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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE EXPANSION OF A MATERIALS RECOVERY FACILITY AT CAPPOGUE AND DUNSINK, BALLYCOOLIN ROAD, DUBLIN 11.

Volume 2 – Main Body of the EIAR
Chapter 11 – Air Quality & Climate

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11. AIR QUALITY AND CLIMATE

11.1 Introduction

This chapter assesses the impacts to air quality and climate associated with the proposed development. The proposed development is defined in Chapter 1: Introduction and a detailed description of the proposed development is set out in Chapter 4: Description of the Existing and Proposed Development. In summary, the proposed development involves the construction and operation of an expanded waste facility at the development site, with a waste intake capacity of 300,000 tonnes per annum.

The following Appendices documents have been prepared in support of this chapter:

- Appendix 11.1: Description of the AERMOD Model
- Appendix 11.2: Meteorological Data – AERMET
- Appendix 11.3: Dust Minimisation Plan

11.1.1 Statement of Competency

This chapter was completed by Ciara Nolan, a Senior Environmental Consultant in the air quality section of AWN Consulting Ltd. She holds an MSc. (First Class) in Environmental Science from University College Dublin and has also completed a BSc. in Energy Systems Engineering. She is an Associate Member of both the Institute of Air Quality Management (AMIAQM) and the Institution of Environmental Science (AMIEnvSc). She has over 5 years of experience working in environmental consultancy focussing on air quality. She has prepared air quality and climate impact assessments for numerous EIARs for a range of projects including commercial, residential, industrial, pharmaceutical and data centre developments.

11.2 Assessment Methodology

11.2.1 Guidance and Standards

11.2.1.1 Odour

The exposure of the population to a particular odour consists of two factors; the concentration and the length of time that the population may perceive the odour. By definition, 1 OU_E/m^3 is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference.

The EPA (EPA 2019) has issued guidance specific to intensive agriculture which has outlined the following standards:

- Target value for new pig-production units of 1.5 OU_E/m^3 as a 98^{th}%ile of one hour averaging periods,
- Limit value for new pig-production units of 3.0 OU_E/m^3 as a 98^{th}%ile of one hour averaging periods,
- Limit value for existing pig-production units of 6.0 OU_E/m^3 as a 98^{th}%ile of one hour averaging periods.

Guidance from the UK (UK EA 2011), and adapted for Irish EPA use, recommends that odour standards should vary from 1.5 – 6.0 OU_E/m^3 as a 98th%ile of one hour averaging periods at the worst-case sensitive receptor based on the offensiveness of the odour and with adjustments for local factors such as population density. A summary of the indicative criterion is given below in Table 11.1 (taken from EPA Guidance document AG9 (EPA 2019):

Table 11-1: Indicative Odour Standards Based on Offensiveness Of Odour and Adapted for Irish EPA

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion Note 1
• Processes involving decaying animal or fish remains. • Processes involving septic effluent or sludge • Waste sites including landfills, waste transfer stations and non-green waste composting facilities.	Most Offensive	1.5 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
• Intensive Livestock Rearing • Fat Frying / Meat Cooking (Food Processing) • Animal Feed • Sugar Beet Processing • Well aerated green waste composting Most odours from regulated processes fall into this category i.e. any industrial sector which does not obviously fall within the "most offensive" or "less offensive" categories.	Moderately Offensive	3.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor
• Brewery / Grain / Oats Production • Coffee Roasting • Bakery • Confectionery	Less Offensive	6.0 OU_E/m^3 as a 98th%ile of hourly averages at the worst-case sensitive receptor

Note 1 Professional judgement should be applied in the determination of where the worst-case sensitive receptor is located.

Based on the guidance above, a primary odour threshold of 1.5 OU_E/m^3 as a 98th%ile of hourly mean values has been selected for identifying the potential for odour nuisance in relation to the proposed development.

11.2.1.2 Ambient Air Quality Standards

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. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC (see Table 11.2). The ambient air quality standards applicable for PM_{10} and $PM_{2.5}$ are outlined in this Directive.

These standards have been used in the current assessment to determine the potential impact of PM_{10} and $PM_{2.5}$ emissions from the development on air quality.

There are no statutory limits on dust deposition and the focus is on the prevention of nuisance and minimising air borne dust emissions where practicable. Although coarse dust is not regarded as a threat to health, it can create a nuisance by depositing on surfaces. No statutory or official air quality criterion for dust annoyance has been set in Ireland, UK, Europe or at World Health Organisation level.

The most commonly applied guideline is the German TA Luft (German VDI, 2002) guideline of 350 mg/m^2/day measured using Bergerhoff type dust deposit gauges as per the German Standard Method for determination of dust deposition rate (VDI 2119). This limit is commonly applied to ensure that no nuisance effects will result from specified industrial activities. Below these thresholds dust problems are considered less likely. Dust deposition is normally measured by gravimetrically determining the mass of particulates and dust deposited over a specified surface area over a period of one month (30 days, +/- 2 days).

Recommendations outlined by the Department of the Environment, Heritage & Local Government (2004), apply the Bergerhoff limit of 350 mg/(m^2*day) to the land ownership boundary of quarries. This standard can be applied to the development in regard to dust deposition.

Table 11-2: Air Quality Standards 2011 and TA Luft

Pollutant	Regulation Note 1	Limit Type	Value
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
Dust deposition (non-hazardous dust)	TA Luft (German VDI 2002)	Average daily dust deposition at the boundary of the site	350 mg/(m^2*day) Total Dust

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

11.2.1.3 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.

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 has a number of goals for the Waste Sector under the heading of Circular Economy. The primary objective is to reduce waste overall through reuse and recycling. Reducing the amount of municipal waste that is landfilled to 10% by 2035 and reducing food waste by 50% by 2030 and increasing the recyclability of wastes are key targets within the 2021 CAP. The 2021 CAP specifies a decarbonisation target for waste of 0.77 $MtCO_2e$ by 2030.

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.

11.2.2 Air Quality and Odour Assessment Methodology

There are a number of sources which have the potential to cause impacts to air quality during both the construction stage of the development and the operational phase. In relation to the construction phase the primary source of impact is because of construction dust emissions. Exhaust emissions from construction vehicles and machinery on site also have the potential to impact air quality. During the operational phase odour emissions from the processing of waste materials will be the primary source of air quality impacts. Exhaust emissions associated with vehicles accessing the site also have the potential to impact air quality during the operational phase.

11.2.2.1 Construction Phase Dust

The Institute of Air Quality Management (IAQM) guidance document entitled '*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 local air quality, dust being the exception to this. Material handling activities, including excavation and backfill, on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1- 75 µm). Deposition typically occurs near each site and potential impacts generally occur within 350 metres of the dust generating activity as dust particles fall out of suspension in the air (IAQM, 2014). Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

The potential for dust to be emitted will depend on the type of activity being carried out (demolition, earthworks, construction and the trackout of dust to public roads) in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. Dust impacts are assessed at sensitive receptors including human receptors in the case of dust soiling and potential human health impacts but also at sensitive ecological areas where particular plant or animal species may be sensitive to dust deposition. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time or areas where users would expect a high level of amenity. Commercial properties, parks 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.

There are a number of sensitive receptors in the form of residential properties in close proximity to the site along Barn Lodge Grove which may experience dust impacts. In terms of sensitive ecological areas, the Royal Canal proposed Natural Heritage Area (pNHA) is located approximately 1.5km south-west of the proposed development. Due to the distance from the proposed development, there is no potential for dust impacts to ecology and therefore no assessment is required. Section 11.3.1 discusses the surrounding land use and sensitive receptors in further detail. A map of land use in the vicinity of the proposed development is shown in Figure 11.1.

The magnitude of the dust generating construction activities has been reviewed in line with the IAQM (2014) guidance. This magnitude in conjunction with the overall sensitivity of the surrounding area allows the level of site specific mitigation to be determined in order to prevent significant dust impacts.

11.2.2.2 Construction Phase Traffic Assessment

The potential impact due to construction traffic is assessed with respect to the impact of an 'affected' road link on nearby (within 200 m) sensitive receptors (i.e. residential properties, schools, hospitals, sensitive ecology). The UK Highways Agency DMRB guidance (UK Highways Agency, 2019a) 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. Transport Infrastructure Ireland (TII) reference the use of the UK DMRB document in their guidance *Guidelines on the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (TII, 2011). The use of the UK DMRB document is considered best practice in the absence of specific Irish guidance.

- 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 phase traffic has been reviewed against the above criteria and it has been determined that the traffic generated as part of the proposed development will not change by over 1,000 AADT or 200 HDV AADT (see Chapter 13 Traffic and Transport, of Volume 2 of this EIAR). Therefore, none of the road links can be classed as 'affected' and a detailed air dispersion modelling assessment of traffic emissions is not required as there is no potential for significant impacts to air quality from construction stage traffic emissions.

11.2.2.3 Operational Phase Traffic Assessment

The site currently accepts 49,500 tonnes per annum (tpa) of construction and demolition (C&D) waste. As part of the proposed development the throughput of waste will be increased to 300,000 tpa with additional waste streams accepted. The proposed breakdown of wastes is outlined below:

- 100,000 tpa municipal solid waste
- 50,000 tpa food waste
- 100,000 tpa construction and demolition (C&D) waste
- 50,000 tpa mixed dry recyclable (MDR) waste

The access road leading to the site / Premier Business Park from the Ballycoolin Road will experience an increase of 325 HGVs (AADT) associated with these tonnages (see Chapter 13 Traffic and Transport). As per the air quality screening criteria in Section 11.2.2.2 this road link can be classed as 'affected' due to the increase of over 200 HGVs (AADT). Once beyond the access road leading to the site and onto the main Ballycoolin Road, as traffic diverges between a number of links, the traffic numbers on each connected link are less significant and fall below the screening criteria outlined in Section 11.2.2.2. The potential local air quality impact associated with operational phase traffic is therefore localised to the access road leading to the site / Premier Business Park.

A small number (3 no.) of the residential properties along Barn Lodge Grove are within 200m of this road link; the closest property being within 186m of the road. The UK Highways Agency guidance states that receptors that are greater than 200m from an impacted road link will not experience significant effects, therefore the assessment is confined to receptors within 200m.

Dispersion modelling of nitrogen dioxide (NO_2) exhaust emissions was carried out using the UK Highways Agency DMRB spreadsheet tool as per the UK Highways Agency guidance (2019). Only modelling of NO_2 was undertaken in detail as per the UK Highways Agency guidance (2019a). 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 pollutant 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.

Modelling of NO_2 emissions was conducted for the opening year (2025) and the design year (2040) at the closest sensitive receptor to the impacted road link identified above. Modelling of the Do Nothing (without the development) and Do Something (with the development) scenarios was conducted in order to determine the degree of impact. The impact of the proposed development has been assessed against the TII significance criteria which are outlined in Appendix 10 of the TII guidance (2011). The traffic data used in the air quality modelling assessment is detailed in Table 11.3 below.

Table 11-3: Traffic Data used in Modelling Assessment

Road Link	Speed (kph)	Opening Year (2025)				Design Year (2040)			
		Do Nothing		Do Something		Do Nothing		Do Something	
		AADT	%HGV	AADT	%HGV	AADT	%HGV	AADT	%HGV
Premier Business Park	40	624	43%	1,072	60%	624	43%	1,072	60%

11.2.2.4 Operational Phase Odour Assessment

11.2.2.4.1 Characteristics of Odour

Odour Intensity and Threshold

Odour intensity is a measure of the strength of the odour sensation and is related to the odour concentration. The odour threshold refers to the minimum concentration of an odorant that produces an olfactory response or sensation. This threshold is normally determined by an odour panel consisting of a specified number of people, and the numerical result is typically expressed as occurring when 50% of the panel correctly detect the odour. This odour threshold is given a value of one odour unit and is expressed as 1 OU_E/m^3. The odour threshold is not a precisely determined value but depends on the sensitivity of the odour panellists and the method of presenting the odour stimulus to the panellists.

An odour detection threshold relates to the minimum odorant concentration required to perceive the existence of the stimulus, whereas an odour recognition threshold relates to the minimum odorant concentration required to recognise the character of the stimulus. Typically, the recognition threshold exceeds the detection threshold by a factor of 2 to 10 (Water Environment Federation 1995) (AEA Technology 1994).

Odour Character

The character of an odour distinguishes it from another odour of equal intensity. Odours are characterised on the basis of odour descriptor terms (e.g. putrid, fishy, fruity etc.). Odour character is evaluated by comparison with other odours, either directly or through the use of descriptor words.

Hedonic Tone

The hedonic tone of an odour relates to its pleasantness or unpleasantness. When an odour is evaluated in the laboratory for its hedonic tone in the neutral context of an olfactometric presentation, the panellist is exposed to a stimulus of controlled intensity and duration. The degree of pleasantness or unpleasantness is determined by each panellist's experience and emotional associations. The responses among panellists may vary depending on odour character; an odour pleasant to many may be declared highly unpleasant by some.

Adaptation

Adaptation, or Olfactory Fatigue, is a phenomenon that occurs when people with a normal sense of smell experience a decrease in perceived intensity of an odour if the stimulus is received continually. Adaptation to a specific odorant typically does not interfere with the ability of a person to detect other odours. Another phenomenon known as habituation or occupational anosmia occurs when a worker in an industrial situation experiences a long-term exposure and develops a higher threshold tolerance to the odour.

11.2.2.4.2 Odour Dispersion Modelling Methodology

Emissions from the facility have been modelled using the AERMOD dispersion model (Version 21112) which has been developed by the U.S. Environmental Protection Agency (USEPA) (USEPA 2018a) and following guidance issued by the EPA (EPA 2019, 2020). The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources and has replaced ISCST3 (USEPA 1995) as the regulatory model by the USEPA for modelling emissions from industrial sources in both flat and rolling terrain (USEPA 2017). The model has more advanced algorithms and gives better agreement with monitoring data in extensive validation studies (USEPA 1999, Schulman et al. 2000). An overview of the AERMOD dispersion model is outlined in Appendix 11.1. The Aermod meteorological pre-processor AERMET used in this assessment is outlined in Appendix 11.2.

The odour dispersion modelling input data consisted of information on the physical environment (including building dimensions and terrain features), design details from all emission points on-site and five years of appropriate hourly meteorological data. Using this input data the model predicted ambient ground level concentrations beyond the site boundary for each hour of the modelled meteorological years. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration.

The modelling incorporated the following features:

- A receptor grid was created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grids were based on Cartesian grids with the site at the centre. The grid measured 2 km x 2 km with the site at the centre and with concentrations calculated at 50 m intervals. Boundary receptor locations were also placed along the boundary of the site, at 25 m intervals. Nearby residential properties were added to the model as discrete receptors. In total there were 1,797 calculation points for the model. All receptors have been modelled at 1.5 m to represent breathing height.
- All on-site buildings and significant process structures were mapped into the computer to create a three dimensional visualisation of the site and its emission points. Buildings and process structures can influence the passage of airflow over the emission sources and draw plumes down towards the ground (termed building downwash). Building downwash was incorporated into the modelling.
- Detailed terrain has been mapped into the model using SRTM data with 30m resolution. The site is located in gentle terrain. This takes account of all significant features of the terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP (USEPA 2018a).
- Hourly-sequenced meteorological information has been used in the model. Meteorological data over a five-year period (Dublin Airport 2017 – 2021) was used in the model (see Figure 11.2).
- The source and emission data, including stack dimensions, volume flows and emission temperatures have been incorporated into the model.

11.2.2.4.3 Terrain

The AERMOD air dispersion model has a terrain pre-processor AERMAP (USEPA 2018a) which was used to map the physical environment in detail over the receptor grid. The digital terrain input data used in the AERMAP pre-processor was obtained from SRTM. This data was run to obtain for each receptor point the terrain height and the terrain height scale. The terrain height scale is used in AERMOD to calculate the critical dividing streamline height, H_{crit}, for each receptor. The terrain height scale is derived from the Digital Elevation Model (DEM) files in AERMAP by computing the relief height of the DEM point relative to the height of the receptor and determining the slope. If the slope is less than 10%, the program goes to the next DEM point. If the slope is 10% or greater, the controlling hill height is updated if it is higher than the stored hill height.

In areas of complex terrain, AERMOD models the impact of terrain using the concept of the dividing streamline (H_c). As outlined in the AERMOD model formulation (USEPA 2018b) a plume embedded in the flow below H_c tends to remain horizontal; it might go around the hill or impact on it. A plume above H_c will ride over the hill. Associated with this is a tendency for the plume to be depressed toward the terrain surface, for the flow to speed up, and for vertical turbulent intensities to increase.

AERMOD model formulation states that the model "captures the effect of flow above and below the dividing streamline by weighting the plume concentration associated with two possible extreme states of the boundary layer (horizontal plume and terrain-following). The relative weighting of the two states depends on: 1) the degree of atmospheric stability; 2) the wind speed; and 3) the plume height relative to terrain. In stable conditions, the horizontal plume "dominates" and is given greater weight while in neutral and unstable conditions, the plume traveling over the terrain is more heavily weighted" (USEPA 2018a).

11.2.2.4.4 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA (USEPA 2017). A primary requirement is that the data used should have a data capture of greater than 90% for all parameters. Dublin Airport meteorological station, which is located approximately 6 km north-east of the site, collects data in the correct format and has a data collection of greater than 90%. Long-term hourly observations at Dublin Airport meteorological station provide an indication of the prevailing wind conditions for the region (see Figure 11.2). Results indicate that the prevailing wind direction is south-westerly in direction over the period 2017 - 2021 with generally moderate wind speeds (Met Eireann, 2022).

11.2.2.4.5 Odour Emission Rates

This assessment has been undertaken considering emissions associated with the proposed development at its maximum operational capacity.

The proposed, expanded facility will accept and process up to 300,000 tonnes per annum (tpa) of waste material, to include:

- 100,000 tpa of municipal solid waste (rMSW);
- 50,000 tpa food waste;
- 100,000 tpa construction and demolition (C&D) Waste
- 50,000 tpa mixed dry recyclable (MDR) waste.

The existing building on-site (MRF1) will be upgraded and expanded to facilitate the acceptance, processing and storage of rMSW, and the acceptance, bulking and storage of food waste. MRF 1 is the only proposed building which will accept rMSW and food waste on-site. MRF 1 will be a fully enclosed waste processing building operating under negative air extraction. An odour abatement system will serve this building. This abatement system will utilise annular carbon absorbers with the extracted air discharged through a c. 20m stack.

To determine the appropriate odour emission rates for the proposed development, odour monitoring reports for a similar facility owned and operated by the Applicant were reviewed for the purposes of this assessment. The proposed odour abatement system will be designed to meet the same standard of odour abatement of the odour abatement system at this sister facility. Monitoring reports for the period 2018 – 2021 inclusive were provided and the maximum odour emissions rates recorded therein have been used in this assessment to allow for a conservative approach. The model input parameters are detailed in Table 11.4.

The new proposed building MRF2 will be used for the storage and bulking of MDR waste while the new building MRF3 will be used for the storage and processing of C&D waste. All buildings on site will have rolling shutter doors. There will be little to no odour associated with the MDR and C&D wastes and all processing will occur internally, therefore there are unlikely to be significant odour emissions generated in buildings MRF2 and MRF3 and thus, no odour abatement system is proposed for these buildings.

Table 11-4: Odour Modelling Input Details, Thorntons Cappogue

Location (Irish Grid Coordinates)		Stack Height (m)	Stack Diameter (m)	Flow Rate (Nm^3/hr)	Velocity (m/s actual)	Temp (K)	Odour Conc. (Ou_E/m^3)	Odour Emission Rate (Ou_E/s)
E310439	N239606	20	1.3	1497.6	18.9	294.6	650	17,296

11.2.3 Climate Assessment Methodology

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 11.3.4). Thereafter the impact of the proposed development on climate is determined. The primary sources of GHG emissions which have the potential to impact climate are embodied carbon emissions from the construction phase of the development as well as vehicle exhaust emissions of carbon dioxide (CO_2) during both the construction and operational phases.

11.2.3.1 Construction Phase Embodied Carbon Assessment

The impact of the construction phase of the proposed development on climate has been assessed by quantifying the embodied carbon dioxide associated with all materials used in the construction of the development, the traffic and plant emissions during the construction phase and additionally emissions related to waste generated during the construction phase.

Emission factors have been taken from the TII Carbon Tool (TII, 2020) which uses emission factors from recognized sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013) as well as using emission factors outlined in the Inventory of Carbon & Energy (ICE) (University of Bath, 2019). The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction phase. The outputs are expressed in terms of $kgCO_2e$ (kilograms of carbon dioxide equivalent).

Information on the material quantities, site activities, land clearance, waste product and construction traffic were obtained for this assessment. This information was input into the carbon calculator to determine an estimate of the GHG emissions associated with the development. Detailed information regarding the proposed construction materials was not available at the time of this assessment and will be specified at the detailed design stage. Best estimates have been used in this assessment to provide an estimate of the GHGs associated with construction materials.

The impact of construction phase traffic emissions due to the proposed development is assessed as part of the TII Carbon Tool (TII, 2020).

11.2.3.2 Operational Phase Traffic Assessment

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. If any of the road links impacted by the proposed development meet or exceed 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.
- A change in daily average speed of more than 20 km/hr.

The access road leading to the site/Premier Business Park from the Ballycoolin Road will experience an increase of 325 HGVs which is a greater than 10% change. Once beyond the access road leading to the site and onto the main Ballycoolin Road, as traffic diverges between a number of links, the traffic numbers on each connected link are less significant and fall below the screening criteria outlined above. The potential climate impact associated with operational phase traffic is therefore localised to the access road leading to the site / Premier Business Park.

The impact of the proposed development 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 11.3).

11.2.3.3 Operational Phase Power Equipment

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.

CO_2 (which is a Greenhouse Gas) generated due to the electricity power demand of the proposed development can be calculated using the carbon intensity of the fuel mix used in the generation of electricity nationally. Carbon intensity is the amount of CO_2 that will be released per kilowatt hour (kWh) of energy of a given fuel. For most fossil fuels the value of this is almost constant, but in the case of electricity from the National Grid it will depend on the fuel mix used to generate the electricity and also on the efficiency of the technology employed. This figure is updated by Sustainable Energy Authority of Ireland (SEAI) annually. The carbon intensity of the fuel mix used to generate electricity in Ireland has dropped by 64% since 1990 driven by an 84% reduction in the use of coal for electrical generation and a 54% increase in renewables used in electricity generation.

The 2021 SEAI Energy in Ireland Report (SEAI 2022) states that the carbon intensity of electricity was 296 gCO_2/kWh in 2021 which can largely be attributed to the 51% reduction in peat used for electricity generation, and the 15% increase in wind generation (SEAI 2022). The Climate Action Plan has set a national target of 70% of electricity demand by renewables by 2030 for the national grid. This would significantly further reduce the carbon intensity of the operation of the proposed development. Future carbon intensities related to changes in the proportion of renewables are not currently available.

Photovoltaic solar panels will be installed on the roof areas of the main buildings within the proposed development. The installation of photovoltaic solar panels will lead to an estimated output capacity of 696.9 MWh. The GHG emissions due to the operational power requirements and generation of renewable power from the on-site solar panels have been calculated using the 2020 carbon intensities (SEAI 2022).

11.2.4 Scoping and Consultation

An overview of the scoping and consultation process is presented in Chapter 6 Scoping and Consultation.

One air and climate related consultation response was received. A pre-planning consultation meeting took place with An Bord Pleanála on the 11th of February 2022. At this meeting the project was discussed with representatives from the SID section of An Bord Pleanála. The Board's representatives advised the Applicant to assess odour and climate related impacts associated with the proposed development. Both these aspects have been addressed in this chapter.

11.3 Baseline Environment

11.3.1 Sensitive Receptors

The development site encompasses the Applicant's existing waste facility situated at Cappogue Industrial Park, Dublin 11, together with lands to the south of this facility situated in the townlands of Cappogue and Dunsink.

The development site is situated approximately 2 km north-west of Finglas village and 2 km east of Blanchardstown village. The site is located is immediately north the M50, approximately midway between Junctions 5 and 6.

Dunsink Landfill and agricultural lands are situated further south of the site on the opposite side of the M50. Agricultural lands are also situated further west of the site.

There are 4 no. residential dwellings adjacent to the site on Barn Lodge Grove to the western boundary known as Coolbrook Cottages. Further to the south-west of the site on Barn Lodge Grove there is a small group of residential properties, some of which border the site's south-western boundary.

Other residential properties are located approximately 200m north-west of the site along Ballycoolin Road. The Stadium Business Park is located approximately 240m to the north of the site and the Premier Business Park is located 270m to the east of the site. Industrial and commercial premises within the business parks are not considered highly sensitive receptors in relation to air quality. The National Orthopaedic Hospital Cappagh is located c.755m to the east of the site. Figure 11.1 shows the land-use in the vicinity of the site and identifies the nearby residential properties.

The Royal Canal proposed Natural Heritage Area (pNHA) (site code 002103) is located approximately 1.5km south-west of the proposed development.

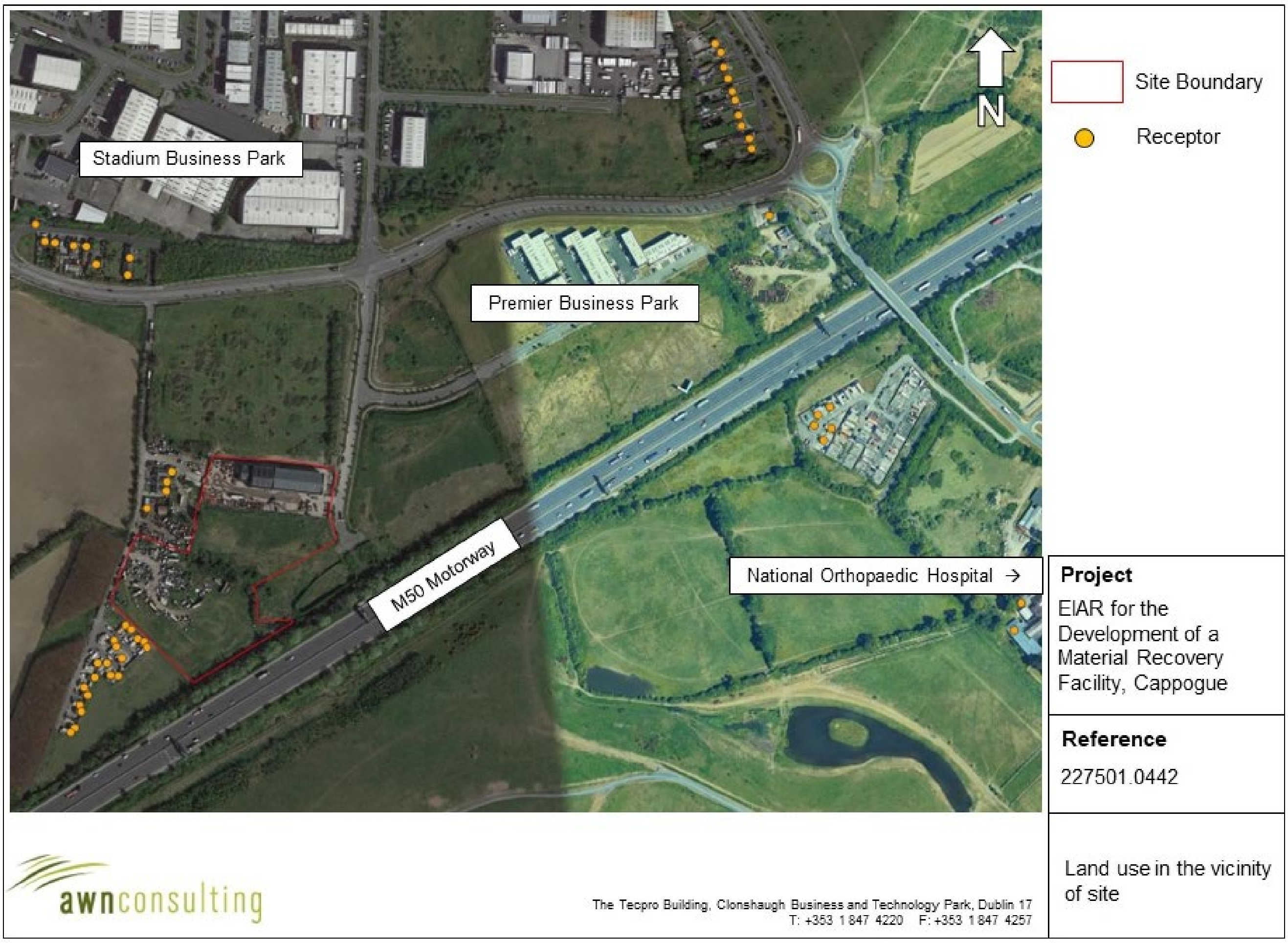

Figure 11-1: Land Use in the Vicinity of Site

11.3.2 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). 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 increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The closest representative Met Éireann synoptic station to the site is at Dublin Airport, which is approximately 6 km north-east of the proposed development. 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. Information collected from Dublin Airport Meteorological Station (Met Eireann, 2022) identified that typically 191 days per annum are "wet". Thus, over 50% of the time no significant dust generation will be likely due to meteorological conditions.

Wind frequency is also 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 prevailing winds in the area are westerly to south-westerly, thereby predominantly dispersing any potential dust emissions to the east and north-east of the site (see Figure 11.2). The mean monthly wind speed was approximately 5.3 m/s over the 30-year period 1981 – 2010 (more recent 30 year averages are not available).

All meteorological data referenced within this report is provided by Met Éireann (source www.met.ie) (Met Eireann, 2022).

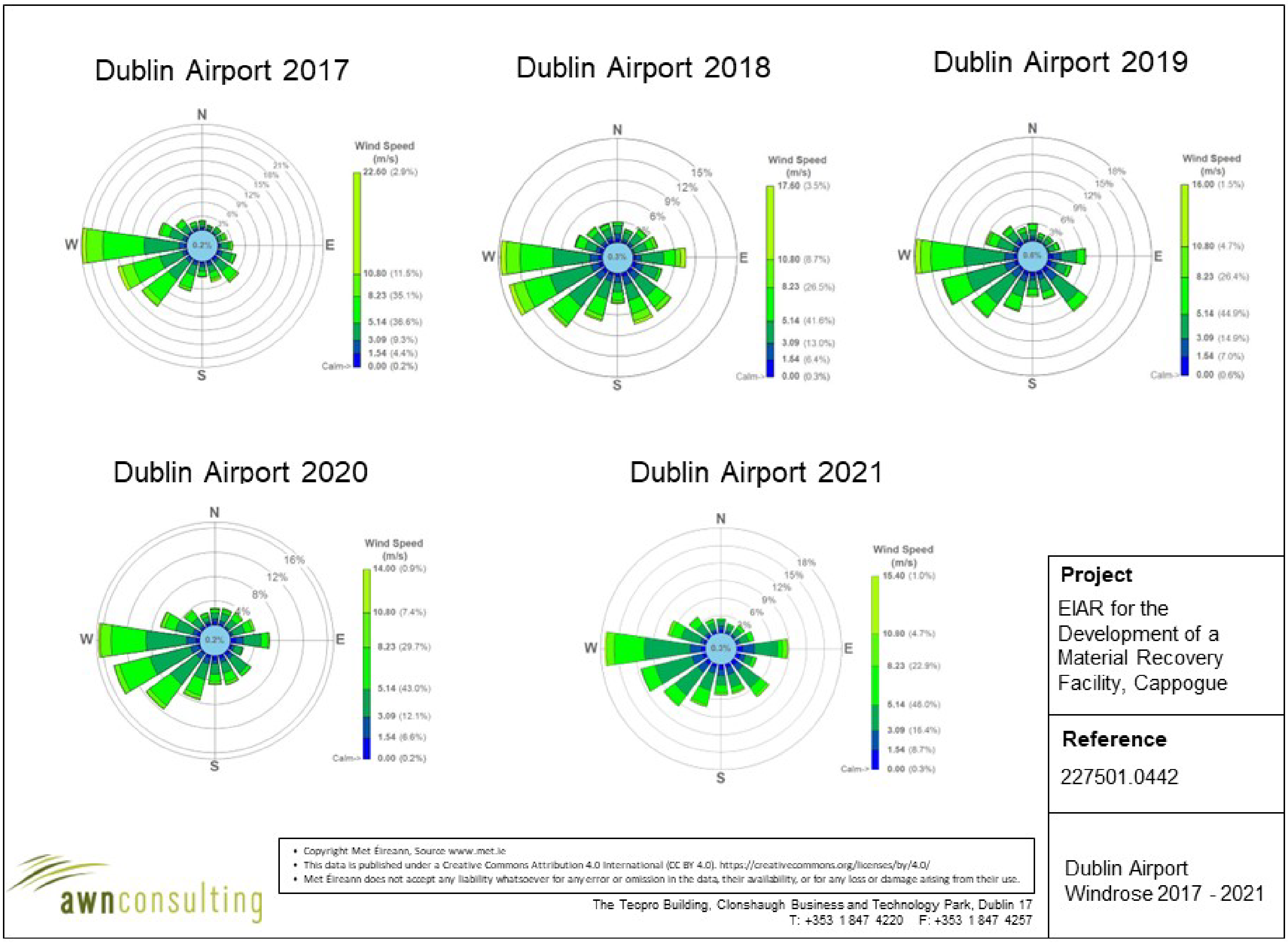

Figure 11-2 : Dublin Airport Windroses 2017 – 2021

11.3.3 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, 2022a).

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, 2022a). 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, 2022a). 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 11.5) for the urban background locations. Based on the above information, a conservative estimate of the current background NO_2 concentration for the region of the proposed development is 20 µg/m^3.

Table 11-5: Trends In Zone A Air Quality - Nitrogen Dioxide (NO_2)

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).

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 11.6). 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.

Table 11-6: Trends In Zone A Air Quality - PM_{10}

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).

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.

Based on the above information the air quality in Zone A locations is generally good, with concentrations of the key pollutants generally well below the relevant limit values. However, the EPA have indicated that road transport emissions are contributing to increased levels of NO_2 with the potential for breaches in the annual NO_2 limit value in future years at locations within urban centres and roadside locations. In addition, burning of solid fuels for home heating is contributing to increased levels of particulate matter (PM_{10} and $PM_{2.5}$). The EPA predict that exceedances in the particulate matter limit values are likely in future years if burning of solid fuels for residential heating continues (EPA, 2021a).

11.3.4 Climate Baseline

Anthropogenic emissions of greenhouse gases (GHGs) in Ireland included in the European Union's Effort Sharing Regulation (ESR) (EU 2018/842) are outlined in the most recent review by the EPA which details provisional emissions up to 2021 (EPA, 2022b). The greenhouse gas emission inventory for 2021 is the first of ten years over which compliance with targets set in the ESR will be assessed. This Regulation sets 2030 targets for emissions outside of the Emissions Trading Scheme (known as ESR emissions) and annual binding national limits for the period 2021-2030. Ireland's target is to reduce ESR emissions by 30% by 2030 compared with 2005 levels, with a number of flexibilities available to assist in achieving this. Ireland's ESR emissions annual limit for 2021 is 43.48 Mt CO_2eq[1].

[1] Mt CO_2eq – million tonnes carbon dioxide equivalent

Ireland's provisional 2021 GHG ESR emissions are 46.19 Mt CO_2eq, this is 2.71 Mt CO_2eq more than the annual limit for 2021 (EPA, 2022). Agriculture continues to be the largest contributor to overall emissions at 37.5% of the total. Transport, energy industries and the residential sector are the next largest contributors, at 17.7%, 16.7% and 11.4%, respectively. GHG emissions for 2021 are estimated to be 4.7% higher than emissions in 2020, this is due to a gradual lifting of covid restrictions and an increase in the use of coal and less renewables within electricity generation. Ireland's GHG emissions have increased by 11.4% from 1990 – 2021.

Provisional National total emissions (including LULUCF) for 2021 are 69.29 Mt CO_2eq, these have used 23.5% of the 295 Mt CO_2eq Carbon Budget for the five-year period 2021-2025. This leaves 76.5% of the budget available for the succeeding four years, requiring an 8.4% average annual emissions reduction from 2022-2025 to stay within budget.

The EPA 2022 GHG Emissions Projections Report for 2021 – 2040 (EPA, 2022) provides an assessment of Ireland's total projected greenhouse gas (GHG) emissions from 2021 to 2040, using the latest Inventory data for 2020 and provides an assessment of Ireland's progress towards achieving its National ambitions under the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021) and EU emission reduction targets for 2030 as set out under the EU Effort Sharing Regulation (ESR) 2018/842. Two scenarios are assessed – a "*With Existing Measures*" (WEM) scenario, which is a projection of future emissions based on the measures currently implemented and actions committed to by Government, and a "*With Additional Measures*" (WAM) scenario, which is the projection of future emissions based on the measures outlined in the latest Government plans at the time projections are compiled. This includes all policies and measures included in the WEM scenario, plus those included in government plans but not yet implemented.

The EPA report states under the "*With Existing Measures"* scenario, the projections indicate that Ireland will cumulatively exceed its ESR emissions allocation by 52.3 Mt CO_2eq over the 2021-2030 period even with full use of the flexibilities available. Under the "*With Additional Measures scenario"*, the projections indicate that Ireland can achieve compliance under the ESR over the 2021-2030 period using both flexibilities but only with full implementation of the 2021 Climate Action Plan. Both projected scenarios indicate that implementation of all climate plans and policies, plus further new measures, are needed for Ireland to meet the 51% emissions reduction target and put the country on track for climate neutrality by 2050 (EPA, 2022).

11.4 Potential Impacts

11.4.1 'Do Nothing' Impacts

Under the 'Do-Nothing' Scenario the site will remain as it currently is and will continue accepting and processing 49,500 tpa of C&D waste.

No construction works on site will take place therefore there is no potential for construction dust emissions. The site currently implements several best practice measures to prevent significant dust emissions from existing facility operations. Waste processing and storage activities that may give rise to dust at the existing facility are carried out within the existing facility building on-site. This limits the potential for dust emissions. Some waste materials such as hard plastics, PVC and tyres are stored in open skips within the yard however there is minimal dust generation associated with these types of wastes. The marshalling yard is regularly hosed down and a road sweeper vehicle is employed as required to ensure the site area is free from a build-up of dust and dirt. In addition, the internal building floor is regularly washed to prevent dust emissions. Due to the nature of C&D waste there is minimal odour associated with this facility and therefore there will be no odour emissions associated with the existing facility in the 'Do Nothing' scenario.

The traffic associated with the existing site in the 'Do Nothing' scenario has been assessed as part of the operational stage air quality and climate assessments (see Section 11.4.3.2 and 11.4.3.3). NO_2 and CO_2 emissions associated with vehicle exhausts have been quantified and it has been determined that there is an imperceptible impact to air quality and climate. NO_2 concentrations are significantly less than the ambient air quality standards. In addition, concentrations of CO_2 associated with vehicles currently accessing the site are in compliance with the National GHG targets and are significantly less than 1% of the annual target indicating there is no significant impact from traffic emissions.

11.4.2 Construction Phase Impacts

11.4.2.1 Air Quality

Impacts to air quality during the construction phase will be as a result of construction dust emissions. As noted in Section 11.3.1 there are a number of high sensitivity residential properties in close proximity to the site along Barn Lodge Grove. The surrounding area can be considered of medium sensitivity to dust soiling impacts and of low sensitivity to human health related dust impacts according to the IAQM criteria (IAQM, 2014). Combining the sensitivity of the area with the magnitude of the construction works allows the potential risk of dust impacts to be determined and the required level of mitigation. The construction works magnitude is assessed under the headings of demolition, earthworks, construction and trackout (movement of heavy vehicles).

There will be some demolition works involved on-site, however these will be minimal in nature and will primarily involve the demolition of the annex on the existing facility building along with the removal of internal walls. Site plant and furnishings will also be removed from the existing building along with the on-site fire pump and existing weighbridge; both of which will be replaced as part of the proposed development. The proposed demolition activities can be categorised as small under the IAQM guidance (2014). The proposed earthworks activities can be categorised as medium according to the IAQM guidance (2014) as approximately 35,640 m^3 of material will be required for excavation and infill works. The new buildings on-site will be constructed primarily of steel and metal cladding which have a low potential for dust release. However, due to the volume of the buildings to be constructed the construction falls under the large category in the IAQM guidance (2014). The trackout activities can be classified as medium according to the IAQM guidance due to the number of outward HGV movements per day being between 10 – 50. A summary of the dust emission magnitude for each category as per the IAQM guidance (2014) is detailed in Table 11.7.

Combining the magnitude of the demolition, earthworks, construction and trackout activities with the sensitivity of the area results in an overall medium risk of dust soiling impacts to nearby receptors as a result of the construction phase and a low risk of human health related dust impacts in the absence of mitigation.

Table 11-7: Dust Impact Risk used to Define Site Specific Mitigation

Potential Impact	Dust Emission Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Emission Magnitude	Small	Medium	Large	Medium
Dust Soiling Risk	Low Risk	Medium Risk	Medium Risk	Medium Risk
Human Health Risk	Negligible Risk	Low Risk	Low Risk	Low Risk

11.4.2.2 Climate

The construction phase of the proposed development will result in a number of GHG emissions from various sources. Embodied carbon is carbon dioxide emitted during the manufacture, transport and construction of building materials, together with end-of-life emissions. As part of the proposed development, construction stage embodied GHG emissions are categorised under the following headings:

- Manufacture of materials
- Materials transport to site; and
- Construction works (including personnel travel and project size);

Detailed project information including volumes of materials were obtained from Fehily Timoney and Company for the purposes of this assessment as detailed in Chapter 4 – Existing and Proposed Development, of Volume 2 of this EIAR. The exact material specifications and quantities are not known at this stage of the project and will be specified at the detailed design stage. In the absence of specific information best-estimates and assumptions have been used. It is expected that construction phase will last approximately 12 months (see Chapter 4). Where possible excavated materials will be re-used on site for fill. A total of 14,520 m^3 of topsoil and subsoil material will be excavated on-site, with 4,752 m^3 suitable for re-use as fill material. The remainder will be transported off-site for disposal at a suitable licensed facility. There is the requirement for the import of 21,120 m^3 of fill material. 3,973 m^3 of concrete and 660 tonnes of steel will be imported to site during the construction phase.

Table 11.8 details the embodied carbon emissions associated with each category. The proposed development is expected to have a construction phase of 12 months approximately. The predicted embodied emissions can be averaged over the full construction phase of the proposed development to give the predicted annual emissions to allow for direct comparison with national annual emissions and targets. Emissions have been compared against Ireland's EU 2030 target of a 30% reduction in non-ETS sector emissions based on 2005 levels (33.38 Mtonnes CO_2eq) (set out in Regulation EU 2018/842 of the European Parliament and of the Council). Emissions have also been compared against the Built Environment sector target of 5 $MtCO_2e$ for 2030 as set out in the Climate Action Plan.

The total construction phase embodied emissions totals 3,122 tonnes CO_2e, this is 0.009% of Ireland's 2030 GHG emission target and 0.062% of the Built Environment CAP target (see Table 11.8). The predicted impact to climate during the construction phase is temporary and negative but, overall, **not significant.**

Table 11-8: Predicted Construction Stage GHG Emissions

Activity	Construction Phase Embodied Emissions (tonnes CO_2e)
Pre-Construction	10.61
Embodied Carbon	3,057
Construction Activities	55
Total Construction Phase Emissions	**3,122**
Total Emissions as % of Irelands CAP emission target for Built Environment sector	0.062%
Total Emissions as % of Irelands 2030 GHG emission target	0.009%

11.4.2.3 Human Health

Dust emissions from the demolition and construction phase of the proposed development have the potential to impact human health through the release of PM_{10} and $PM_{2.5}$ emissions. The surrounding area is of low sensitivity to human health impacts from dust emissions according to the IAQM guidance (2014). There is at most a low risk of human health impacts as a result of the demolition and construction phase of the proposed development (see Table 11.7). Therefore, in the absence of mitigation there is the potential for a **negative, temporary, imperceptible impact** to human health as a result of the proposed development.

11.4.3 Operational Phase Impacts

11.4.3.1 Odour

Odour emissions associated with the odour abatement stack at MRF1 have been modelled to determine the impact to the nearby sensitive receptors. Details of the 98th%ile of 1-hour mean odour concentrations at the worst-case off-site location are given in Table 11.9 over an historical five-year period ranging from 2017 to 2021 based on the USEPA approved AERMOD model (version 21112). The worst-case scenario for the 98th%ile of 1-hour concentrations occurs in 2021 where the maximum off-site concentrations is 63% of the guideline value of 1.5 OU_E/m^3 at the worst-case receptor. Figure 11.3 shows the ambient odour concentration contour pattern (as a 98th%ile of one-hour concentrations) in the vicinity of the proposed development for the worst-case year of 2021. Based on the results detailed below, no nearby receptors (which are shown in Figure 11.1) are predicted to experience odour nuisance issues as a result of the proposed development. Results are within the acceptable range for odour emissions.

Table 11-9: Predicted Odour Concentration At Worst-Case Offsite Receptor

Pollutant / Meteorological Year	Averaging Period	Predicted Odour Concentration (OU_E/m^3)	Guideline (OU_E/m^3) Note 1
Ambient Odour / 2017	Maximum 1-Hour (as a 98th%ile)	0.70	1.5
Ambient Odour / 2018	Maximum 1-Hour (as a 98th%ile)	0.84	
Ambient Odour / 2019	Maximum 1-Hour (as a 98th%ile)	0.90	
Ambient Odour / 2020	Maximum 1-Hour (as a 98th%ile)	0.89	
Ambient Odour / 2021	Maximum 1-Hour (as a 98th%ile)	0.95	

Figure 11-3: 98th Percentile of 1-Hour Odour Concentrations (OU$_E$/m^3)

11.4.3.2 Air Quality

There is potential for waste handling and processing activities to cause the generation of airborne, particularly in the MRF3 building where dusty wastes are being accepted. Management and mitigation measures are required to minimize and prevent airborne dust generation on-site (these measures are described in Section 11.5.2).

There is the potential for traffic emissions to impact air quality during the operational phase due to the increased number of vehicles accessing the site. The operational stage traffic has been reviewed and an air quality assessment using the UK Highways Agency DMRB screening model was undertaken (UK Highways Agency, 2007). The air quality assessment was carried out at the closest sensitive residential receptor to the impacted road link (Premier Business Park Access Road) (same receptor as shown in Figure 11-3, otherwise known as 'R1'). This receptor is along Barn Lodge Grove and is approximately 186m from the impacted road. Concentrations of pollutants at other nearby receptors will be lower than at the modelled receptor, therefore the assessment represents a conservative approach. 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.

NO_2 emissions as a result of the operational phase traffic are in compliance with the ambient air quality standards for NO_2 set out in Table 11.2. Concentrations of NO_2 are at most 43% of the annual limit value in the Opening Year of 2025 and 36% of the annual limit in the Design Year of 2040 (see Table 11.10). The decrease in predicted concentrations between the opening and design years is due to decreased background concentrations as traffic levels are not predicted to decrease. The maximum 1-hour NO_2 concentration is not predicted to be exceeded at the receptor modelled in either 2025 or 2040. Compared to 'Do Nothing' levels, concentrations of NO_2 will increase by 0.03 $\mu g/m^3$ at the receptor modelled (see Table 11.10). As per the TII assessment criteria outlined in Appendix 10 of the TII guidance document "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" (2011) the changes in NO_2 concentrations as a result of the operational phase traffic emissions are considered negligible. Therefore, the impact of operational traffic emissions on air quality is predicted to be long-term and imperceptible.

Table 11-10: Predicted Annual Mean NO_2 Concentrations

Receptor	Impact Opening Year 2025				
	DN	DS	DS – DN	Magnitude	Description
R1	17.21	17.24	0.03	Imperceptible	Negligible Increase
Receptor	**Impact Design Year 2040**				
	DN	**DS**	**DS – DN**	**Magnitude**	**Description**
R1	14.48	14.51	0.03	Imperceptible	Negligible Increase

11.4.3.3 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.

There is the potential for CO_2 emissions associated with vehicles accessing the site to impact climate. The traffic generated by the development was reviewed against the DMRB screening criteria for climate as outlined in Section 11.2.3.2 and it was determined that there is the potential for the local access road to the Premier Business Park to exceed the screening criteria. The predicted concentrations of CO_2 for the future years of 2025 and 2040 are detailed in Table 11.11. These are significantly less than the 2025 and 2030 targets set out under EU legislation (targets beyond 2030 are not available). It is predicted that in 2025 traffic associated with the proposed development will increase CO_2 emissions by 0.00007% of the 2025 target for Ireland. In 2040 CO_2 emissions will increase by 0.00009% of the 2030 target. Therefore, the impact to climate as a result of traffic associated with the proposed development is considered **long-term and imperceptible.**

Table 11-11: Climate Traffic Impact Assessment

Year	Scenario	CO_2 (tonnes/annum)
2025	Do Nothing	25
	Do Something	53
2040	Do Nothing	25
	Do Something	53
Increment in 2025		28.4 Tonnes
Increment in 2040		28.4 Tonnes
Emission Ceiling (kilo Tonnes) 2025 [Note 1]		38,991
Emission Ceiling (kilo Tonnes) 2030 [Note 1]		33,381
Impact in 2025 (%)		0.00007 %
Impact in 2040 (%)		0.00009 %

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*

During the operational phase the proposed development will be powered primarily by electricity from the National Grid. In addition, photovoltaic solar panels will be installed on the main buildings to provide some of the power to the site and to meet the renewable energy requirements for the development. The indirect CO_2 emissions associated with the proposed development's electricity requirements can be calculated using the carbon intensity of the National Grid. The 2020 carbon intensity figure of 296 gCO_2/kWh based on the fuel mix of electricity from the National Grid has been published by the SEAI in their report *Energy in Ireland – 2021 Report* (SEAI 2022).

Photovoltaic solar panels with an output capacity of 696.9 MWh will be installed on the main buildings as part of the proposed development. Using the 2020 carbon intensity this has the potential to offset up to 206.27 Tonnes CO_2 annually compared to if this electricity was sourced from the national grid.

The operational phase power demand for the full site will be 6,000 MWh annually. This figure is based on the Applicant's Killen Road facility which is of similar nature and scale to that of the proposed development. A total of 11.6% of the proposed developments power demand can be generated by the on-site solar panels, with the remaining fraction being supplied by the National Grid. Using the 2020 carbon intensity figure outlined above this will result in the indirect emissions of 1,570 tonnes CO_2 annually however this will reduce as the renewables percentage on the national grid is increased in line with the 2030 target of up to 80% renewables on the national grid as per the 2021 Climate Action Plan.

In addition to operational electricity, there is an operational demand for 15,000 litres of diesel annually. The 2019 Report on Diesel and Alternative-Fuel Bus trials (DTTS 2019) 1 MJ of diesel emits 73.3 g/CO_2. Each MJ of diesel is equal to 0.0278 litres. This results in emissions of 39.55 Tonnes CO_2 annually based on 15,000 litres of diesel.

Operational phase impacts to climate will be **long-term, negative and slight but overall not significant.**

11.4.3.4 Human Health

The operational phase of the proposed development can impact human health through the release of odours as a result of waste processing activities on site. Odour emissions have the potential to cause nuisance issues which can result in human health effects. Waste processing activities carried out in building MRF1 which will accept rMSW and food waste are the primary sources of odour at the proposed development. All processes in MRF1 will be carried out internally and under negative air pressure. Air from the building will be fed through an odour abatement unit and discharged to air. As per Section 11.4.3.1 odour emissions from the proposed odour abatement unit have been modelled in detail and it was determined that no nuisance issues are envisaged at nearby sensitive receptors. All odour emissions from the site are in compliance with the guideline value of 1.5 OU_E/m^3 (measured as a 98th percentile). Modelling of operational stage traffic emissions (see Section 11.4.3.2) has shown that pollutant emissions from vehicle exhausts will be in compliance with the ambient air quality standards which are set for the protection of human health. Therefore operational phase impacts to human health are deemed **long-term, neutral and imperceptible.**

11.4.4 Cumulative Impacts

11.4.4.1 Construction Phase

According to the IAQM guidance (2014) should the construction phase of the proposed development coincide with the construction phase of any other development within 350m then there is the potential for cumulative construction dust impacts.

The construction phase of the proposed development may also coincide with the construction of the following proposed development:

- Permission was granted on 07th July 2022 for development comprising: (i) construction of 5 no. industrial / warehouse / logistics units contained within 3 no. blocks and creation of vehicular access point (Planning reference: FW22A/0061), c.150m east of the proposed development.
- Permission was granted on 26th May 2022 for the construction of a security hit, 2 no. warehouse/ light industrial units, warehouse/ logistic unit and associated site works (Planning reference: FW21A/0149), c.200m northeast of the proposed waste facility.

Potential exists for the proposed development to have a cumulative impact in terms of dust in-combination with the development listed above. However, a high level of dust control will be implemented across the proposed development construction site which will avoid significant dust emissions. Provided these mitigation measures (see Section 11.5.1.1) are in place for the duration of the demolition and construction phase cumulative dust related impacts to nearby sensitive receptors are not predicted to be significant. Cumulative impacts to air quality during construction will be temporary and imperceptible.

Due to the short-term duration of the construction phase and the low potential for significant CO_2 emissions cumulative impacts to climate are considered neutral.

There are no significant cumulative impacts to air quality or climate predicted for the construction phase.

11.4.4.2 Operational Phase

The traffic data reviewed for the operational stage impacts to air quality and climate included the cumulative traffic associated with other existing and permitted developments in the local area. Therefore, the cumulative impact is included within the operational stage impact assessment for the proposed development contained in this chapter. The impact of the operational phase of the proposed development is predicted to be long-term and imperceptible with regards to air quality and climate.

There are no sites within 1 km of the proposed development that have significant odour emissions sources which may lead to a cumulative odour impact.

Another Materials Recovery Facility operated by Starrus Eco Holdings Ltd T/A Panda is situated 1.3 km north of the proposed development. Odour emissions from this facility are controlled via an odour abatement system and under the IE licence for the facility. Therefore, there is no potential for the proposed facility and Panda's facility causing a cumulative odour impact.

As per Section 11.4.3.1 odour emissions from the site are in compliance with the guideline value of 1.5 OU_E/m^3 and are not predicted to cause odour nuisance issues to nearby sensitive receptors.

There are no significant cumulative impacts to air quality or climate predicted for the operational phase.

11.5 Mitigation Measures

11.5.1 Construction Phase Mitigation

11.5.1.1 Air Quality

Construction dust emissions are considered the primary source of air quality impacts associated with the proposed development. It has been established that there is an overall medium risk of dust related impacts as a result of the proposed development.

A Construction Environmental Management Plan (CEMP) has been developed in order to manage, prevent and control potential environmental impacts associated with Construction Phase activities. This document is included as Appendix 4.2, Construction Environmental Management Plan, in Volume 3 of this EIAR. This document outlines construction phase activities to be undertaken and environmental control and mitigation measures to be adopted to prevent adverse impacts on the environment due to these construction activities.

A detailed dust minimisation plan associated with a medium-level risk of dust impacts is outlined in Appendix 11.3 (Volume 3 of the EIAR). This plan draws on best practice mitigation measures from Ireland, the UK and the USA in order to ensure the highest level of mitigation possible.

The following specific mitigation measures will be implemented at the site during the construction phase of the proposed development:

- Prior to demolition blocks will be soft striped inside buildings (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Drop heights from loading shovels and other loading equipment will be minimised.

- If encountered, asbestos on site will be removed by a suitably qualified contractor prior to any demolition taking place in accordance with an Asbestos Management Plan and HSA Guidelines on the management and Disposal of Asbestos defined in their Guidance Document entitled 'Practical Guidelines on ACM Management and Abatement.'
- 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.
- 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.

11.5.1.2 Climate

Impacts to climate during the construction stage are predicted to be insignificant 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.

11.5.2 Operational Phase Mitigation

11.5.2.1 Air Quality

11.5.2.1.1 Odour

An odour management plan will be developed for the proposed development. This plan will include management strategies for the prevention of emissions and a strict preventative maintenance and management program for ensuring that all odour mitigation techniques remain operational at optimal capacity throughout all operational scenarios. Measures include:

- Good housekeeping practices (internally and externally) and a closed-door management strategy will also be maintained at all times. Fasting acting roller doors will be installed at MRF Building 1 to minimize the potential for odour existing the building;
- The facility will have a high level of cleanliness with outdoor surfaces cleaned down on a daily basis.

- Cleaning schedules will be developed in accordance with insurer and manufacturer specifications and will be overview and implemented by the Applicant's QEHS team.
- Cleaning of waste and storage bins, trucks carrying odorous materials and holding vessels will be undertaken regularly with an increased frequency in summer months;
- Indoor food waste and rMSW processing and storage areas will be subject to washdown on a daily basis during operations;
- All spills, overflows and leaks will be cleaned up promptly with all operators aware and trained in the relevant SOP for this procedure; and
- Washwater from wash down of waste process and storage areas on-site will be directed to and stored temporarily in a below ground 'dirty water' storage tank situated at the south-east corner of building MRF 3. Discharges to foul sewer from this tank will be via a submersible pump and a rising main into the proposed new foul sewer connection. No odour generation is envisaged from this tank due to its underground, enclosed nature.
- As the site will hold an IE licence from the EPA once operational, this will require regular maintenance and upkeep of the OCU in MRF1 to ensure the abatement system is working satisfactorily. Periodic monitoring of odour emissions from the OCU will be carried out by a third-party monitoring contractor to ensure and verify that no odour nuisance is occurring. Odour emission monitoring results will be compared with emission limit values prescribed in the IE licence granted and enforced by the EPA. These monitoring results will be reported to the EPA as the regulatory body.

11.5.2.1.2 Dust

The existing facility currently implements several best practice measures to prevent significant dust emissions from the site, these measures will continue to be enforced once the proposed development is in place. The measures include:

- Storage and processing of wastes will occur within the proposed buildings.
- The yard will be regularly misted, and a road sweeper vehicle will be employed as required to ensure the site area is free from a build-up of dust and dirt.
- Internal building floors will be regularly cleaned which will prevent dust emissions. A team of operatives will be assigned to carry out such clean downs on a continuous basis.

In addition to the above, a misting system will be employed in MRF 3 (where C&D waste will be handled and processed) to drop dust out of the air closer to its generation sources.

Periodic dust monitoring will be carried out at boundary locations at the site. Dust monitoring results will be compared with dust emission limit values prescribed by the EPA under the prospective IE licence for the facility to verify that nuisance levels of airborne dust or not arising due to site activities. These monitoring results will be reported to the EPA on an ongoing basis as the competent regulatory body.

11.5.2.2 Climate

Vehicle and machinery specific mitigation measures can be implemented by ensuring that all vehicles are regularly maintained and upgraded where possible to the best available technology in order to ensure emissions are minimised. In addition, there will be no idling of vehicles/machinery on site.

4 no. car parking spaces and 8 no. RCV parking spaces on-site will be provided with EV charging facilities to facilitate the transition toward use of electric cars and waste collection vehicles.

A Mobility Management Plan will be adopted and implemented to promote sustainable travel. Adequate cycle parking provisions will be provided on-site. 24 bicycle racks will be provided adjacent to the eastern façade of the Administration building. Cyclists arriving on-site will use Entrance 1 to access this location. These bicycle racks will cater to all staff members working at the site.

The proposed development will result in the sorting and separation of waste material and the onward transfer of material output to recovery or recycling facilities. The TII Carbon Tool (TII, 2020) provides emissions for a number of waste types and destinations. Waste recovery and recycling management methods have a significantly lower carbon footprint than the landfilling of waste. Estimates of carbon savings associated with the diversion of particular waste types dealt with in the TII Carbon Tool from landfilling is presented below. The benefit of landfill avoidance is reflected in the substantially reduced emissions per tonne shown.

'Mixed Construction and Demolition Waste' embodied carbon comparison:

- Recycled 1.00 kgCO_2e per Tonne
- Energy Recovery 2.00 kgCO_2e per Tonne
- Landfill 285.00 kgCO_2e per Tonne

At 100,000 tonnes annually this is a saving of up to 28,400 Tonnes of CO_2 annually if the waste is recycled or sent for energy recovery rather than being landfilled.

'Paper and Cardboard Waste' (taken to mean MDR waste) embodied carbon comparison:

- Recycled 21.35 kgCO_2e per Tonne
- Energy Recovery 21.35 kgCO_2e per Tonne
- Landfill 1041 kgCO_2e per Tonne

At 50,000 tonnes annually this is a saving of up to 509,825 Tonnes of CO_2 annually if the waste is recycled or sent for energy recovery rather than being landfilled.
'General Office Waste' (taken to mean rMSW waste) embodied carbon comparison:

- Recycled 21.35 kgCO2e per Tonne
- Incineration (With Energy Recovery) 21.35 kgCO2e per Tonne
- Landfill 99.76 kgCO2e per Tonne

At 100,000 tonnes annually this is a saving of up to 7,841 Tonnes of CO_2 annually if the waste is recycled or sent for energy recovery rather than being landfilled.

'Organic Waste' (taken to mean Food waste) embodied carbon comparison:

- Recycled 21.35 kgCO_2e per Tonne
- Composting 10.20 kgCO_2e per Tonne
- Landfill 579.04 kgCO_2e per Tonne

At 50,000 tonnes annually this is a saving of up to 2,844 Tonnes of CO_2 annually if the waste is composted rather than being landfilled.

Therefore, there is the potential to offset the construction embodied carbon of 3,122 Tonnes of CO_2 within the first months of opening of the proposed development. The operational carbon associated with power requirements will be offset through diverting the waste from landfill and sending it for recycling/recovery instead.

11.6 Residual Impacts

It is not anticipated that there will be an adverse impact on air quality and climate at nearby sensitive receptors in the vicinity of the proposed development due to the carrying out of the construction or operational phase of the proposed development

Odour modelling based on the USEPA approved AERMOD model has found that the worst-case scenario for the 98^{th}%ile of 1-hour concentrations occurs in 2021 where the maximum off-site concentration is at most 63% of the guideline value of 1.5 OU_E/m^3 at the worst-case receptor. Based on these results, no nearby receptors are predicted to experience odour nuisance issues as a result of the proposed development.

The proposed development has the potential to have a residual benefit with respect to climate by diverting waste from landfill and therefore reducing the wastes embodied carbon.

Thus, the impact on odour, air quality and climate as a result of the proposed development is not significant and thus no residual impact is anticipated. In accordance with the EPA Guidelines (EPA 2022) the residual impacts are considered overall **not significant and long-term.**

References

1. AEA Technology (1994) Odour Measurement and Control – An Update, M. Woodfield and D. Hall (Eds)
2. Civil Engineering Standard Method of Measurement (CESSM) (2013) Carbon and Price Book database.
3. Department of Transport, Tourism and Sport (2019) Report on Diesel and Alternative-Fuel Bus trials
4. Environmental Protection Agency (2022a) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
5. Environmental Protection Agency (2022b) Ireland's Final Greenhouse Gas Emissions 1990 – 2021
6. Environmental Protection Agency (2022c) EPA website Available at: http://www.airquality.ie
7. Environmental Protection Agency (2022d) GHG Emissions Projections Report - Ireland's Greenhouse Gas Emissions Projections 2021 – 2040
8. Environmental Protection Agency (2021a) Air Quality Monitoring Report 2020 (& previous annual reports)
9. Environmental Protection Agency (2019) Odour Emissions Guidance Note (AG9)
10. Environmental Protection Agency (2020) Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)
11. Environmental Protection Agency (2001) Odour Impacts & Odour Emission Control Measures for Intensive Agriculture

12. German VDI (2002) Technical Guidelines on Air Quality Control – TA Luft
13. Government of Ireland (2015) Climate Action and Low Carbon Development Act
14. Government of Ireland (2019) Climate Action Plan 2019
15. Government of Ireland (2021a) Climate Action and Low Carbon Development (Amendment) Act 2021
16. Government of Ireland (2021b) Climate Action Plan 2021
17. Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction Version 1.1
18. Met Eireann (2022) Met Eireann Website Available at: www.met.ie
19. Schulman, L.L; Strimaitis, D.G.; Scire, J.S. (2000) Development and evaluation of the PRIME plume rise and building downwash model. Journal of the Air & Waste Management Association, 50, 378-390.
20. Sustainable Energy Authority of Ireland (SEAI) (2022) Energy in Ireland – 2021 Report.
21. Sustainable Energy Authority of Ireland (SEAI) (2021) Conversion Factors. Available from: seai.ie/data-and-insights/seai-statistics/conversion-factors/
22. Transport Infrastructure Ireland (TII) (2020) TII Carbon Assessment Tool (Version 2).
23. UK Environment Agency (2011) H4 – Odour Management
24. UK Highways Agency (2019a) UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality
25. UK Highways Agency (2019b) UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate
26. UK Highways Agency (2007) Design Manual for Roads and Bridges (DRMB), Volume 11, Section 3, Part 1 - HA207/07 (Document and Calculation Spreadsheet).
27. University of Bath (2019) Inventory of Carbon and Energy (ICE) Version 3.0
28. USEPA (1995) User's Guide for the Industrial Source Complex (ISC3) Dispersion Model Vol I & II
29. USEPA (1999) Comparison of Regulatory Design Concentrations: AERMOD vs. ISCST3 vs. CTDM PLUS
30. USEPA (2017) Guidelines on Air Quality Models, Appendix W to Part 51, 40 CFR Ch.1
31. USEPA (2018a) User's Guide to the AERMOD Meteorological Pre-processor (AERMET)
32. USEPA (2018b) AERMOD Description of Model Formulation
33. USEPA (2019) AERMOD Description of Model Formulation and Evaluation
34. Warren & Parkins (1985) "Single-sided ventilation through open windows". Conf. Proceedings, Thermal Performance of the exterior envelopes of buildings, Floride, Ashrae sp 49, pp. 209 – 228.
35. Water Environment Federation (1995) Odour Control in Wastewater Treatment Plants

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