

10. AIR QUALITY

10.1 INTRODUCTION

This chapter comprises an assessment of the likely effect on local air quality associated with the proposed project. A full description of the proposed project is presented in Chapter 2 (Description of the Proposed Project).

This chapter provides a baseline assessment of the setting of the proposed project in terms of air quality and discusses the likely effects that the construction, operation and decommissioning of the proposed project will have. Where required, appropriate mitigation measures to limit any identified likely significant negative effects on air quality are recommended. The air quality assessment takes into consideration the construction and operation of the proposed project based on the turbine options detailed in Chapter 2 (Description of the Proposed Project) for which design flexibility has been obtained. The choice of turbine will have no bearing on the air quality assessment. Therefore, the conclusions of this air quality assessment are applicable to whichever option is selected.

An overview of the methodology undertaken for the air quality impact assessment for the proposed project is outlined below:

- The existing ambient environment of the proposed project has been characterised by a review of available published ambient air quality monitoring data.
- A review of the most applicable best practice standards and guidelines has been undertaken in order to define the air quality significance criteria for the construction, operational and decommissioning phases of the proposed project.
- The direct, indirect and cumulative impacts of construction dust resulting from construction activities, in terms of dust soiling, human health and ecology effects have been assessed.
- The potential for direct, indirect and cumulative air quality impacts associated with changes in traffic volumes associated with the construction, operational and decommissioning phases of the proposed project has been considered.
- The indirect impacts to air quality from savings in nitrogen oxides (NO_x) emissions arising from the production of electricity using renewable sources have been assessed.
- A schedule of mitigation measures has been incorporated, where required, to reduce, where necessary, the identified potential air quality impacts associated with the proposed project; and
- An assessment of the significance of any residual impacts after mitigation has also been undertaken.

10.2 STATEMENT OF AUTHORITY

This chapter was prepared by Dr. Jovanna Arndt, a Principal Environmental Consultant in the Air Quality & Climate section of Awn Consulting. She holds a BSc. in Environmental Science and a Ph.D. in Atmospheric Chemistry from University College Cork. She is an Associate Member of both the Institute of Air Quality Management and the Institute of Environmental Sciences. She has been specialising in the area of air quality and climate over 9 years and has prepared air quality and climate assessments for inclusion within EIARs for a variety of developments, with



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This chapter was reviewed by Ciara Nolan. Ciara is a Principal Environmental Consultant in the Air Quality & Climate section of AWN Consulting. She holds a BSc in Energy Systems Engineering from University College Dublin and has also completed an MSc in Applied Environmental Science at UCD. She is a Member of the Institute of Air Quality Management (MIAQM) and the Institute of Environmental Science (MIEnvSc). She has over 9 years of experience in undertaking air quality and climate assessments. She has prepared air quality and climate impact assessments as part of EIARs for a variety of developments, with recent renewable energy developments including Rockahenny Windfarm, Upperchurch Windfarm, Knocknamona Windfarm and Keerglen Windfarm.

10.3 METHODOLOGY

10.3.1 Construction Phase

10.3.1.1 Construction Dust Assessment

The Institute of Air Quality Management in the UK (IAQM) guidance document ‘*Guidance on the Assessment of Dust from Demolition and Construction*’ (2024) outlines an assessment method for predicting the impact of dust emissions from construction activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. The IAQM methodology has been applied to the construction phase of this project in order to predict the likely risk of dust impacts in the absence of mitigation measures and to determine the level of site-specific mitigation required. The use of this UK guidance is recommended by Transport Infrastructure Ireland in their guidance document *Air Quality Assessment of Specified Infrastructure Projects – PE-ENV-01106* (TII, 2025).

The IAQM states that an assessment of construction dust impacts is normally required where there is a human or ecological receptor within 250m of the boundary of the construction works (this should consider offsite construction compounds) and/or within 50 m of the route(s) used by construction vehicles on the public road network (on roads up to 250 m from the construction site entrance). This constitutes the Zone of Influence (Zoi) for the construction dust assessment.

The major dust generating activities are divided into four types within the IAQM guidance (2024) to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (transport of dust and dirt from the construction site entrance onto the public road network).

The magnitude of each of the four categories is divided into large, medium or small scale depending on the nature of the activities involved. The criteria for determining the category for the works involved are outlined in Table 10.1, these are based on the IAQM guidance (2024). The magnitude of each activity (see Section 10.6.2.1.1) is combined with the overall sensitivity of the area (see Section 10.5.2) to determine the risk of dust impacts from site activities (see Section 10.6.2.1.2). This allows the level of site-specific mitigation to be determined.



Table 10.1: IAQM Criteria to Determine Dust Emissions Magnitude

Dust Emission Magnitude		
Small	Medium	Large
Demolition		
<ul style="list-style-type: none"> total building volume <12,000 m³ construction material with low potential for dust release (e.g. metal cladding or timber) demolition activities <6 m above ground demolition during wetter months 	<ul style="list-style-type: none"> total building volume 12,000 - 75,000 m³ potentially dusty construction material demolition activities 6 - 12 m above ground level 	<ul style="list-style-type: none"> total building volume >75,000 m³ potentially dusty construction material (e.g. concrete) on-site crushing and screening demolition activities >12 m above ground level
Earthworks		
<ul style="list-style-type: none"> total site area <18,000 m² soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one time formation of bunds <3 m in height earthworks during wetter months 	<ul style="list-style-type: none"> total site area 18,000 m² - 110,000 m² moderately dusty soil type (e.g. silt) 5 - 10 heavy earth moving vehicles active at any one time formation of bunds 3 - 6 m in height 	<ul style="list-style-type: none"> total site area >110,000 m² 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 >6 m in height
Construction		
<ul style="list-style-type: none"> total building volume <12,000 m³ construction material with low potential for dust release (e.g. metal cladding or timber) 	<ul style="list-style-type: none"> total building volume 12,000 - 75,000 m³ potentially dusty construction material (e.g. concrete) on-site concrete batching 	<ul style="list-style-type: none"> total building volume >75,000 m³ on-site concrete batching sandblasting



Dust Emission Magnitude		
Small	Medium	Large
Trackout (heavy duty vehicle movements)		
<ul style="list-style-type: none"> • <20 HDV (>3.5 t) outward movements in any one day • surface material with low potential for dust release • unpaved road length <50 m 	<ul style="list-style-type: none"> • 20 – 50 HDV (>3.5 t) outward movements in any one day • moderately dusty surface material (e.g. high clay content) • unpaved road length 50 – 100 m 	<ul style="list-style-type: none"> • >50 HDV (>3.5 t) outward movements in any one day • potentially dusty surface material (e.g. high clay content) • unpaved road length >100 m

Once the dust emission magnitude has been determined the next step, according to the IAQM guidance (2024), is to establish the level of risk by combining the magnitude with the overall sensitivity of the area to dust soiling, human health and ecological effects. The level of risk associated with each activity is determined using the criteria in Table 10.2.



Table 10.2: IAQM Criteria to Determine Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible



10.3.1.2 Construction Phase Traffic Assessment

Construction phase traffic can also impact air quality. The TII guidance '*Air Quality Assessment of Specified Infrastructure Projects – PE-ENV-01106*' (TII, 2025), states that road links meeting one or more of the following criteria can be defined as being “affected” by a proposed project and should be included in the local air quality assessment. While the guidance is specific to infrastructure projects the approach can be applied to any development that causes a change in traffic and has been applied for this assessment.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- Daily average speed change by 10 kph or more;
- Peak hour speed change by 20 kph or more;
- A change in road alignment by 5 m or greater.

As per Chapter 14 Transport and Transportation of this EIAR, it has been determined by the traffic consultant that the construction stage traffic will not increase by 1,000 AADT, or 200 HDV AADT. Therefore, it does not meet the above scoping criteria. In addition, there are no proposed changes to the traffic speeds or significant road alignment. As a result, a detailed air assessment of construction stage traffic emissions has been scoped out from any further assessment as there is no potential for significant impacts to air quality.

10.3.2 Operational Phase

10.3.2.1 Operational Phase Traffic Assessment

Operational phase traffic has the potential to impact air quality. The TII scoping criteria (TII, 2022) were used to determine if any road links required a detailed modelling assessment.

The operational phase of the project will involve only very occasional inspection and low traffic movements by maintenance vehicles. Maintenance vehicles will access the wind farm and BESS site and access the joint bays for periodic maintenance and carry out point works along the proposed GCR to address any issues during the operational period. The traffic consultant has confirmed that there are no road links impacted as a result of the proposed project, by definition of the TII scoping criteria. Therefore, a detailed air assessment of operational stage traffic emissions has been scoped out from any further assessment as there is no potential for significant impacts to air quality as a result of vehicle emissions.

10.3.2.2 Operational Energy Production

The assessment of baseline air quality in the region is conducted to review and ensure that the current levels of key pollutants are in compliance with their limit values.

The operation of the turbines themselves will not give rise to any significant emissions to air.

The operational phase of the proposed project will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source. The indirect impacts to air quality from savings in nitrogen oxides (NO_x) emissions arising from the production of electricity using renewable sources were calculated and compared against those produced using non-renewable sources. The calculations were carried out using SEAI published emission rates from non-renewable energy sources.



The most recent report by the SEAI entitled “*Energy in Ireland 2024 Report*” (SEAI, 2024) estimates that a total of 34.6 TWh of electricity was generated nationally in 2023. Renewable energy accounted for 40.7% of the electricity generated in 2023, with 11.7 TWh from wind generation.

The EPA state that a total of 98.2 kt NO_x was emitted in 2021 in their report entitled “*Ireland’s Air Pollutant Emissions 1990 – 2030*” (EPA, 2023). These are the most recently published figures for NO_x emissions. Power generation accounted for 8.7% of the total emissions produced in 2021.

The above figures from the SEAI and EPA were used in the current assessment to quantify the NO_x emissions savings from the windfarm project both annually and over the lifespan of the proposed project and the results were compared against the 2030 national air emissions target of 40.6 kt (see Section 10.6.3.1).

Due to the agreed design flexibility approach with An Coimisiún Pleanála regarding the range of design parameters associated with the wind turbines for the proposed project, the make and manufacturer of the turbines to be installed has not yet been decided at this stage of the project and will be decided post consent should permission be granted. As a result, information from wind turbine manufacturers has been reviewed, and the appropriate information has been used in this assessment. The wind farm is estimated to have an export capacity of between 61.6 and 77 MW and an assumed capacity factor of 33%, therefore the power generation from the project is expected to be approximately a minimum of 178 GWh of electricity per annum.

10.3.3 Criteria for Rating of Impacts

10.3.3.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland are set out in *Directive (EU) 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (CAFE Directive)* and *Directive (EU) 2024/2881 of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe (recast)*, which will repeal and replace the CAFE Directive from 12 December 2026. The 2024 directive sets out the air quality standards for pollutants that apply today and the new air quality standards for pollutants that apply from 1 January 2030 which are more closely aligned with the World Health Organisation (WHO) air quality guidelines.

The Air Quality Standards Regulations 2022 (S.I. 739 of 2022) transposed EU Directive 2008/50/EC. With the adoption of Directive (EU) 2024/2881, Ireland must transpose this directive into national law (i.e. update the Air Quality Standards Regulations) before December 2026.



The ambient air quality standards applicable for particulate matter (as PM₁₀) are outlined in Table 10.3.

Table 1 of Annex I in Directive (EU) 2024/2881 sets out the updated air quality limit values for pollutants to be achieved by 1 January 2030, which are more closely aligned with the WHO air quality guidelines. Table 2 of Annex I in Directive (EU) 2024/2881 sets out the limit values for air pollutants which are to be achieved by 11 December 2026 and are also applicable up to 2030. The limit values in Table 2 of Annex I are the same as the limits set under Directive 2008/50/EC and the Air Quality Standards Regulations 2022.

Table 10.3: Ambient Air Quality Limit Values

Pollutant	2008/50/EC Limit Type	2008/50/EC Limit Value (applicable until 2030)	2024/2881/EC Limit Type	2024/2881/EC Limit Value (to be attained by 2030)
Particulate Matter (as PM ₁₀)	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m ³	24-hour limit for protection of human health - not to be exceeded more than 18 times/year	45 µg/m ³
	Annual limit for protection of human health	40 µg/m ³	Annual limit for protection of human health	20 µg/m ³

In April 2023, the Government of Ireland published the *Clean Air Strategy for Ireland* (Government of Ireland 2023), which provides a high-level strategic policy framework needed to reduce air pollution. The strategy commits Ireland to achieving the 2021 WHO Air Quality Guidelines Interim Target 3 (IT3) by 2026 (shown in Table 10.4), the IT4 targets by 2030 and the final targets by 2040 (shown in Table 10.4). The strategy notes that a significant number of EPA monitoring stations observed air pollution levels in 2021 above the WHO targets; 80% of these stations would fail to meet the final PM_{2.5} target of 5 µg/m³. The strategy also acknowledges that “meeting the WHO targets will be challenging and will require legislative and societal change, especially with regard to both PM_{2.5} and NO₂”.

Annex II of Directive 2024/2881/EC gives assessment thresholds which align with the clean air strategy final 2040 WHO targets. Directive (EU) 2024/2881 states that “Member States shall endeavour to achieve and preserve the best ambient air quality and a high level of protection of human health and the environment, with the aim of achieving a zero-pollution objective as referred to in Article 1(1), in line with WHO recommendations, and below the assessment thresholds laid down in Annex II.”

These assessment thresholds relate to monitoring of ambient air quality by Member States, where “exceedances of the assessment thresholds specified in Annex II shall be determined on the basis of concentrations during the previous 5 years where sufficient data are available. An assessment threshold shall be deemed to have been exceeded if it has been exceeded during at least 3 separate years out of those previous 5 years.”

The applicable air quality limit values for the purposes of this assessment are those set out in Table 10.3. The limit values stipulated under Directive 2008/50/EC and the Air Quality



Standards Regulations 2022 are applicable prior to 2030. The limit values stipulated by Directive (EU) 2024/2881 are applicable after 2030.

Table 10.4: WHO Air Quality Guidelines

Pollutant	Regulation	Limit Type	IT3 (2026)	IT4 (2030)	Final Target (2040)
PM (as PM ₁₀)	WHO Air Quality Guidelines	24-hour limit for protection of human health	75 µg/m ³	50 µg/m ³	45 µg/m ³
		Annual limit for protection of human health	30 µg/m ³	20 µg/m ³	15 µg/m ³

10.3.3.2 Dust Deposition Guidelines

The concern from a health perspective is focused on particles of dust which are less than 10 microns and the EU ambient air quality standards have set ambient air quality limit values for PM₁₀ and PM_{2.5}.

With regard to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland.

However, best practice guidelines for dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/m²/day averaged over a one-year period at any receptors outside the site boundary. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled *Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals)* (EPA, 2006). The document recommends that the Bergerhoff limit of 350 mg/m²/day be applied to the site boundary of quarries. This limit value can be implemented with regard to dust impacts from construction of the proposed project.

10.3.3.3 National Air Emissions Targets

Regional air emissions associated with the proposed project can be assessed relative to the emission ceilings given in Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants (as amended) (hereafter referred to as the National Emissions Reduction Directive). This National Emissions Reduction Directive applied the limits set out in Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 (now repealed) on national emission ceilings for certain atmospheric pollutants until 2020 and established new national emission reduction commitments which are applicable from 2020 and 2030 for sulphur dioxide (SO₂), NO_x, non-methane volatile organic compounds (NMVOC), NH₃, PM_{2.5} and methane (CH₄).

In relation to Ireland, the 2020 to 2029 emission targets are 26 kilotonnes (kt) for SO₂ (65% reduction on 2005 levels), 68kt for NO_x (49% reduction on 2005 levels), 58kt for NMVOCs (25%



reduction on 2005 levels), 123kt for NH₃ (1% reduction on 2005 levels) and 15kt for PM_{2.5} (18% reduction on 2005 levels) as shown in Table 10.5. In relation to 2030, Ireland’s emission targets are to achieve an 85% reduction in SO₂, 69% reduction in NO_x, 32% reduction in VOCs, 5% reduction in NH₃ and 41% reduction in PM_{2.5} compared to 2005 levels, also shown in Table 10.5.

Table 10.5: National Air Emission Targets (Ireland’s Air Pollutant Emissions 2020 to 2030)

Pollutant	2020 – 2029 Reduction Commitments		2030 Reduction Commitments	
	kt	% Reduction Compared to 2005 Levels	kt	% Reduction Compared to 2005 Levels
SO ₂	25.6	-65%	11.1	-85%
NO _x	68.2	-49%	41.5	-69%
NMVOC	57.6	-25%	52.5	-32%
NH ₃	122.6	-1%	117.6	-5%
PM _{2.5}	15.3	-18%	11.0	-41%

10.4 DIFFICULTIES ENCOUNTERED

There were no difficulties encountered in compiling this assessment.

10.5 EXISTING ENVIRONMENT

10.5.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality are the prevailing meteorological conditions. Wind frequency is important as dust can only be dispersed by winds, and deposition of dust is a simple function of particle size, wind speed and distance. The closer the source of dust is to a receptor the higher the potential risk of impact of dust blow.

The nearest representative weather station collating detailed weather records is Oak Park, which is located approximately 69 km southeast of the proposed wind farm site. Oak Park meteorological station data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period. The mean wind speed is 4.4 m/s over the period of 2020 – 2024 (Met Eireann, 2025). The prevailing winds in the area are westerly to south-westerly in direction, thereby predominantly dispersing any potential dust emissions to the east and north-east of the proposed wind farm site (see Figure 10.1).

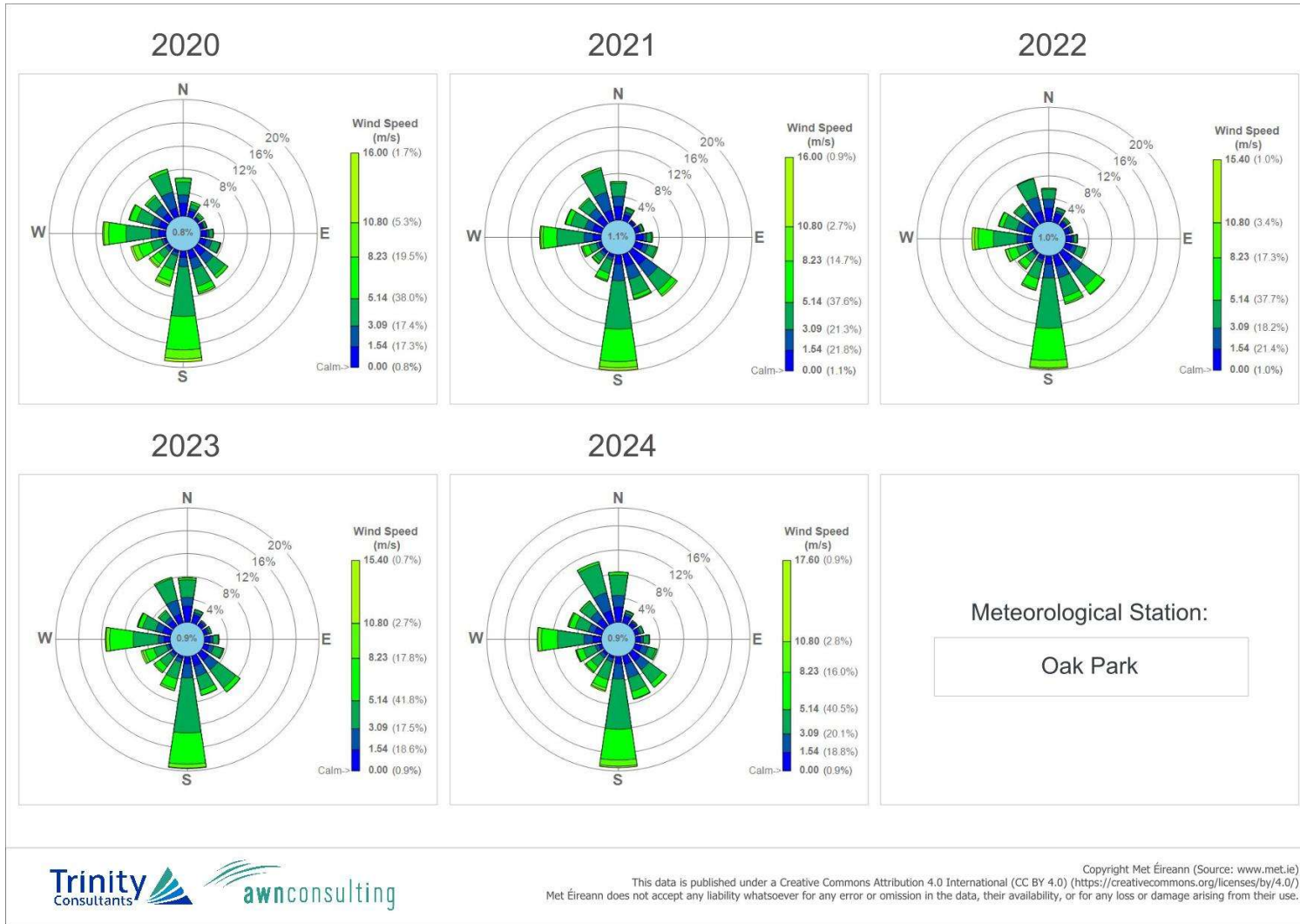
Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under “wet day” conditions where rainfall greater than 0.2 mm has fallen (IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning, 2016). Information collected from Casement Aerodrome meteorological station (the closest station with 30-year averages), identified that typically 194 days per annum are “wet” (Met Eireann 2024, 30-year averages). Thus, if the rainfall at Casement Aerodrome is indicative of



the site location, over 53% of the time no significant dust generation will be likely due to natural meteorological conditions.



Figure 10.1: Wind Roses for Oak Park



10.5.1.1 Baseline Air Quality

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones were defined in Ireland for air quality management and assessment purposes as outlined within the EPA document titled *Air Quality in Ireland 2023* (EPA 2024). Dublin is defined as Zone A and Cork as Zone B. Zone C is comprised of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, the area of the proposed project is categorised as Zone D.

Continuous monitoring by the EPA is carried out at a number of monitoring stations within Zone D (EPA, 2024); these include rural background sites, roadside (traffic) sites and suburban background sites.

It is necessary to select monitoring stations that are representative of the proposed project location. Not all monitoring stations are considered suitable for determining background pollutant concentrations and must be reviewed on a case-by-case basis to determine the most appropriate EPA monitoring sites for the assessment. The selected monitoring sites (Kilkitt and Claremorris) are rural background monitoring locations which are not heavily influenced by traffic or other major air emission sources and can provide an indicative estimate of the background NO₂ concentrations in the vicinity of the proposed project.

10.5.1.2 Particulate Matter (PM₁₀)

Continuous PM₁₀ monitoring was carried out at two representative Zone D rural background locations from 2020 – 2024; Kilkitt and Claremorris (EPA, 2025). Annual average PM₁₀ concentrations across the sites ranged from 7 – 10 µg/m³ over the 2020 – 2024 period (see Table 10.6). There were no exceedances of the daily limit of 50 µg/m³ in the five-year period (35 exceedances are permitted per year) (EPA, 2024). The overall average PM₁₀ concentration at the rural background Zone D sites over the 2020 – 2024 period is 8 µg/m³. Based on the EPA data, a conservative estimate of the current background PM₁₀ concentration in the region of the proposed project is 8 µg/m³.

Table 10.6: Baseline Zone D Air Quality – PM₁₀

Station	Averaging Period	Year				
		2020	2021	2022	2023	2024
Kilkitt	Annual Mean PM ₁₀ (µg/m ³)	8	8	9	7	7
	24-hr Mean > 50 µg/m ³ (days)	0	0	0	0	0
Claremorris	Annual Mean PM ₁₀ (µg/m ³)	10	10	8	8	8
	24-hr Mean > 50 µg/m ³ (days)	0	0	0	0	0



10.5.1.3 Particulate Matter (PM_{2.5})

The results of PM_{2.5} monitoring at Claremorris over the period 2020 – 2024 ranged from 5 – 8 µg/m³ (EPA, 2024). Long-term average PM_{2.5} concentrations measured at this location were significantly lower than the annual average limit value of 25 µg/m³. Based on this information, a background PM_{2.5} concentration of 8 µg/m³ has been used in the assessment.

10.5.1.4 Dust Deposition

Dust is present naturally in the air from a number of sources including weathering of minerals, pick-up across open land and dust generated from fires. Monitoring of dust deposition is not undertaken in the area and therefore background levels for the immediate vicinity of the proposed wind farm site are not available.

However, a study by the UK Office of Deputy Prime Minister (UK ODPM, 2002) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 mg/m²/day is typical, rising to 59 mg/m²/day on the outskirts of towns, and peaking at 127 mg/m²/day for a purely industrial area. A level of 39 mg/m²/day can be estimated as the background dust deposition level for the region of the proposed project due to its rural location.

10.5.2 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2024) prior to assessing the impact of dust from a proposed project, the sensitivity of the area must first be assessed as outlined below. Both receptor sensitivity and proximity to proposed construction works areas are taken into consideration. The types of construction works areas required are detailed further in Section 10.6.2.1.1.

For the purposes of this assessment, in line with the IAQM guidance, high sensitivity receptors are regarded as residential properties (where people are likely to spend the majority of their time), schools or hospitals. 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.

Table 10.7 outlines the criteria for determining the sensitivity of the area to dust soiling and dust-related human health effects as per the IAQM guidelines.



Table 10.7: Criteria for Determining the Sensitivity of the Area to Construction Dust

Sensitivity of the Area to Dust Soiling Effects on People and Property						
Receptor Sensitivity	Number of Receptors	Distance from Source (m)				
		<20	<50	<100	<250	
High	>100	High	High	Medium	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	

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	<250
High	< 24 µg/m ³	>100	Medium	Low	Low	Low
		10 - 100	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low
Medium	< 24 µg/m ³	>10	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low
Low	< 24 µg/m ³	>1	Low	Low	Low	Low

Sensitivity of the Area to Ecological Impacts		
Receptor Sensitivity	Distance from Source (m)	
	20	50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

In terms of receptor sensitivity to dust soiling, the area directly surrounding the proposed project (within 250 m of the boundary of all works as part of the proposed project) is predominantly rural in nature. The following range of receptors within 250 m of the proposed project construction works has been identified (see Figure 10.2):

- There are between 1 and 10 highly sensitive residential properties within 20 m of the proposed wind farm site boundary;
- There are between 10 and 100 highly sensitive residential properties within 20 m of the proposed grid connection route (GCR); and



- There are between 1 and 10 highly sensitive residential properties within 50 m of the area of proposed turbine delivery route (TDR) which requires permanent works (i.e. adjustment to road alignment).

Based on these receptor numbers and using the IAQM criteria in Table 10.7, the worst-case sensitivity of the area to dust soiling impacts from the proposed project is high.

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 PM₁₀ concentration, receptor sensitivity based on type (residential receptors are classified as high sensitivity) and the number of receptors affected within various distance bands from the construction works. A conservative estimate of the current annual mean PM₁₀ concentration in the vicinity of the proposed project is 11 µg/m³. The following range of receptors within 250 m of the proposed project construction works has been identified works (see Figure 10.2):

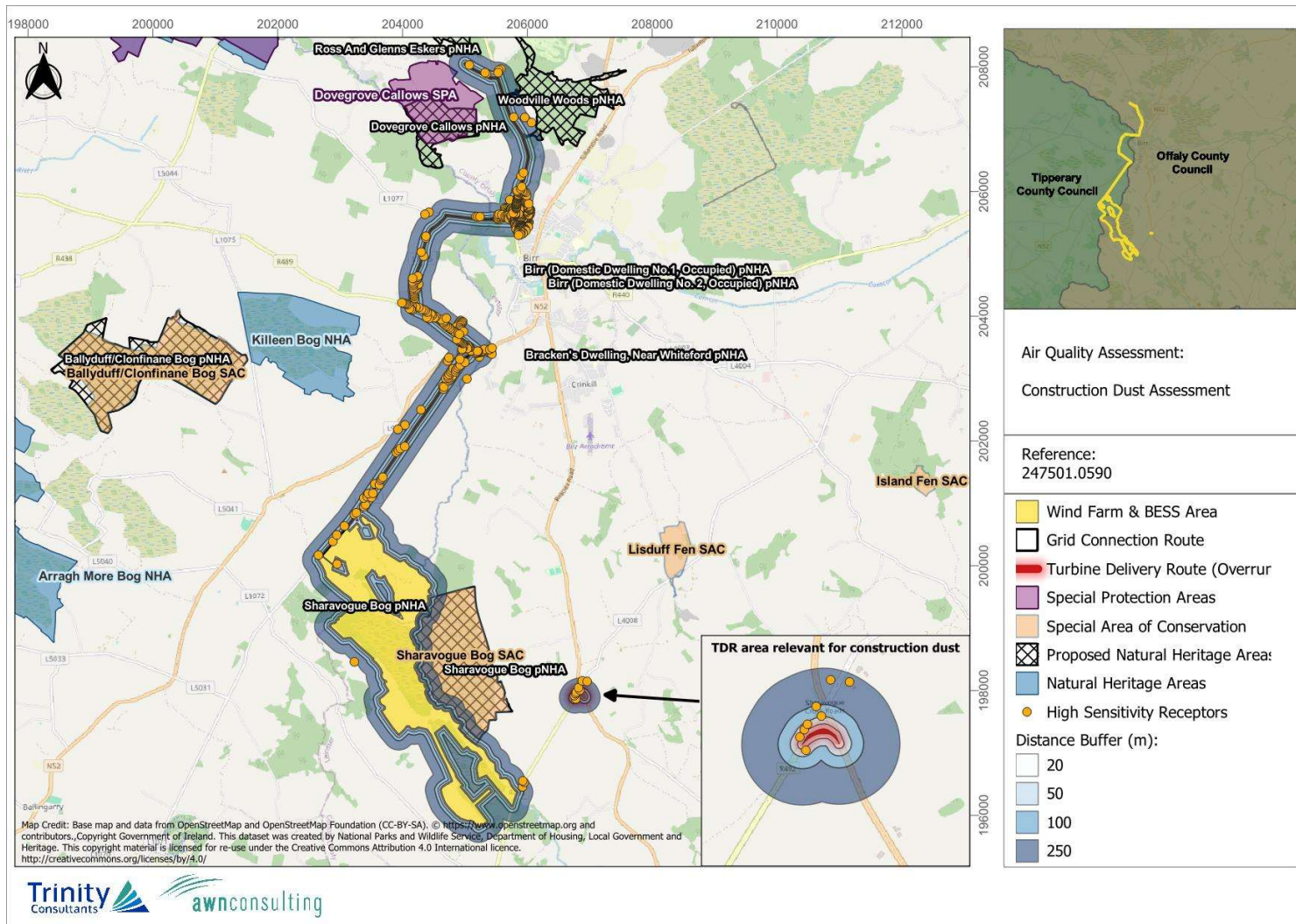
- There are between 1 and 10 highly sensitive residential properties within 20 m of the proposed wind farm site boundary;
- There are between 10 and 100 highly sensitive residential properties within 20 m of the proposed GCR; and
- There are between 1 and 10 highly sensitive residential properties area of proposed TDR which requires permanent works (i.e. adjustment to road alignment).

Based on the IAQM criteria outlined in Table 10.7 the worst-case sensitivity of the area to dust-related human health effects is low.

The IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to dust-related ecological impacts. Dust emissions can coat vegetation leading to a reduction in the photosynthesising ability of the plant, as well as other effects. The guidance states that dust impacts to vegetation can occur up to 50 m from the site, and 50 m from the proposed wind farm site access roads, up to 250 m from the proposed wind farm site entrance. The sensitivity of the area is determined based on the distance to the source, the designation of the site, (European, National or local) and the potential dust sensitivity of the ecologically important species present. The Sharavogue Bog SAC is within 20 m of the wind farm site boundary and the Woodville Woods pNHA is within 20 m of the proposed GCR, therefore the sensitivity of the area to ecological impacts from construction dust is considered high.



Figure 10.2: Construction Dust Assessment - Sensitive Receptors within 250m of Wind Farm Site Boundary, Proposed GCR and TDR (Permanent Works Area)



10.6 ASSESSMENT OF EFFECTS

10.6.1 Do Nothing Scenario / Future Baseline

Under the Do-Nothing Scenario no construction works will take place and the impacts of construction dust and particulate matter emissions, and emissions from equipment and machinery will not occur. The ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from new developments in the surrounding area, changes in road traffic, etc.).

In the Do-Nothing scenario the clean renewable power associated with windfarms, which replaces power generated from fossil fuels, would be delayed or prevented (i.e. renewable energy production capacity reduced).

Therefore, this scenario can be considered *direct, negative, long-term* and *slight* in terms of effect on air quality.

10.6.2 Construction Phase

10.6.2.1 Construction Dust Assessment

The greatest potential impact on air quality during the construction phase of the proposed project is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 250 m of a construction site, the majority of the deposition occurs within the first 50 m (IAQM, 2024). The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. A review of Oak Park meteorological data indicates that the prevailing wind direction is westerly to south-westerly and wind speeds are generally moderate in nature (see Section 10.5.1). In addition, dust generation is considered negligible on days where rainfall is greater than 0.2 mm. A review of historical 30-year average data for Casement Aerodrome meteorological station (the nearest station with 30-year data) indicates that on average 194 days per year have rainfall over 0.2 mm (Met Eireann, 2025) and therefore it can be assumed on average that 53% of the time dust generation will be reduced due to natural meteorological conditions.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 10.5.2). These steps are described in the following sections.



10.6.2.1.1 Determining the Potential Dust Emission Magnitude

The magnitude of the works under each category can be classified as either small, medium or large depending on the scale of the works involved. The potential for dust generating activities is considered for the wind farm and BESS site, the proposed GCR, the proposed TDR which requires permanent works (i.e. adjustment to road alignment) and all associated enabling construction works. Small areas of temporary works will be required along the proposed TDR to accommodate the turbine blades, however these will have a negligible dust generating potential and have therefore been scoped out from further assessment.

The magnitude of each activity has been determined and summarised below for the proposed project using the criteria in Table 10.1.

- **Demolition:** There is no demolition required as part of the proposed project.
- **Earthworks:** The dust emission magnitude for the proposed earthwork activities can be classified as **large** as the total site area is greater than 110,000 m².
- **Construction:** The dust emission magnitude for the proposed construction activities can be classified as **large** as a worst-case as the total volume of structures with dust generating potential during their construction will be greater than 75,000 m³.
- **Trackout:** The dust emission magnitude for the proposed trackout can be classified as **medium**, as there will be between 20 – 50 outward HGV movements per day (see Chapter 14 Transport and Transportation of this EIAR) during the construction phase of the proposed project.

10.6.2.1.2 Determining the Risk of Dust Impacts

Once the dust emission magnitude has been determined the next step, according to the IAQM guidance (2024), is to establish the level of risk by combining the magnitude with the overall sensitivity of the area to dust soiling, dust-related human health and ecological effects (see Section 10.5.2). The level of risk associated with each activity is determined using the criteria in Table 10.2. The overall risk of dust impacts from the construction works is shown in Table 10.8 for each category.

There is at most a high risk of dust soiling impacts, a low risk of dust-related human health impacts and a high risk of ecological impacts associated with the proposed works. As a result, best practice dust mitigation measures associated with high-risk works will be implemented to ensure there are no significant impacts at nearby sensitive receptors. In the absence of mitigation, dust impacts are predicted to be direct, short-term, negative and slight.



Table 10.8: Risk of Construction Dust Impacts Used to Define Site-Specific Mitigation

Receptor	Receptor Sensitivity	Dust Emission Magnitude	Risk of Dust-Related Impacts
Demolition			
Dust Soiling	n/a	n/a	n/a
Human Health	n/a		n/a
Ecology	n/a		n/a
Earthworks			
Dust Soiling	High	Large	High Risk
Human Health	Low		Low Risk
Ecology	High		High Risk
Construction			
Dust Soiling	High	Large	High Risk
Human Health	Low		Low Risk
Ecology	High		High Risk
Trackout			
Dust Soiling	High	Medium	Medium risk
Human Health	Low		Low risk
Ecology	High		Medium risk

10.6.3 Operational Phase

10.6.3.1 Operational Phase Indirect Air Quality Impacts from Renewable Electricity Production

The generation of electricity due to the installation of the wind farm will lead to indirect net savings in terms of NO_x emissions. The wind farm is estimated to have an export capacity of between approximately 61.6 to 77 MW and an assumed capacity factor of 33%, therefore the power generation from the project is expected to be approximately a minimum of 178 GWh per annum.

The minimum supply of 178 GWh of renewable electricity to the national grid will lead to a net saving in terms of NO_x emissions which may have been emitted from fossil fuels to produce electricity. Results, outlined in Table 10.9, indicate that the impact of the wind farm on Ireland's obligations under the National Emissions Reduction Directive are positive.



The annual impact of the project is annual NO_x emission savings of 0.2% of the 2030 ceiling of 40.6kt and savings of 0.9% relative to the NO_x emissions associated with power generation in Ireland in 2021 (EPA, 2023)). This is considered an *indirect, long-term, slight, positive* effect on air quality.



Table 10.9: Predicted Impact of proposed project on Ireland’s National Emissions Ceiling Obligations

NO _x Emissions Saved Due to Wind farm (tonnes/annum)	Comparison Scenario	NO _x (tonnes/annum)	Annual NO _x Saving (%)
74	National Emission Ceiling 2020 – 2029 ^{Note 1}	40,600	0.2%
	NO _x Emissions from Power Generation in 2021 ^{Note 2}	8,543	0.9%

Note 1 National Emission Ceiling (EU Directive 2016/2284)

Note 2 For NO_x emissions associated with power generation in Ireland (taken from EPA (2023) Ireland's Air Pollutant Emissions 1990 – 2030)

10.6.4 Decommissioning Phase

Dust impacts during the decommissioning phase are expected to be of similar type and similar or lesser in magnitude to those anticipated during the construction phase, but generally of a shorter duration. The same mitigation measures implemented during the construction phase will be applied during the decommissioning works and are also considered appropriate for the decommissioning demolition works. It can therefore be determined that the decommissioning phase will have a *short-term, direct, localised, negative* and *not significant* effect on air quality.

10.7 MITIGATION MEASURES

10.7.1 Embedded Mitigation

No measures embedded into the design of the proposed project required consideration for the assessment of air quality impacts. Additional mitigation measures to be employed during the construction phase are required and are discussed further in the following section.

10.7.2 Construction Phase

The proposed project has been assessed as having a medium risk of dust soiling impacts, a low risk of dust related human health impacts and a high risk of ecological impacts during the construction phase as a result of construction and trackout activities (see Section 10.6.2.1). Therefore, the following dust mitigation measures shall be implemented during the construction phase of the proposed project. These measures are appropriate for sites with a high risk of dust impacts and aim to ensure that no significant negative effects occur at nearby sensitive receptors. The mitigation measures draw on best practice guidance from Ireland (DCC (2018), DL RCC (2022)), the UK (IAQM (2024), BRE (2003), The Scottish Office (1996), UK ODPM (2002)) and the USA (USEPA, 1997).

These measures are incorporated into the overall CEMP, see Appendix 2-3, prepared for the proposed project. The measures are divided into different categories for different activities.

The developer in association with the contractor will be required to implement the dust control plan as part of the CEMP. In the event the Planning Authority decides to grant permission for the proposed project, the final CEMP will address the requirements of any relevant planning



conditions, including any additional mitigation measures which are conditioned by the Planning Authority.

Table 10.10: Standard Construction Dust Management and Mitigation Measures

Mitigation Type	Location	Description of Mitigation or Monitoring Measures
Communications	Construction Compound/Site Boundary and throughout (as required)	<p>An Environmental Manager (EM) will be assigned by the appointed contractor. The EM will be responsible for coordinating the day-to-day management of environmental impacts during the Construction Phase. The EM will be responsible for performing inspections as deemed necessary and manage responses to environmental incidents. The name and contact details of the EM who will be responsible for construction dust management and air quality issues will be displayed at the construction compound/site boundary hoarding, as well as head/regional office contact details.</p> <p>A complaints register will be kept by the appointed contractor detailing all telephone calls and letters of complaint received in connection with dust nuisance or air quality concerns, together with details of any remedial actions carried out.</p>
Construction Works Area Management	Construction Compound/Site Boundary and throughout (as required)	<p>Construction compounds will be laid out so that machinery and dust causing activities such as stockpiles are located away from receptors, as far as is practicable.</p> <p>The appointed contractor will provide a site hoarding of 2.4m height at a minimum at construction compounds, which will assist in minimising the potential for dust impacts off-site. Construction works area fencing, barriers and scaffolding will be kept clean using wet methods.</p> <p>Receptors which have the potential to receive dusting and soiling temporary works at TDR nodes located adjacent to dwellings; and dwellings directly adjacent to the GCR construction that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling occur.</p> <p>Stockpiles will be covered to prevent wind whipping.</p> <p>Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.</p> <p>Any chutes and conveyors will be enclosed and skips will be covered.</p> <p>Drop heights from any conveyors, loading shovels, hoppers and other loading or handling equipment will be minimised. Fine water sprays will be used on such equipment where visible dust plumes are generated.</p> <p>Cutting, grinding or sawing equipment will be fitted with or used in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.</p>



Mitigation Type	Location	Description of Mitigation or Monitoring Measures
		<p>Equipment will be readily available in the construction works areas site to clean any dry spillages. Spillages will be cleaned up as soon as reasonably practicable after the event using wet cleaning methods.</p> <p>A water bowser will be used to spray work areas (wind turbine area and proposed GCR) and haul roads, especially during periods of excavations works coinciding with dry periods of weather.</p> <p>An adequate water supply for effective dust or particulate matter suppression and mitigation will be ensured, and non-potable water will be used where possible and appropriate.</p> <p>Construction works area runoff of water or mud will be managed as per the Surface Water Management Plan (Appendix 9-4 of this EIAR).</p>
Operating Vehicles / Machinery	Construction Compound/Site Boundary and throughout (as required)	<p>Engines of all vehicles will be switched off engines when stationary - idling vehicles are not permitted.</p> <p>The use of diesel- or petrol-powered generators will be avoided and mains electricity or battery powered equipment will be used where practicable.</p> <p>A Traffic Management Plan (TMP – Appendix 2-2) has been developed as part of the CEMP (Appendix 2-3) to minimise use of the Local Road Network. The CEMP will be adhered to be the appointed contractor.</p>
Earthworks Activities	Areas where earthworks are required	<p>Materials with the potential to produce dust, such as excavated material, will be removed from the construction works area as soon as possible, unless being re-used within the construction works area. Management of extracted material is detailed in the Construction and Demolition Resource and Waste Management Plan (CEMP, Appendix 2-3).</p> <p>Areas exposed by earthworks will be re-vegetated to stabilise surfaces as soon as practicable. Hessian, mulches or trackifiers will be used where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. Cover will only be removed in small areas during work and not all at once.</p> <p>During dry and windy periods and when there is a likelihood of dust nuisance (defined under “Monitoring” measures below), water-based dust suppression (e.g. bowser) will operate to ensure soil moisture content is high enough to increase the stability of the soil and thus suppress dust.</p>
Construction Activities	Areas where construction is required	<p>Sand and other aggregates will be stored in bunded areas and will not be allowed to dry out, unless this is required for a particular process.</p> <p>Smaller supplies of fine power materials bags will be sealed after use and stored appropriately to prevent dust escaping.</p>



Mitigation Type	Location	Description of Mitigation or Monitoring Measures
Measures specific to trackout (transport of dust and dirt from the construction works areas onto the public road network)	Construction Compound/Site Boundary and throughout (as required)	<p>A speed restriction of 15 kph will be applied as an effective control measure for dust for on-site vehicles.</p> <p>Vehicles transporting loose materials (e.g. spoil or sand) entering and leaving the proposed project works areas and construction compounds will be covered with tarpaulin to prevent escape of materials during transport. Before entrance onto public roads, trucks will be checked to ensure the tarpaulins are properly in place.</p> <p>Where construction work area or construction compound conditions result in large amounts of mud building up on truck wheels, wheel washing will be carried out for trucks before they use the public road network.</p> <p>Water-assisted dust sweeper(s) will be used at the access points to a construction compound and the immediate adjoining local road, to remove, as necessary, any material tracked out of the compound.</p> <p>Any on-site haul routes will be inspected for integrity and necessary repairs to the surface will be carried out as soon as reasonably practicable.</p>
Monitoring	Construction Compound/Site Boundary and throughout (as required)	<p>To determine if any short-term dust impacts will occur, a minimum of daily visual inspections for dust soiling of receptors (including roads, and surfaces such as street furniture, cars and windowsills) adjoining the construction works areas will be undertaken. Inspection results will be recorded in the site inspection log. Cleaning will be provided, if necessary, such as in the event of a dust complaint resulting from the proposed project construction works.</p> <p>The potential for dust generation increases when rainfall is less than 0.2 mm/day and at wind speeds of greater than 10 m/s. To determine if these conditions are likely to affect the site, the weather forecast will be consulted daily, specifically the hourly forecasts for wind speeds as well as 12-hour rainfall radar showing anticipated amounts of precipitation in mm.</p> <p>The frequency of site inspections by the EM responsible for dust management will be increased to a minimum of twice daily during the above conditions. The effectiveness of dust control methods will be monitored via visual inspections and work that would generate dust (e.g. moving materials from stockpiles or transferring loose dry materials from trucks) will be limited in so far as is practicable during these weather conditions.</p>

10.7.3 Operational Phase

During the operational phase of the proposed project, the works onsite will be limited to maintenance associated with the wind farm components. Although the intensity of activity will be only a small fraction of the construction phase, all employees and contractors that are on site



will ensure that machinery used is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from maintenance traffic.

10.7.4 Decommissioning Phase

As the dust emissions during the decommissioning phase are expected to be of a similar or lesser magnitude to those identified during the construction phase, the mitigation measures applicable to construction phase dust emissions are also considered suitable for those during the decommissioning phase.

The proposed access tracks across the wind farm site are proposed to be left in situ following decommissioning and no mitigation measures are proposed. In terms of the proposed GCR and substation, these will be left in situ and so no mitigation measures are proposed.

10.8 RESIDUAL EFFECTS

The following table summarises the identified likely effects during the construction phase of the proposed project following the application of mitigation measures, which are not considered to be significant.

Table 10.11: Summary of Air Quality Effects Post Mitigation

Likely Significant Effect in accordance with EPA Terminology	Quality	Significance	Extent	Probability	Duration	Type
Impact of construction dust from construction and trackout in terms of dust soiling, and human health	Negative	Not significant	Study area as per Section 10.5.2	Likely	Short-term	Direct
Impact of operational phase emissions from facility on air quality	Positive	Slight - Not significant	National	Likely	Long-term	Indirect

10.8.1 Construction Phase

When the dust mitigation measures detailed in the mitigation section of this report are implemented, the residual effect of fugitive emissions of dust and particulate matter from the site will be *short-term, direct, localised, negative* and *not significant* in nature and will pose no nuisance at nearby human receptors and sensitive designated habitats.

Best practice mitigation measures are proposed for the construction phase of the proposed project which will focus on the proactive control of dust and other air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during construction of the proposed project will ensure that the impact of the project complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the residual effect of construction of the proposed project post-mitigation will be *short-term, direct, negative* and *not significant* with respect to human health and ecology.



Accordingly, there will be **no significant negative residual effects** arising from the construction phase.

10.8.2 Operational Phase

There are no predicted direct impacts to air quality during the operational phase of the proposed project. Emissions from infrequent maintenance vehicles were scoped out as they will have an imperceptible effect on air quality.

There will be indirect positive impacts to air quality from the generation of renewable electricity from the proposed project. There will be NO_x emission savings which may otherwise have been generated from fossil fuels. The generation of a minimum of 242 GWh of renewable electricity will result in a decrease in annual NO_x emission levels by 0.2% of the 2030 National Air Emissions Target of 40.6kt. This is an *indirect, long-term, slight, positive* effect on air quality. Accordingly, there will be **no significant negative residual effects** arising from the operational phase.

10.8.3 Decommissioning Phase

Dust impacts during the decommissioning phase are expected to be of similar type and similar or lesser in magnitude to those anticipated during the construction phase, but generally of a shorter duration. The same mitigation measures implemented during the construction phase will be applied during the decommissioning works and are also considered appropriate for the decommissioning demolition works. It can therefore be determined that the residual effect of the decommissioning phase on air quality post-mitigation will be *short-term, direct, localised, negative* and *not significant*. Accordingly, there will be **no significant negative residual effects** arising from the decommissioning phase.

10.9 CUMULATIVE EFFECTS

The geographic extent of the cumulative assessment is considered on a case-by-case basis, in line with the Guidance on the preparation of the Environmental Impact Assessment Report (European Union, 2017). As per the IAQM guidance (IAQM, 2024) cumulative construction dust impacts may occur if large-scale developments within 500 m of the site are under construction simultaneously.

A review of the planned and permitted projects within 500m of the site (see Table 10-12 below) was undertaken to identify developments with the potential for cumulative construction phase impacts. Similarly, cumulative dust impacts may occur where developments within 500 m of the proposed wind farm site are under construction or decommissioning (i.e. dust generating phases) simultaneously with the decommissioning phases of the proposed project. The following developments were identified of sufficient scale to potentially generate cumulative dust impacts with the proposed project.



Table 10.12: Summary of Planned and Permitted Developments with Potential for Cumulative Effects

Planning Reference No.	Description
18230	Installation of approximately 12.5km of 38kv electricity transmission line from the permitted (wind farm) substation (Offaly County Council planning register reference 14/188 & ABP reference PI19.244053)
18235	Residential development consisting of 16 no. houses
19282	Residential development consisting of 18 no. houses as follows: (a) this application is for phase 2 of previously approved development Pl. Ref. No. 18/235
22274	Erection of a fully serviced residential housing development of 40 units
2360140	Ten-year planning permission for the provision of underground electrical cabling (38kV) from the townland of Townparks to the existing Dallow 110kV substation in the townland of Clondallow
2560367	100MW Battery Energy Storage Station with 53 battery containers and associated equipment
201388	Construction of 6 no. new dwelling houses
20612	Construction of 6 no. two-storey semi-detached dwelling houses
20614	Construction of 4 no. two storey semi-detached dwelling houses

The dust mitigation measures outlined in Section 10.7.2 will be applied during the construction and decommissioning phases which will avoid significant cumulative impacts on air quality. Similar dust mitigation measures are required for other permitted developments as per their respective impact assessments and planning conditions.

With appropriate mitigation measures in place, the likely cumulative impacts on air quality associated with the construction and decommissioning phases of the proposed project is **short-term, direct, negative** and **not significant**.

The operational phases of the planned and permitted committed developments could result in slight increases in road traffic emissions. However, given the emissions of oxides of nitrogen (NO_x), sulphur dioxide (SO₂) or dust emissions during the operational phase of the proposed project will be minimal, relating to the use of operation and maintenance vehicles onsite, there will be no significant negative cumulative effect with other developments on air quality.

No significant negative cumulative effects on air quality are predicted for the operational phase.

10.10 CONCLUSION

This chapter of the EIAR has assessed the potential environmental impacts on air quality, focusing on the potential construction and decommissioning dust emissions and impacts to nearby sensitive receptors such as ecology, residential properties, schools, hospitals, etc.



In summary, it is concluded that there will be no direct, indirect or cumulative significant negative residual effects, on air quality as a result of the construction, operational and decommissioning phases of the proposed project.



10.11 REFERENCES

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