoring shall be carried out in accordance with Section 10.8 of the updated EIAR received by the Planning Authority on the 15th of March 2019.
- (b) A monthly survey and monitoring programme of dust and particulate emissions shall be undertaken to provide for compliance with these limits. This programme shall include an annual review of all dust monitoring data, to be undertaken by a suitably qualified person acceptable to the planning authority. The results of the reviews shall be submitted to the planning authority within two weeks of completion. The developer shall carry out any amendments to the programme required by the planning authority following this annual review.

Condition 11

- (a) The wheels and undersides of all vehicles transporting aggregate from the site onto the public road shall, prior to the exit of such vehicles onto the public road, be washed in a wheel washing facility, which shall be constructed, installed and operated in accordance with the requirements of the planning authority.
- (b) in dry weather conditions, all roads within the site and the active working face shall be sprayed with water at least three times a day.
- (c) All loads of fine dry materials shall be either sprayed with water or covered/sheeted prior to exiting the quarry.

Taking into consideration the above conditions and mitigation measures outlined with the EIAR prepared for planning reference 18818, there will be no significant cumulative effect on either air quality or climate once those mitigation measures are implemented.

There will be no carbon dioxide or any other GHG emissions once the wind farm is operational, except for occasional operational and maintenance vehicles exhausts. This effect will be **imperceptible**. Therefore, there will be no measurable significant adverse cumulative effect with other developments.

Should this wind farm and other renewable electricity generation projects become operational, the combined beneficial cumulative effects will be greater than those described in this chapter. The tonnes of CO_2 emissions avoided and the improvement to air quality, especially in our towns and cities, will be greatly enhanced. The potential cumulative effect with other renewable energy projects will be **long term, significant** and **positive** on air quality and climate as there is no emission to the atmosphere from the proposed development during the operational phase, there will be no cumulative effect on air quality with ongoing forestry operations.

14.5 Mitigation Measures

Outlined below is a series of mitigation measures and good working practices to ensure that any potential effects during the construction phase are minimized and to ensure there will be no adverse effect on the receiving environment. The mitigation measures are recommended by National and International best practice guidance documents for the implementation of dust management plans such as;

- '*Control of Dust from Construction and Demolition Activities'*, UK British Research Establishment (BRE).
- '*Environmental Good Practice on Site'*, Construction Industry Research and Information Association (CIRA).
- '*Environmental Management Plans'*, Institute of Environmental Management and Assessment (IEMA).
- '*Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan'* National Roads Authority of Ireland (NRA).

Mitigation measures as outlined in the various other chapters of this EIAR and specifically the procedures contained within the CEMP (Volume III, Appendix 2A) will minimise any potential effects, ensuring there is no significant adverse effect.

14.5.1 Construction Phase

14.5.1.1 Dust Generation

Construction phase generated dust will be minimised by the following measures, which are also incorporated into the site-specific CEMP (Volume III, Appendix 2A):

- The use of water as a dust suppressant, e.g. a water bowser to spray access tracks and crane hardstanding areas during any extended dry periods when fugitive dust emissions could potentially arise;
- Public roads will be inspected regularly for cleanliness and cleaned as necessary;
- All loads entering and leaving the site will be covered during dry periods if dust results in a disturbance on site;
- Control of vehicle speeds passing over access tracks and crane hardstanding areas within the site;
- Wheel wash facilities will be implemented at the site entrance from the public road to facilitate removal of any material collected by vehicles entering or leaving the site and preventing its deposition on public roads;
- Site stockpiling of materials will be designed and laid out to minimise exposure to wind;
- Daily site inspections will take place to examine dust measures and their effectiveness.

14.5.1.2 Construction Traffic Emissions

Construction traffic emissions will be reduced using the following measures:

- Ensure regular maintenance of plant and equipment. Carry out periodic technical inspection of vehicles to ensure they perform most efficiently;
- Implementation of the Traffic Management Plan (Volume III, Appendix 2D) to minimise congestion;
- All site vehicles and machinery will be switched off when not in use, and no idling of engines will be permitted;
- The majority of aggregate materials for the construction of the proposed development will be obtained from an on-site borrow pit. This will reduce the number of delivery vehicles to site, thereby reducing emissions associated with vehicle movements.

It is not expected that any significant adverse effects to the climate will occur during the operational phase, therefore no mitigation measures are required.

14.5.2 Decommissioning Phase

Effects resulting from the decommissioning phase are expected to be similar in nature, however smaller in scale in comparison to the construction phase. Therefore, similar mitigation measures such as those related to dust and construction vehicles are recommended.

14.6 Risk of Major Accidents and Disasters

Given the temporary nature of the construction stage and the scale of the proposed project, as well as the environmental protection measures that will be implemented from the outset, the risk of disasters (typically considered to be natural catastrophes e.g. very severe weather event) or accidents (e.g. fuel spill, traffic accident, land-slide) is considered low.

A review of the national flood hazard mapping website (www.floodinfo.ie) indicates there is no history of flooding within the planning boundary. Notwithstanding this, in the case of the occurrence of a severe weather event such as flooding during construction, construction work will cease.

During the operational life of the wind farm, particularly in the context of climate change, potential exists for increased storm events and severe weather. Wind turbines are designed for specific wind parameters and will shut down during high wind speed events. Therefore, the potential effects of climate change on the operational development may involve curtailment where the turbines will be restricted from operation due to severe winds, however this does not present a likely risk of a major accident or disaster.

14.7 Residual Effects

There will be no significant adverse residual effects from the construction phase of the development on air quality and climate.

Once operational, there will be no significant adverse residual air quality effects or GHG emissions. The operation of the proposed development will displace air pollutants that would otherwise have been produced by fossil fuel generated electricity. By displacing fossil fuel generated electricity, the proposed development operational phase will help to reduce GHG emissions and contribute to national decarbonisation targets.

Overall, the operational phase of the development will have a **positive**, **moderate** and **long-term** effect on air quality and climate.

Table 14-14: Operational Phase Assessment of Air Quality and Climate Effects

Residual Effect: Improved Air Quality and Increased Carbon Savings						
	Quality of Effect	Significance	Spatial Extent	Duration	Other Relevant Criteria	Likelihood
Whole Wind Farm Development	Positive	Moderate	Extensive	Long-term	Direct	Likely

14.8 Conclusions

Decarbonisation is critical to reducing rising global temperatures and the resultant adverse effects to the Planet and its occupants.

The proposed wind farm development will facilitate decarbonisation objectives at local and national levels as set out in the National Climate Action Plan (DCCAE, 2023) and the Clare County Development Plan 2023 – 2029, which states that *Clare County Council will facilitate the development of energy sources which will achieve low carbon outputs.*

The proposed development comprises the creation of a renewable energy source which aligns with the type of projects the above plans propose for decarbonisation. The site has been designated as a strategic area for wind farm development by Clare County Council as part of the Clare County Development Plan 2023 -2029 (Renewable Energy Designation). This is due to its regional and national importance and the favourable conditions for wind energy generation.

14.9 References

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