CHAPTER 9

AIR QUALITY AND CLIMATE

9.0 AIR QUALITY AND CLIMATE

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts associated with the proposed development at Fosterstown North, Swords, Co. Dublin. The proposed development, for which a seven year permission is sought, comprises a Strategic Housing Development of 645 residential units, a community facility, a childcare facility, 5 commercial units, car and cycle parking, landscaping, public and communal open space, road upgrades and vehicular access and associated internal roads, pedestrian and cycle paths and all associated site and infrastructural works. A full description of the development can be found in Chapter 2.

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9.2 STUDY METHODOLOGY

This chapter has been prepared having regard to the following guidelines:

- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports – Draft (EPA, 2017)
- Advice Note on Preparing Environmental Impact Statements – Draft (EPA, 2015)
- Advice Notes On Current Practice (In The Preparation Of Environmental Impact Statements) (EPA, 2003)
- Guidelines On Information To Be Contained in Environmental Impact Statements (EPA, 2002)
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, 2013)
- Guidance on the Assessment of Dust from Demolition and Construction Version 1.1 (Institute of Air Quality Management (IAQM), 2014)
- UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality (UK Highways Agency, 2019a)
- UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate (UK Highways Agency, 2019b)

9.2.1 Criteria for Rating of Impacts

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 (see Table 9.1 and Appendix 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which

incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants. The limit values for NO_2, PM_{10} and $PM_{2.5}$, are relevant to this assessment as these are traffic related pollutants (see Table 9.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 9.1).

Pollutant	Regulation Note 1	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
		Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 9.1: Air Quality Standards Regulations

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards 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. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to 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/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Heritage & Local Government (DEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

Climate Agreements

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to*

climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013 (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for, *inter alia*, a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019a). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021a). The plan contains similar elements as the 2019 CAP and aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050. The 2021 CAP outlines that emissions from the Built Environment sector must be reduced to 4 – 5 $MtCO_2e$ by 2030 in order to meet our climate targets. This will require further measures in addition to those committed to in the 2019 CAP. This will include phasing out the use of fossil fuels for the space and water heating of buildings, improving the fabric and energy of our buildings, and promoting the use of lower carbon alternatives in construction.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland 2019b) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021) (hereafter referred to as the 2021 Climate Act) in July 2021 (Government of Ireland, 2021b). The 2021 Climate Act was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act is to provide for the approval of plans '*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'*. The 2021 Climate Act will also '*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*'. The 2021 Climate Act defines the carbon budget as '*the total amount of greenhouse gas emissions that are permitted during the budget period*'. The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a '*local authority climate action plan'* lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

The Fingal County Council Climate Change Action Plan 2019 – 2024 published in 2019 (Fingal County Council and Codema, 2019) outlines a number of goals and plans to prepare for and adapt to climate change. There are five key action areas within the plan: Energy and Buildings, Transport, Flood Resilience, Nature-based Solutions and Resource Management. Some of the measures promoted within the Action Plan under the 5 key areas involve building retrofits, energy master-planning, better integration of transport and land use planning, increasing public bike facilities, developing public transport routes, development of flood resilient designs,

promotion of the use of green infrastructure and waste prevention initiatives. The implementation of these measures will enable the Fingal County Council area to adapt to climate change and will assist in bringing Ireland closer to achieving its climate related targets in future years. New developments need to be cognisant of the Action Plan and incorporate climate friendly designs and measures where possible.

9.2.2 Assessment of Construction Phase

Air Quality

The assessment focuses on identifying the existing baseline levels of PM_{10} and $PM_{2.5}$ in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the impact of the construction phase of the development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the proposed development.

Construction phase traffic also has the potential to impact air quality and climate. The UK DMRB guidance (UK Highways Agency, 2019), states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment. The use of the UK guidance is recommended by the TII (2011) in the absence of specific Irish guidance, this approach is considered best practice and can be applied to any development that causes a change in traffic.

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) AADT changes by 200 or more;
- A change in speed band;
- A change in carriageway alignment by 5m or greater.

The construction stage traffic will not increase by 1,000 AADT or 200 HDV AADT and therefore does not meet the above scoping criteria. 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.

Climate

The impact of the construction phase of the development on climate was determined by a qualitative assessment of the nature and scale of greenhouse gas generating construction activities associated with the proposed development.

9.2.3 Assessment of Operational Phase

Air Quality

The air quality assessment has been carried out following procedures described in the publications by the EPA (2015; 2017) and using the methodology outlined in the guidance documents published by the UK Highways Agency (2019a) and UK Department of Environment Food and Rural Affairs (DEFRA) (2016; 2018). Transport Infrastructure Ireland (TII) reference the use of the UK Highways Agency and DEFRA guidance and methodology in their document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011). This approach is considered best practice in the absence of Irish guidance and can be applied to any development that causes a change in traffic.

In 2019 the UK Highways Agency DMRB air quality guidance was revised with *LA 105 Air Quality* replacing a number of key pieces of guidance (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). This revised document outlines a number of changes for air quality assessments in relation to road schemes, but can be applied to any development that causes a change in traffic. Previously the DMRB air quality spreadsheet was used for the majority of assessments in Ireland with detailed modelling only required if this screening tool indicated compliance issues with the EU air quality standards. Guidance from Transport Infrastructure Ireland

(TII, 2011) recommends the use of the UK Highways Agency DMRB spreadsheet tool for assessing the air quality impacts from road schemes. However, the DMRB spreadsheet tool was last revised in 2007 and accounts for modelled years up to 2025. Vehicle emission standards up to Euro V are included but since 2017, Euro 6d standards are applicable for the new fleet. In addition, the model does not account for electric or hybrid vehicle use. Therefore, this a somewhat outdated assessment tool. The LA 105 guidance document states that the DMRB spreadsheet tool may still be used for simple air quality assessments where there is unlikely to be a breach of the air quality standards. Due to its use of a "dirtier" fleet, vehicle emissions would be considered to be higher than more modern models and therefore any results will be conservative in nature and will provide a worst-case assessment.

The 2019 UK Highways Agency DMRB air quality revised guidance *LA 105 Air Quality* states that modelling should be conducted for NO_2 for the base, opening and design years for both the do minimum (do nothing) and do something scenarios. Modelling of PM_{10} is only required for the base year to demonstrate that the air quality limit values in relation to PM_{10} are not breached. Where the air quality modelling indicates exceedances of the PM_{10} air quality limits in the base year then PM_{10} should be included in the air quality model in the do minimum and do something scenarios. Modelling of $PM_{2.5}$ is not required as there are currently no issues with compliance with regard to this pollutant. The modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value as if compliance with the PM_{10} limit is achieved then compliance with the $PM_{2.5}$ limit will also be achieved. Historically modelling of carbon monoxide (CO) and benzene was required however, this is no longer needed as concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (EPA, 2021a). The key pollutant reviewed in this assessment is NO_2. Concentrations of PM_{10} have been modelled for the base year to indicate that there are no potential compliance issues. Modelling of operational NO_2 concentrations has been conducted for the do nothing and do something scenarios for the opening year (2024) and design year (2039).

The TII guidance (2011) states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- Sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK DMRB scoping criteria outlined in Section 9.2.2 has been used in the current assessment to determine the road links required for inclusion in the modelling assessment. Sensitive receptors within 200m of impacted road links are included within the modelling assessment. Pollutant concentrations are calculated at these sensitive receptor locations to determine the impact of the proposed development in terms of air quality. The guidance states a proportionate number of representative receptors which are located in areas which will experience the highest concentrations or greatest improvements as a result of the proposed development are to be included in the modelling (UK Highways Agency, 2019a). The TII guidance (2011) defines sensitive receptor locations as: residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. A total of seven high sensitivity residential receptors (R1 – R7) were included in the modelling assessment and are detailed in Figure 9.1.

The following model inputs are required to complete the assessment using the DMRB spreadsheet tool: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles (%HGV), annual average traffic speeds and background concentrations. Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The DMRB model uses conservative emission factors, the formulae for which are outlined in the DMRB Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the proposed development with these ambient air quality standards.

The TII document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) details a methodology for determining air quality impact significance criteria for road schemes which can be applied to any project that causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. The TII significance criteria are outlined in Appendix 10 of the TII guidance and have been adopted for the proposed development. The significance criteria are based on NO_2 and PM_{10} as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3).

Conversion of NO_x to NO_2

NO_X (NO + NO_2) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGV's the proportion of NO_X emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NOx to NO_2 in "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" (2011). The TII guidelines recommend the use of DEFRAs NOx to NO_2 calculator (2020) which was originally published in 2009 and is currently on version 8.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NOx emitted as NO for each local authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and the TII guidance recommends the use of 'Armagh, Banbridge and Craigavon' as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO_2 and NO_x for Ireland. The "All Non-Urban UK Traffic" traffic mix option was used.

Update to NO_2 Projections using DMRB

In 2011 the UK DEFRA published research (Highways England, 2013) on the long term trends in NO_2 and NO_X for roadside monitoring sites in the UK. This study marked a decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO_2 concentrations which UK DEFRA previously published and monitored concentrations. The impact of this 'gap' is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency published an Interim advice note (IAN 170/12) in order to correct the DMRB results for future years. This methodology has been used in the current assessment to predict future concentrations of NO_2 as a result of the proposed development.

Traffic Data Used in Modelling Assessment

Traffic flow information was obtained for the purposes of this assessment. Data for the Do Nothing and Do Something scenarios for the base year 2020, opening year 2024 and design year 2039 were provided. The traffic data includes the Do Maximum scenario (see Traffic Impact Assessment for further details) which includes the traffic associated with the proposed development, the permitted development to the north of the site and the redistribution of traffic as a result of the construction of the Fosterstown Link Road. This scenario is considered the worst-case scenario in terms of traffic emissions and allows for the most conservative assessment. The traffic data is detailed in Table 9.2. Only road links that met the DMRB scoping criteria outlined in Section 9.2.2 and that were within 200m of receptors were included in the modelling assessment. Background concentrations have been included as per Section 9.3.3 of this chapter based on available EPA background monitoring data (EPA, 2021a).

This traffic data has also been used in the operational stage climate impact assessment.

Road Name	Speed (kph)	% HGV	Base	Do Nothing	Do Maximum	Do Nothing	Do Maximum
			2020	2024		2039	
R836	60	3%	11,353	12,114	17,722	14,038	19,680
R132	80	6%	17,857	19,070	18,339	22,259	20,700
L2300	50	3%	11,732	12,520	9,866	14,522	11,125
R132	80	6%	17,558	18,750	17,921	21,889	20,242
Forest Road	50	3%	4,079	4,353	5,093	5,047	5,676
L2300	50	3%	10,434	11,135	9,650	12,918	10,856
Hawthorn Park	30	0%	434	463	528	534	590
Forest Road	50	3%	3,786	4,040	5,341	4,685	5,976
Forest Road	50	3%	3,786	4,040	6,195	4,685	6,915
Fosterstown Link Road	50	0%	0	0	5,042	0	5,580
Forest Road	50	4%	6,381	6,811	5,665	7,922	6,391
Forest Road	50	3%	3,790	4,044	5,291	4,689	5,919

Table 9.2: Traffic Data Used in Air & Climate Modelling Assessments

Figure 9.1: **Approximate Location of Receptors used in Local Air Quality Modelling Assessment**

Climate

Ireland has annual GHG targets which are set at an EU level and need to be complied with in order to reduce the impact of climate change. Impacts to climate as a result of GHG emissions are assessed against the targets set out by the EU under *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013,* which has set a target of a 30% reduction in non-ETS sector emissions by 2030 relative to 2005 levels.

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established by reference to EPA data on annual GHG emissions (see Section 9.3.3). Thereafter the impact of the proposed development on climate is determined. Emissions from road traffic associated with the proposed development have the potential to emit carbon dioxide (CO_2) which will impact climate.

The UK Highways Agency has published an updated DMRB guidance document in relation to climate impact assessments *LA 114 Climate* (UK Highways Agency, 2019b). The following scoping criteria are used to determine whether a detailed climate assessment is required for a proposed project during the operational stage. During the operational phase, if any of the road links impacted by the proposed development meet the below criteria then further assessment is required.

- A change of more than 10% in AADT;
- A change of more than 10% to the number of heavy duty vehicles; and
- A change in daily average speed of more than 20 km/hr.

There are a number of road links that will experience an increase of 10% or more in the AADT. These road links have been included in the detailed climate assessment (see Table 9.2).The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland (2011) and the methodology provided in Annex D in the UK Design Manual for Roads and Bridges (UK Highways Agency, 2007). The assessment focused on determining the resulting change in emissions of carbon dioxide (CO_2). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes and can be applied to any project that causes a change in traffic. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds (see Table 9.2).

The EU guidance (2013) also states indirect GHG emissions as a result of a development must be considered, this includes emissions associated with energy usage. In addition to the EU guidance, the Institute of Environmental Management and Assessment (IEMA) guidance note on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022) states that "*the crux of significance regarding impact on climate is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050".* Mitigation has taken a leading role within the guidance compared to the previous edition published in 2017. Early stakeholder engagement is key and therefore mitigation should be considered from the outset of the project and continue throughout the project's lifetime in order to maximise GHG emissions savings.

The Energy Statement prepared by Waterman Moylan Consulting Engineers in relation to this assessment has been reviewed and used to inform the operational phase climate assessment. This report outlines a number of measures in relation to energy usage from the proposed development primarily in relation to heat and electricity. A number of measures have been incorporated into the overall design of the development to reduce the impact to climate where possible, in line with the objectives of the IEMA guidance (2022).

9.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

9.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport meteorological station, which is located approximately 1.5 km south of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.2). For data collated during five representative years (2017 – 2021), the predominant wind direction is westerly to south-westerly with a mean wind speed of 5.3 m/s over the 30-year period 1990 - 2010 (Met Eireann, 2022).

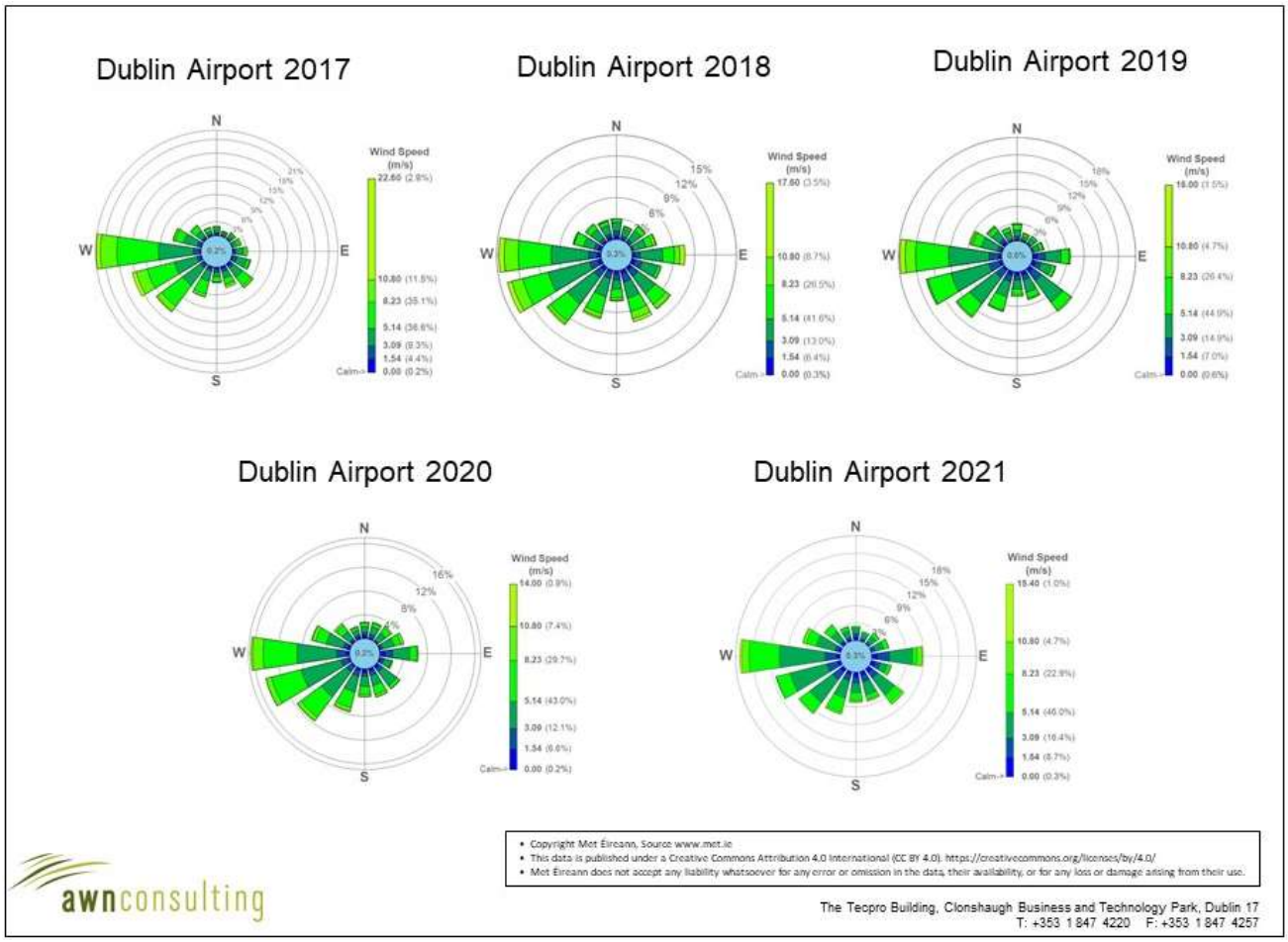

Figure 9.2: **Dublin Airport Windrose 2017 – 2021**

9.3.2 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2020*" (EPA, 2021a). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2022).

As part of the implementation of the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), as amended, four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2021b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed 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 and assessment, the proposed development site is within Zone A (EPA, 2022). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

In 2020 the EPA reported (EPA, 2021a) that Ireland was compliant with EU legal air quality limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA *Air Quality in Ireland 2021* report details the effect that the Covid-19 restrictions had on air monitoring stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have significantly increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason, they have not been included in the baseline section and previous long-term data has been used to determine baseline levels of pollutants in the vicinity of the proposed development.

Long-term NO_2 monitoring was carried out at the Zone A urban background locations of Rathmines, Dún Laoghaire, Swords and Ballyfermot for the period 2015 - 2019 (EPA, 2021a). Long term average concentrations are significantly below the annual average limit of 40 µg/m^3, average results range from 13 – 22 µg/m^3 for the suburban background locations. The NO_2 annual average for this five year period suggests an upper average limit of no more than 19 µg/m^3 (Table 9.3) for the urban background locations. The monitoring site in Swords is approximately 1 km north of the proposed development. Concentrations of NO_2 at the Swords site ranged from 13 – 16 µg/m^3 over the period 2015 – 2019. Based on the above information, a conservative estimate of the current background NO_2 concentration for the region of the proposed development is 17 µg/m^3.

Station	Averaging Period Note 1	Year				
		2015	2016	2017	2018	2019
Rathmines	Annual Mean NO_2 (µg/m^3)	18	20	17	20	22
	Max 1-hr NO_2 (µg/m^3)	106	102	116	138	183
Dun Laoghaire	Annual Mean NO_2 (µg/m^3)	16	19	17	19	15
	Max 1-hr NO_2 (µg/m^3)	103	142	153	135	104
Swords	Annual Mean NO_2 (µg/m^3)	13	16	14	16	15
	Max 1-hr NO_2 (µg/m^3)	170	206	107	112	108
Ballyfermot	Annual Mean NO_2 (µg/m^3)	16	17	17	17	20
	Max 1-hr NO_2 (µg/m^3)	142	127	148	217	124

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
1-hour limit value - 200 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.3: Trends In Zone A Air Quality - Nitrogen Dioxide (NO_2)

Continuous PM_{10} monitoring was carried out at five Zone A locations from 2015 - 2019, Ballyfermot, Rathmines, Dún Laoghaire, Tallaght and Phoenix Park. These showed an upper average limit of no more than 16 µg/m^3 (Table 9.4). Levels range from 9 - 16 µg/m^3 over the five year period with at most 9 exceedances (in Rathmines) of the 24-hour limit value of 50 µg/m^3 in 2019 (35 exceedances are permitted per year) (EPA, 2021a). Based on the EPA data, a conservative estimate of the current background PM_{10} concentration in the region of the proposed development is 16 µg/m^3.

Station	Averaging Period Note 1	Year				
		2015	2016	2017	2018	2019
Ballyfermot	Annual Mean PM_{10} (µg/m^3)	12	11	12	16	14
	24-hr Mean > 50 µg/m^3 (days)	3	0	1	0	7
Dún Laoghaire	Annual Mean PM_{10} (µg/m^3)	13	13	12	13	12
	24-hr Mean > 50 µg/m^3 (days)	3	0	2	0	2
Tallaght	Annual Mean PM_{10} (µg/m^3)	14	14	12	15	12
	24-hr Mean > 50 µg/m^3 (days)	4	0	2	1	3
Rathmines	Annual Mean PM_{10} (µg/m^3)	15	15	13	15	15
	24-hr Mean > 50 µg/m^3 (days)	5	3	5	2	9
Phoenix Park	Annual Mean PM_{10} (µg/m^3)	12	11	9	11	11
	24-hr Mean > 50 µg/m^3 (days)	2	0	1	0	2

Note1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Daily limit value - 50 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.4: Trends In Zone A Air Quality - PM_{10}

Average $PM_{2.5}$ levels in Rathmines over the period 2015 - 2019 ranged from 8 - 10 µg/m^3, with a $PM_{2.5}/PM_{10}$ ratio ranging from 0.53 – 0.68 (EPA, 2021a). Based on this information, a conservative ratio of 0.7 was used to generate an existing $PM_{2.5}$ concentration in the region of the development of 11.2 µg/m^3.

Background concentrations for the Opening Year 2024 and Design Year of 2039 have been calculated for the local air quality assessment. These have used current estimated background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

9.3.3 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details provisional emissions up to 2020 (EPA, 2021b). The data published in 2021 states that Ireland will exceed its 2020 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by an estimated 6.73 Mt. For 2021, total national greenhouse gas emissions are estimated to be 57.70 million tonnes carbon dioxide equivalent (Mt CO_2eq) with 44.38 MtCO_2eq of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2021 at 37.1% of the total, with the transport sector accounting for 17.9% of emissions of CO_2.

GHG emissions for 2020 are estimated to be 3.6% lower than those recorded in 2019. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for five years in a row. Emissions from 2016 – 2020 exceeded the annual EU targets by 0.29 MtCO_2eq, 2.94 MtCO_2eq, 5.57 MtCO_2eq,6.85 MtCO_2eq and 6.73 MtCO_2eq respectively. Agriculture is consistently the

largest contributor to emissions with emissions from the transport and energy sectors being the second and third largest contributors respectively in recent years.

The EPA 2020 GHG Emissions Projections Report for 2020 – 2040 (EPA, 2021c) notes that there is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018 and the Climate Action Plan published in 2019. Implementation of these are classed as a "*With Additional Measures scenario*" for future scenarios. A change from generating electricity using coal and peat to wind power and diesel vehicle engines to electric vehicle engines are envisaged under this scenario. While emissions are projected to decrease in these areas, emissions from agriculture are projected to grow steadily due to an increase in animal numbers. However, over the period 2013 to 2020 Ireland is projected to cumulatively exceed its compliance obligations with the EU's Effort Sharing Decision (Decision No. 406/2009/EC) 2020 targets by approximately 12.2MtCO_2eq under the "With Existing Measures" scenario and under the "With Additional Measures" scenario. The projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 – 2030 assuming full implementation of the Climate Action Plan and the use of the flexibilities available (EPA, 2021c).

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development comprises a Strategic Housing Development of 645 residential units, a community facility, a childcare facility, 5 commercial units car and cycle parking, landscaping, public and communal open space, road upgrades and vehicular access and associated internal roads, pedestrian and cycle paths and all associated site and infrastructural works. The site is located at Fosterstown North, Swords, Co. Dublin. A full description of the development can be found in Chapter 2.

Impacts to air quality and climate can occur during both the construction and operational stages of the development. During the construction stage the main source of air quality impacts will be as a result of fugitive dust emissions from site activities. Emissions from construction vehicles and machinery have the potential to impact climate. The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows or congestion in the local areas which are associated with the development. The following describes the primary sources of potential air quality and climate impacts which have been assessed as part of this EIAR.

9.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

9.5.1 Construction Stage

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust. While construction dust tends to be deposited within 350 m of a construction site, the majority of the deposition occurs within the first 50 m. 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 Dublin Airport meteorological data (see Section 9.3.1) indicates that the prevailing wind direction is westerly to south-westerly and wind speeds are generally moderate in nature. 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 Dublin Airport indicates that on average 191 days per year have rainfall over 0.2 mm (Met Eireann, 2022) and therefore it can be determined that over 50% of the time dust generation will be reduced.

The proposed development can be considered moderate in scale and therefore there is the potential for significant dust soiling 50 m from the source (TII, 2011) (Table 9.5). There are a number of high sensitivity residential receptors in housing estates bordering the site to the west and south, some of which are within 50m.

In the absence of mitigation there is the potential for significant, negative, short-term impacts to nearby sensitive receptors as a result of dust emissions from the proposed development.

Source		**Potential Distance for Significant Effects (Distance from source)**		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large construction sites with high use of haul routes	100m	25m	25m
Moderate	Moderate sized construction sites with moderate use of haul routes	50m	15m	15m
Minor	Minor construction sites with limited use of haul routes	25m	10m	10m

Source: Appendix 8: Assessment of Construction Impacts taken from "*Guidelines for the treatment of Air Quality During the Planning & Construction of National Road Schemes*" (TII, 2011)

Table 9.5: Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

There is also the potential for traffic emissions to impact air quality in the short-term over the construction phase. Particularly due to the increase in HGVs accessing the site. The construction stage traffic has been reviewed and a detailed air quality assessment has been scoped out as none of the road links impacted by the proposed development satisfy the DMRB assessment criteria in Section 9.2.2. It can therefore be determined that the construction stage traffic will have an imperceptible, neutral and short-term impact on air quality.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. The Institute of Air Quality Management document *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) states that site traffic and plant is unlikely to make a significant impact on climate. Therefore, the potential impact on climate is considered to be imperceptible, neutral and short-term.

Human Health

Dust emissions from the construction phase of the proposed development have the potential to impact human health through the release of PM_{10} and $PM_{2.5}$ emissions. As per Table 9.5 PM_{10} emissions can occur within 15 m of the site for a development of this scale. There are a number of high sensitivity receptors bordering the site to the west and south, a small number of which are within 15m of the site boundary. Therefore, in the absence of mitigation there is the potential for slight, negative, short-term impacts to human health as a result of the proposed development.

9.5.2 Operational Phase

Air Quality

The potential impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. The traffic data includes the Do Maximum scenario (see Traffic Impact Assessment for further details) which includes the traffic associated with the proposed development, the permitted development to the north of the site and the redistribution of traffic as a result of the construction of the Fosterstown Link Road. This scenario is considered the worst-case scenario in terms of traffic emissions and allows for the most conservative assessment. The impact of NO_2 emissions for the opening and design years was predicted at the nearest sensitive receptors to the development. This assessment allows the significance of the development, with respect to both relative and absolute impacts, to be determined.

Transport Infrastructure Ireland's document *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (2011) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any development that causes a change in traffic. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Results are compared against the 'Do-Nothing' scenario, which assumes that the proposed development is not in place in future years, in order to determine the degree of impact.

The results of the assessment of the impact of the proposed development on NO_2 in the opening year 2024 are shown in Table 9.6 and for design year 2039 are shown in Table 9.7. The annual average concentration is in compliance with the limit value at all worst-case receptors in 2024 and 2039. Concentrations of NO_2 are at most 59% of the annual limit value in 2024 and at most 57% in 2039. There are some increases in traffic volumes between 2024 and 2039 therefore any reduction in concentrations is due to decreased background values. In addition, the hourly limit value for NO_2 is 200 µg/m^3 and is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The maximum 1-hour NO_2 concentration is not predicted to be exceeded in any modelled year (Table 9.8).

The impact of the proposed development on annual mean NO_2 concentrations can be assessed relative to "Do Nothing (DN)" levels. Relative to baseline levels, there are predicted to be some imperceptible to small decreases in NO_2 concentrations at receptors R2, R3, R4 and R7. There are some imperceptible to small increases in NO_2 concentrations at receptors R1, R5 and R6. Concentrations will decrease by at most 0.99 µg/m^3 in 2024 and by 0.78 µg/m^3 in 2039 at receptor R1. Concentrations at worst-case receptor R6 will increase by at most 0.97 µg/m^3 in 2024 and 1.31 µg/m^3 in 2039. The addition of the Fosterstown Link Road redistributes traffic on the surrounding road network leading to increases in traffic on certain roads and decreases in traffic volumes on other roads.

Using the assessment criteria outlined in Appendix 10 of the TII guidance (TII, 2011) the impact of the proposed development in terms of NO_2 is considered negligible. Therefore, the overall impact of NO_2 concentrations as a result of the proposed development is long-term, positive and imperceptible at the majority of receptors assessed.

Concentrations of PM_{10} were modelled for the baseline year of 2020. The modelling showed that concentrations were in compliance with the annual limit value of 40 µg/m^3 at all receptors assessed, therefore, further modelling for the opening and design years was not required. Concentrations reached at most 0.93 µg/m^3. When a background concentration of 16 µg/m^3 is included the overall impact is 42% of the annual limit value at the worst case receptor.

The impact of the proposed development on ambient air quality in the operational stage is considered long-term, localised, neutral and imperceptible and therefore, no mitigation is required.

Receptor	Opening Year 2024				
	DN	DS	DS-DN	Magnitude	Description
R1	21.0	22.0	0.99	Small Increase	Negligible
R2	23.6	23.5	-0.10	Imperceptible Decrease	Negligible
R3	21.3	20.6	-0.72	Small Decrease	Negligible
R4	20.3	20.0	-0.29	Imperceptible Decrease	Negligible
R5	19.2	19.8	0.55	Small Increase	Negligible
R6	18.4	19.4	0.97	Small Increase	Negligible
R7	19.9	19.9	0.05	Imperceptible Increase	Negligible

Table 9.6: Predicted Annual Mean NO_2 Concentrations – Opening Year 2024 (µg/m^3)

Receptor	Design Year 2039				
	DN	DS	DS-DN	Magnitude	Description
R1	20.7	21.5	0.78	Small Increase	Negligible
R2	22.9	22.7	-0.21	Imperceptible Decrease	Negligible
R3	21.0	19.9	-1.07	Small Decrease	Negligible
R4	19.8	19.3	-0.49	Small Decrease	Negligible
R5	18.6	19.3	0.67	Small Increase	Negligible
R6	17.6	18.9	1.31	Small Increase	Negligible
R7	19.3	19.3	-0.01	Imperceptible Decrease	Negligible

Table 9.7: Predicted Annual Mean NO_2 Concentrations – Design Year 2039 (µg/m^3)

Receptor	Opening Year 2024		Design Year 2039	
	DN	DS	DN	DS
R1	74	77	72	75
R2	82	82	80	80
R3	75	72	74	70
R4	71	70	69	68
R5	67	69	65	67
R6	64	68	61	66
R7	70	70	68	68

Table 9.8: Predicted 99.8th percentile of Daily Maximum 1-hour NO_2 Concentrations (µg/m^3)

Climate

Climate change has the potential to alter weather patterns and increase the frequency of rainfall in future years. As a result of this there is the potential for flooding related impacts on site in future years. However, adequate attenuation and drainage have been provided for to account for increased rainfall in future years as part of the design of this development. Therefore, the impact will be long-term, localised, neutral and imperceptible.

There is also the potential for increased traffic volumes to impact climate. The predicted concentrations of CO_2 for the future years of 2024 and 2039 are detailed in Table 9.9. These are significantly less than the 2024 and 2030 targets set out under EU legislation (targets beyond 2030 are not available). It is predicted that in 2024 the proposed development will increase CO_2 emissions by 0.00030% of the EU 2024 target. Similarly low increases in CO_2 emissions are predicted to occur in 2039 with emissions increasing by 0.00034% of the EU 2030 target. Therefore, the potential climate impact of the proposed development is considered negative, long-term and imperceptible.

The proposed development has been designed to reduce the impact to climate where possible. A number of measures have been incorporated into the design to ensure the operational phase emissions are minimised. These are outlined fully within the Energy Statement prepared by Waterman Moylan Consulting Engineers and are summarised below.

The development will be a Nearly Zero Energy Building (NZEB) in accordance with the Part L2021 requirements. Each building will have a Building Energy Rating (BER) that will comply with the Part L requirements. The following measures, or similar will be incorporated into the proposed development to achieve a more energy efficient (i.e. less carbon intensive) design. All measures will be reviewed at the detailed design stage and the most appropriate options will be implemented.

- High performance U-values;
- Improved air tightness;
- Improved thermal transmittance and thermal bridging;
- Use of renewable technologies to ensure energy consumption is in line with the Part L 2021 requirements

It is proposed to incorporate bicycle parking spaces within the proposed development to promote the use of sustainable transport. In addition, it is proposed to include electric vehicle (EV) charging spaces and infrastructure for additional charging spaces. Overall these measures will aid in reducing the impact to climate during the operational phase of the proposed development.

Year	Scenario	CO2 (tonnes/annum)
2024	Do Nothing	498
	Do Something	620
2039	Do Nothing	578
	Do Something	692
Increment in 2024		121.6 Tonnes
Increment in 2039		114 Tonnes
Emission Ceiling (kilo Tonnes) 2024		**40,113** Note 1
Emission Ceiling (kilo Tonnes) 2030		**33,381** Note 1
Impact in 2024 (%)		0.0003 %
Impact in 2039 (%)		0.00034 %

Note 1 Target under *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013*

Table 9.9: Climate Impact Assessment

Human Health

Traffic related air emissions have the potential to impact air quality which can affect human health. However, air dispersion modelling of traffic emissions has shown that levels of all pollutants are below the ambient air quality standards set for the protection of human health. It can be determined that the impact to human health during the operational stage is long-term, neutral and imperceptible and therefore, no mitigation is required.

9.6 'DO NOTHING' IMPACT

Under the Do Nothing Scenario no construction works will take place and the previously identified impacts of fugitive dust and particulate matter emissions and emissions from equipment and machinery will not occur. Impacts from increased traffic volumes and associated air emissions will also 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.). Therefore, this scenario can be considered neutral in terms of both air quality and climate.

9.7 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

There is the potential for a number of impacts to air quality and climate during the construction and operational phases of the proposed development. Construction dust emissions are considered the primary source of air quality impacts associated with the proposed development. To avoid any potential significant impacts the following mitigation measures have been proposed.

9.7.1 Construction Phase

AIR QUALITY CONST 1: Fugitive Dust Prevention

The proactive control of fugitive dust will ensure the prevention of significant emissions. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 9.2. These measures have been incorporated into the overall Construction Environmental Management Plan (CEMP) prepared in respect of the proposed development.

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

CLIMATE CONST 1: Climate Mitigation

Impacts to climate during the construction stage are predicted to be imperceptible however, good practice measures can be incorporated to ensure potential impacts are lessened. These include:

- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods.
- Ensure all plant and machinery are well maintained and inspected regularly.
- Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

9.7.2 Operational Stage

The impact of the operational traffic associated with proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no site specific mitigation measures are required other than those set out in Section 9.5.2 in relation to operational phase energy usage.

9.8 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

9.8.1 Construction Stage

Air Quality

Once the dust minimisation measures outlined in Section 9.7 and Appendix 9.2 are implemented, the impact of the proposed development in terms of dust soiling will be short-term, negative, localised and imperceptible at nearby receptors.

Climate

According to the IAQM guidance (2014) site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore the predicted impact is short-term, neutral and imperceptible.

Human Health

Best practice mitigation measures are proposed for the construction phase of the proposed development which will focus on the pro-active 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 development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values which are based on the protection of human health. Therefore, the impact of construction of the proposed development is likely to be negative, short-term and imperceptible with respect to human health.

9.8.2 Operational Stage

Air Quality

Air dispersion modelling of operational traffic emissions associated with the proposed development was carried out using the UK DMRB model. The modelling assessment determined that the change in emissions of NO_2 at nearby sensitive receptors as a result of the proposed development will be imperceptible. Therefore, the operational phase impact to air quality is long-term, localised, neutral and imperceptible.

Climate

Modelling of operational phase CO_2 emissions as a result of the traffic associated with the proposed development was carried out to determine the impact to climate. It was found that emissions of CO_2 will increase by an imperceptible amount as a result of the proposed development and are significantly below the EU 2024 and 2030 GHG targets. The operational phase impact to climate is long-term, negative and imperceptible. In addition, the proposed development has been designed to reduce the impact to climate where possible during operation.

Human Health

As the air dispersion modelling has shown that emissions of air pollutants are significantly below the ambient air quality standards which are based on the protection of human health, impacts to human health are long-term, neutral and imperceptible.

9.9 CUMULATIVE IMPACTS

According to the IAQM guidance (2014) should the construction phase of the proposed development coincide with the construction of any other permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors. A review of recent planning permissions for the area was conducted and it was found that there were 2 no. relevant sites for which cumulative impacts may occur should their construction phase and that of the proposed development overlap. These include a strategic housing development at Phase 1 lands, Townlands of Fosterstown North and Cremona (planning ref. ABP-308366-20) and a residential development at Fosterstown North, Boroimhe Link Road (planning ref. F18A/0306).

Both permitted developments (ABP-308366-20 and F18A/0306) are of moderate scale. There is the potential for cumulative construction dust impacts should the construction phases overlap with that of the proposed development. However, the dust mitigation measures outlined in Appendix 9.2 will be applied throughout the construction phase of the proposed development which will avoid significant cumulative impacts on air quality. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality associated with the construction phase of the proposed development are deemed short-term, negative and imperceptible.

According to the IAQM guidance (2014) site traffic, plant and machinery are unlikely to have a significant impact on climate. Therefore, cumulative impacts are not predicted.

Cumulative impacts have been incorporated into the traffic data supplied for the operational stage air and climate modelling assessments where such information was available. The results of the modelling assessment (section 9.5.2) show that there is a long-term, neutral and imperceptible impact to air quality and climate during the operational stage.

9.10 MONITORING

9.10.1 Construction Stage

Monitoring of construction dust deposition along the site boundary to nearby sensitive receptors during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

9.10.2 Operational Stage

There is no monitoring recommended for the operational phase of the development as impacts to air quality and climate are predicted to be imperceptible.

9.11 REINSTATEMENT

Not applicable to air quality and climate.

9.12 INTERACTIONS

Air quality does not have a significant number of interactions with other topics. The most significant interactions are between population and human health and air quality. An adverse impact due to air quality in either the demolition, construction or operational phase has the potential to cause health and dust nuisance issues. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is short-term, negative and imperceptible with respect to the construction phase and long-term, neutral and imperceptible with respect to the operational phase.

Interactions between air quality and traffic can be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The impacts of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible.

With the appropriate mitigation measures to prevent fugitive dust emissions, it is predicted that there will be no significant interactions between air quality and land and soils. No other significant interactions with air quality have been identified.

9.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered when compiling this assessment.

9.14 REFERENCES

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APPENDIX 9.1 - AMBIENT AIR QUALITY STANDARDS

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ was to establish a target value of 25 µg/m^3, as an annual average (to be attained everywhere by 2010) and a limit value of 25 µg/m^3, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 µg/m^3 to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 µg/m^3). Where the AEI is currently greater than 22 µg/m^3 all appropriate measures should be employed to reduce this level to 18 µg/m^3 by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 µg/m^3 was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation
- As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. 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 Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

APPENDIX 9.2 – DUST MANAGEMENT PLAN

The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the following management plan has been formulated by drawing on best practice guidance from Ireland, the UK (IAQM (2014), BRE (2003), The Scottish Office (1996), UK ODPM (2002)) and the USA (USEPA, 1997). The following measures have been incorporated into the Construction & Environment Management Plan (OC&DMP) prepared for the site.

Site Management
The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design and effective control strategies.

At the construction planning stage, the siting of activities and storage piles will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance (see Figure 9.2 for the windrose for Dublin Airport). As the prevailing wind is predominantly south-westerly to south-easterly, locating construction compounds and storage piles downwind of sensitive receptors will minimise the potential for dust nuisance to occur at sensitive receptors.

Good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or quickly implementing effective control measures before the potential for nuisance occurs. When rainfall is greater than 0.2mm/day, dust generation is generally suppressed (IAQM, 2014; UK ODPM, 2002). The potential for significant dust generation is also reliant on threshold wind speeds of greater than 10 m/s (19.4 knots) (at 7m above ground) to release loose material from storage piles and other exposed materials (USEPA, 1986). Particular care should be taken during periods of high winds (gales) as these are periods where the potential for significant dust emissions are highest. The prevailing meteorological conditions in the vicinity of the site are favourable in general for the suppression of dust for a significant period of the year. Nevertheless, there will be infrequent periods were care will be needed to ensure that dust nuisance does not occur. The following measures shall be taken in order to avoid dust nuisance occurring under unfavourable meteorological conditions:

- The Principal Contractor or equivalent must monitor the contractors' performance to ensure that the proposed mitigation measures are implemented and that dust impacts and nuisance are minimised;
- During working hours, dust control methods will be monitored as appropriate, depending on the prevailing meteorological conditions;
- The name and contact details of a person to contact regarding air quality and dust issues shall be displayed on the site boundary, this notice board should also include head/regional office contact details;
- It is recommended that community engagement be undertaken before works commence on site explaining the nature and duration of the works to local residents and businesses;
- A complaints register will be kept on site 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;
- It is the responsibility of the contractor at all times to demonstrate full compliance with the dust control conditions herein;
- At all times, the procedures put in place will be strictly monitored and assessed.

The dust minimisation measures shall be reviewed at regular intervals during the works to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed and satisfactory procedures implemented to rectify the problem. Specific dust control measures to be employed are described below.

Site Roads / Haulage Routes

Movement of construction trucks along site roads (particularly unpaved roads) can be a significant source of fugitive dust if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25 to 80% (UK ODPM, 2002).

- A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles using unpaved site roads;
- Access gates to the site shall be located at least 10m from sensitive receptors where possible;
- Bowsers or suitable watering equipment will be available during periods of dry weather throughout the construction period. Research has found that watering can reduce dust emissions by 50% (USEPA, 1997). Watering shall be conducted during sustained dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use;
- Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only.

Land Clearing / Earth Moving

Land clearing / earth-moving works during periods of high winds and dry weather conditions can be a significant source of dust.

- During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

Storage Piles

The location and moisture content of storage piles are important factors which determine their potential for dust emissions.

- Overburden material will be protected from exposure to wind by storing the material in sheltered regions of the site. Where possible storage piles should be located downwind of sensitive receptors;
- Regular watering will take place to ensure the moisture content is high enough to increase the stability of the soil and thus suppress dust. The regular watering of stockpiles has been found to have an 80% control efficiency (UK ODPM, 2002).
- Where feasible, hoarding will be erected around site boundaries to reduce visual impact. This will also have an added benefit of preventing larger particles from impacting on nearby sensitive receptors.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads should be reduced to a minimum by employing the following measures:

- Vehicles delivering or collecting material with potential for dust emissions shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust;
- At the main site traffic exits, a wheel wash facility shall be installed if feasible. All trucks leaving the site must pass through the wheel wash. In addition, public roads outside the site shall be regularly inspected for cleanliness, as a minimum on a daily basis, and cleaned as necessary.

Summary of Dust Mitigation Measures

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory performance of the contractor. The key features with respect to control of dust will be:

- The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- The development of a documented system for managing site practices with regard to dust control;

- The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- The specification of effective measures to deal with any complaints received.