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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE DEMOLITION OF AGRICULTURAL STRUCTURES AND THE DEVELOPMENT OF A MATERIALS RECOVERY FACILITY AT DERRYARKIN, RHODE, CO. OFFALY

VOLUME 2 – MAIN BODY OF THE EIAR

CHAPTER 11 – AIR QUALITY AND CLIMATE

Prepared for: **Oxigen Environmental Unlimited Company**

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working for a cleaner environment

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11. AIR QUALITY AND CLIMATE

11.1 Introduction

AWN Consulting Ltd were commissioned by Fehily Timoney to carry out an air quality, climate and odour emissions impact assessment from the subject proposed development at Derryarkin, Rhode, Co. Offaly. The proposed development is defined in Chapter 1 and a detailed description of the proposed development is set out in Chapter 4: Description of the Existing and Proposed Development.

The modelling study includes a determination of whether the odour emissions from the site, will lead to ambient concentrations which are in compliance with the criterion of 1.5 OU_E/m^3 as a 98th percentile of the hourly average concentrations and to identify the location and maximum of the worst-case ground level odour concentrations. The potential for construction phase impacts with respect to dust nuisance, health and ecology impacts have also been assessed. In addition, the impact of the construction and operational phase vehicle movements associated with the development has been assessed with respect to odour, air quality and climate impacts.

The EIAR assessment consists of the following components:

- Review of activities which are likely to generate odorous emissions based on the current operations at the facility;
- Estimate the odour emissions (in terms of OU_E/s) and other relevant information needed for the modelling study;
- Dispersion modelling of odour under the maximum emission scenario to determine the likely level of odour in the ambient environment;
- Presentation of predicted ground level concentrations of released odours;
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient Odour Guidelines;
- Impact assessment of the embodied carbon on climate;
- Potential impacts of traffic during the construction and operational phase on local air quality; and
- Potential construction phase dust emission impacts.

11.1.1 Statement of Competency

This chapter was completed by Dr. Avril Challoner who is a Senior Environmental Consultant in the Air Quality section of AWN Consulting. She holds a BEng (Hons) in Environmental Engineering from the National University of Ireland Galway, HDip in Statistics from Trinity College Dublin and has completed a PhD in Environmental Engineering (Air Quality) in Trinity College Dublin. She is a Chartered Scientist (CSci), Member of the Institute of Air Quality Management and specialises in the fields of air quality, EIA and air dispersion modelling. She has experience with preparing air quality and climate impact assessments for EIARs for various residential, mixed-use, commercial and industrial developments.

11.2 Assessment Methodology

The assessment has been undertaken with reference to the most appropriate guidance documents relating to air quality, odour and climate which are set out in the following sections.

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 2001) 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 98^{th}%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 (EPA 2019)

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 OUE/m3 as a98th%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 OUE/m3 as a 98th%ile of hourly averages at the worst-case sensitive receptor

Industrial Sectors	Relative Offensiveness of Odour	Indicative Criterion Note 1
Brewery / Grain / Oats Production Coffee Roasting Bakery Confectionery	Less Offensive	6.0 OUE/m3 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 98^{th}%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 applied guideline is the German TA Luft (German VDI, 2002) guideline of 350 mg/(m^2*day) as measured using Bergerhoff type dust deposit gauges as per the German Standard Method for determination of dust deposition rate (VDI 2119). This 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 a national mitigation plan, and 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 *Climate Action Plan* (CAP) (Government of Ireland, 2019), published in June 2019, outlines the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlines the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The CAP also details 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 CAP has set a built environment sector reduction target of 40 - 45% relative to 2030 pre-NDP (National Development Plan) projections. There are no targets specific to the mining, quarrying or extractive industry.

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, 2019) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (S.I. 32 of 2021) (hereafter referred to as the 2021 Climate Act) (Government of Ireland, 2021a). 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 and climate neutral economy by the end of the year 2050'. The 2021 Climate Act will also 'provide for carbon budgets and a decarbonisation target range for certain sectors of the economy'. The 2021 Climate Act defines the carbon budget as 'the total amount of greenhouse gas emissions that are permitted during the budget period'.

The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister shall request each local authority to make a 'local authority climate action plan' lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

The Government has published the second Climate Action Plan in November 2021 (Government of Ireland, 2021b). The plan 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. This section of the plan states that 'Minimising waste generation, and improving segregation, reuse and recycling, will lead to less emissions associated with waste transport and treatment. The Plan defines a number of targets which are relevant to the proposed development. These are as follows:

Limit diversion of biodegradable municipal waste to landfill to maximum limit of 427,000 tonnes by 2020, and for every year after.

11.2.2 Odour Assessment Methodology

There is no potential for odour impacts during the construction stage, the following methodology describes the assessment for the operational phase odour assessment.

11.2.2.1 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.

11.2.2.2 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 2010, 2019). 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 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:

- Two receptor grids were 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. An outer grid extended to 2.5 km with the site at the centre and with concentrations calculated at 250 m intervals. An inner grid extended to 1 km from the site with concentrations calculated at 25 m intervals. Boundary receptor locations were also placed along the boundary of the site, at 10 m intervals, giving a total of 6,886 calculation points for the model. All receptors have been modelled at 1.8 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 (Casement Aerodrome 2016 - 2020) 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.

11.2.2.3 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 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. Casement Aerodrome meteorological station, which is located approximately 56 km east of the site, collects data in the correct format and has a data collection of greater than 90%. Long-term hourly observations at Casement Aerodrome 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 2016 - 2020.

11.2.2.5 Odour Emission Rates

This assessment has been undertaken considering emissions associated with the proposed development at its maximum operational capacity. An overview of the maximum amount of waste to be accepted and processed on-site is shown in Table 11-3:

Table 11-3: Waste Quantities

Waste Type	Maximum Waste Acceptance Levels (Tonnage Per Annum)
Municipal Solid Waste (MSW) *(Household, Commercial & Industrial sources)*	40,000
Construction & Demolition (C&D)	30,000
Commercial / Industrial / Other / Mixed Dry Recyclables	20,000
Total	**90,000**

Data from 40 Materials Recovery Facilities and Mechanical Biological Treatment facilities in Italy was obtained (Sironi et al 2006). The assessment was based on the results of odour measurements conducted over the period 2000 – 2005 at 40 waste facilities in Italy treating either non-segregated organic fraction of MSW or segregated organic material and using composting but not anaerobic digestion. The capacity of the plants monitored ranged from 10,000 – 240,000 tonnes with an average capacity of 60,000 tonnes. Around 50 air samples were taken at each plant giving a total of 2,000 individual samples. The measurements were carried out in different seasons and differing weather conditions.

The emission rates determined from the facilities were normalised to the tonnage of waste processed and were presented upstream of any abatement systems. Table 11-4 outlines the average odour concentrations, median and % deviation:

Table 11-4: Odour Average Odour Concentration Values, Median And Percent Deviation (Sironi et al 2006)

Waste Process	Geometric Mean (OU_E/m^3)	Median (OU_E/m^3)	% Deviation
Waste Receiving	2,786	3,000	11.8
Aerobic Biological Treatment	10,079	11,000	8.9
Maturation	1,701	3,899	24.1
Overscreen Storage	490	836	29.1
Final Product Storage	414	529	20.5
All Process Steps	7,903	8,234	7.8

The actual odour experienced at the nearest residential receptors will be subject to a range of factors. Of critical importance will be the frequency with which the odour from the interior of the building can be released to the outside environment.

The proposed MRF will receiving food waste, temporarily storing it, before sending it on, with no aerobic biological treatment on site. The appropriate median odour emission rate for waste receiving (Table 11-4) of 3,000 OU_E/m^3 has therefore been modelled (Table 11-5).

Research on single-sided natural ventilation has been undertaken over the last 30 years. Early research by (Warren et al 1985) found that, when wind is the main driver of airflow through the opening (i.e. temperature difference between the inside and outside air can be neglected), the mean wind speed needs to be considered together with the effect of turbulence in the wind and the fluctuations in pressure in the opening.

Warren derived the following expression based on both wind tunnel and full-scale experiments:

$Q = 0.025 \times A \times U_R$

where:

Q = Odour emission rate (m^3/sec)
A = area of inlet (m^2)
U_R = Reference wind speed at 10m (m/s)

The formula above indicates that the key parameters influencing the release of odour from the processing building will be the area of the opening (roller shutter door) and the average reference wind speed, which for Casement Aerodrome is approximately 5.5 m/s on an annual basis. For modelling, windspeeds every hour of the year will be input, and the odour emissions will vary accordingly with 5 years of met data being modelled. The formula also indicates that the release of odour from the processing building will be significantly reduced when the building doors are closed.

However, in order to ensure a worst-case scenario is modelled, it is assumed that doors are open continuously. Given that the process building is not heated, temperature differences should not be significant and thus the formula above should be a reasonable approximation of the current situation.

A review of the range of odour concentrations from waste transfer stations and related industries indicates (see Table 11-5) that a worst-case odour concentration from the internal environment at the facility is likely to be at most 3000 OU_E/m^3 with levels outside of production (when the doors are closed, and turning / unloading operations are suspended) likely to be significantly lower.

As a worst-case continuous emissions have been assumed from the buildings although hours of operation when the door will be open will be limited to the hours of operation of the facility i.e. waste processing and consignment from the facility are 07:00 – 22:00 Monday to Saturday. These differ slightly from the hours of waste acceptance which are 05:00 to 00:00 Monday to Saturday.

Table 11-5 outlines the odour concentration and derived odour emission rate from the facility based on the area of the door openings. The overall OER (odour emission rate) in odour units per sec (OU_E/s) is derived based on an odour concentration of 3000 OU_E/m^3 with the doors open for 100% of the time. These odour concentrations are converted to units of odour emissions / sec for input into the air dispersion model ($OU_E s^{-1}$).

In addition to the odour emissions from the MSW, C&D, C&I and DMR waste was also assumed to give rise to odour emission. As a worst-case scenario all doors have been assumed to have the same odour emission rate as the MSW as there is no internal separation within the building to prevent odours from the MSW being emitted from the other roller doors.

Indoor waste processing and storage areas and external waste storage areas will be subject to washdown on a daily basis during operations. This wash water will drain to foul lines which in turn will direct into an underground collection tank. Dirty stormwater and wash water collected in these tanks will be periodically tankered off-site and brought to an appropriately authorized wastewater treatment plant for treatment. Due to the underground enclosed nature of the tanks no additional odour is predicted.

Sanitary effluent generated at staff sanitary facilities present in the Administration Building will be directed by way of foul pipelines toward an on-site wastewater treatment plant, which will be located to the southeast of the site. No effluent from the waste processing and storage areas will be put through the wastewater treatment plant. Wastewater will pass through a treatment process at this plant before being discharged to ground via a connected percolation area. Percolation testing and a Site Suitability Assessment has been undertaken to demonstrate that the ground present in the proposed percolation area is suitable for safely filtering and moving treated effluent from the wastewater treatment plant. Once correctly manged, there are no significant odours predicted from the wastewater treatment plant and percolation area.

Table 11-5: Worst-case Odour Emission Rates Based On The Proposed Operations At The Oxigen Environmental Derryarkin Facility

Emission Source Reference	Approximate Area (m^2) Of Opening	% Of Operational Day Door Open	Odour Emission Rate	
			Concentration (OUE/m^3)	Mass Emission (OUE/s) Note 1
MSW Area Roller Door (1)	(5.5m x 8m) 46.4	100	3,000	19,140
MSW Area Roller Door (2)	(5.5m x 8m) 46.4	100	3,000	19,140
C&D and C&I Area Roller Door	(5.5m x 8m) 46.4	100	3,000	19,140
DMR Area Roller Door	(5.5m x 8m) 46.4	100	3,000	19,140

Note 1 Based on area of open door and an average wind speed of 5.5 m/s

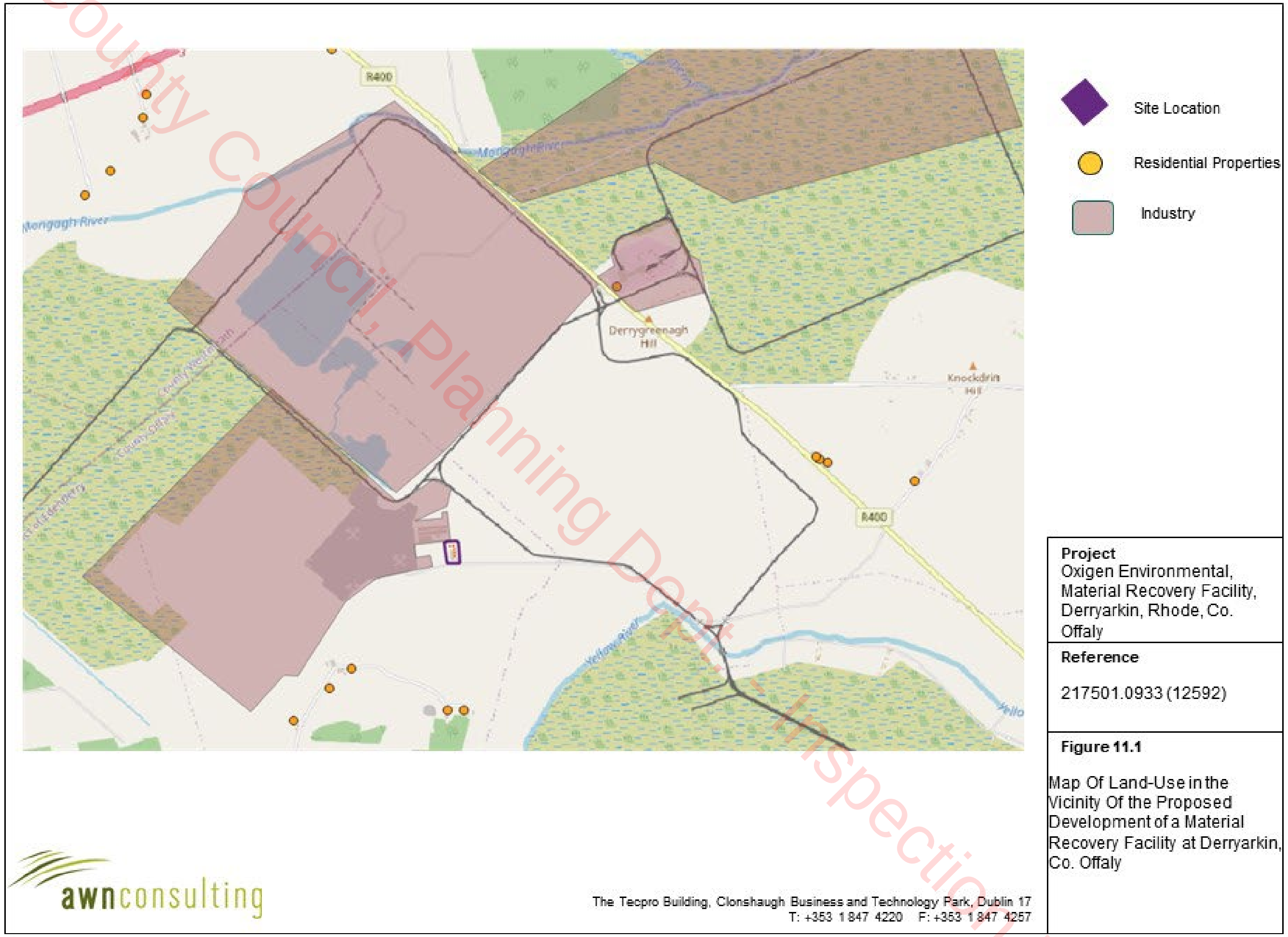

Figure 11.1:Map of Land-Use

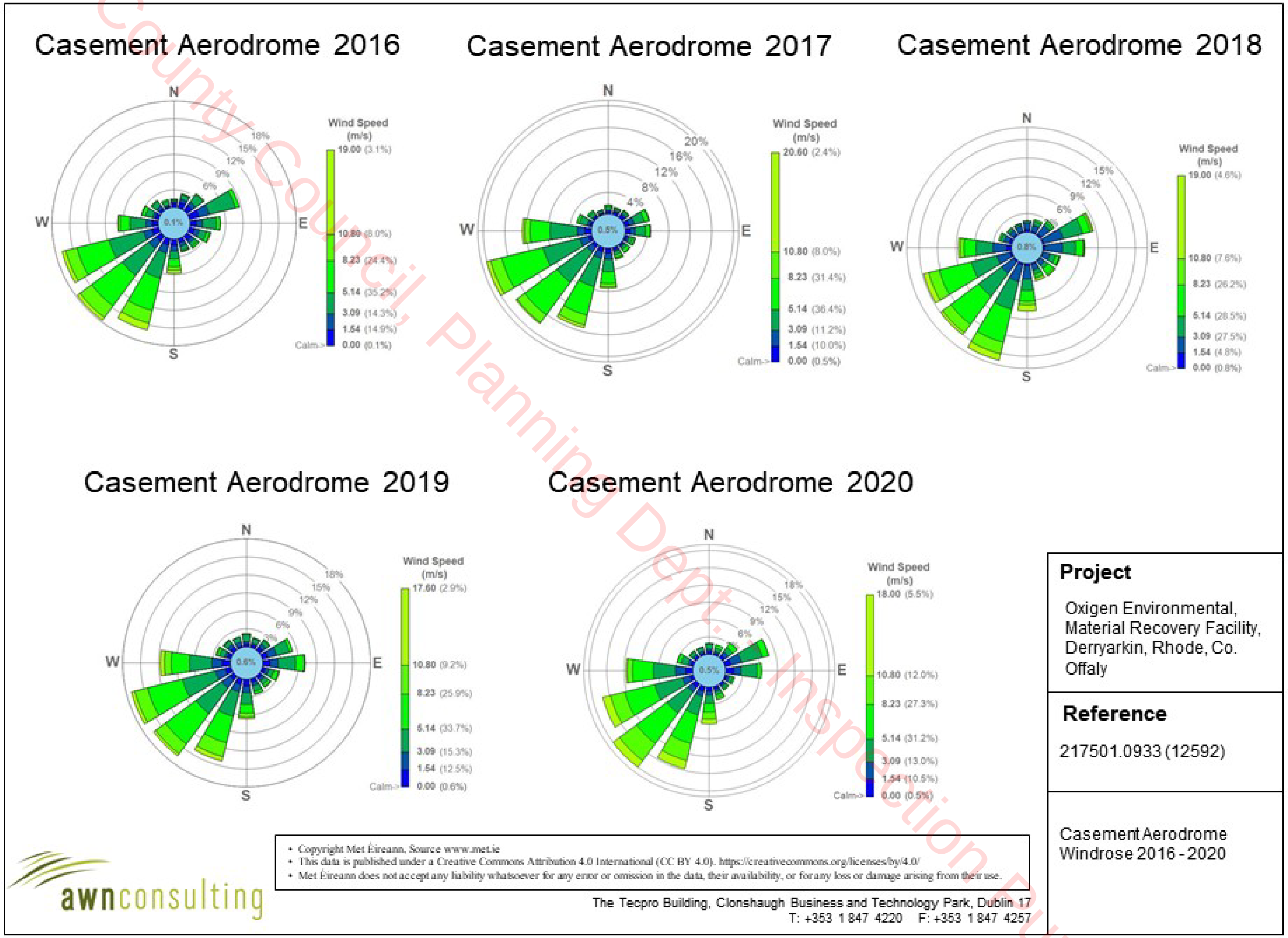

Figure 11.2: Casement Aerodrome Windroses 2016-2020

11.2.3 Air Quality

11.2.3.1 Construction Phase Dust

The Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2016) 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 in close proximity to each site and potential impacts generally occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air. 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.

A map of land use in the vicinity of the proposed development is shown in Figure 11.1. There are no sensitive human or ecological receptors within 350 m of the site boundary or 500 m from the exit of the site along the road. The construction stage dust assessment does not therefore have any receptors to assess the sensitivity of and the dust assessment has been scoped out from any further assessment as there is no potential for significant impacts.

11.2.3.2 Construction Phase Traffic Assessment

The potential impact due to construction traffic is assessed with respect to the impact on nearby (within 200 m) sensitive receptors (i.e. residential properties, schools, hospitals, sensitive ecology) by an 'affected' road link. The UK 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:

- 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.

Soil and stone excavation generated during construction on-site will be utilized on-site as fill. The vast majority of waste leaving the site during construction will be concrete waste. Concrete waste and will be sent to the adjoining Kilmurray site for recovery through land deposition.

The vast majority of construction material (soil/stone and concrete) will be sourced from the adjoining Kilmurray site next to the proposed development site (Planning Application P15141 & P18324), from Kilmurray Precast Concrete.

Only the portion of the private road between the two adjoining sites will be used. As a result there will be no traffic load on the Private Access Road leading to the site or R400 associated with soil/stone and concrete inputs or any concrete waste arising on-site. There are no sensitive receptors within 200 m of the transportation route between the Kilmurray site and the proposed development site, as shown in the map of land use in the vicinity of the proposed development (Figure 11.1).

Some traffic to and from the R400 will be generated during construction due from the importation of steel and cladding and other incidental materials to the site, and from the dispatch of waste steel and cladding from the site however the estimated volumes and associated traffic levels will be insignificant in scale.

The construction stage traffic does not meet the above scoping criteria as there are no impacts within 200m of a sensitive receptor and are below the scoping criteria. Therefore, traffic impacts have been scoped out from any further assessment as there is no potential for significant impacts to air quality.

11.2.3.3 Operational Phase Traffic Assessment

The proposed facility will accept a total of 90,000 tonnes per annum during the more intensive Phase 2, broken down as follows:

- 40,000t Household & Commercial Mixed municipal waste types (MSW);
- 20,000t Commercial and Industrial waste types (C&I), Dry Mix Recyclables (DMR);
- 30,000t Construction and demolition waste (C&D).

The HDV movements associated with these tonnages equates to approx. 57 to 77 no. trips per day, or 114 no. to 154 no. traffic movements per day on the local road network. In addition, there will be 24 staff car parking spaces on site. With a conservative total number of traffic movements per day at four for each staff member, as a result it is estimated that 96 no. traffic movements per day are generated by staff. Access to the site is via a single carriage, tarmac private access road from the R400 regional road (which is located approximately 2.2 km east of the site.).

The operational phase traffic assessment was conducted using the same scoping criteria set out in Section 11.2.3.2. Air quality impacts due to the operational phase can be scoped out for further assessment as there is no potential for significant impacts to air quality.

11.2.3.4 Air Quality Impact on Ecological Sites

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DEHLG, 2010) provide details regarding the legal protection of designated conservation areas.

If both of the following assessment criteria are met, an assessment of the potential for impact due to nitrogen deposition should be conducted:

- A designated area of conservation is located within 200 m of the proposed development; and
- A significant change in AADT flows (>5%) will occur.

There are no designated areas within 200m of road links directly impacted by the proposed development for the construction or operational phases. As such an assessment of the impact with regards to air quality impacts on sensitive ecology was screened out as there is no potential for significant impacts

11.2.4 Climate

11.2.4.1 Construction Phase Embodied Carbon

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).

11.2.4.2 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 HDV movements associated with the proposed development in the more intensive Phase 2 (as determined in Chapter 13 Traffic and Transportation in Volume 2 of this EIAR) show that there is a change of 10% or more in HDVs on the R400 due to the proposed development. The volumes of HDV traffic are not predicted to be significant (i.e. exceed the 10% threshold) once they reach the M6 junction which is approximately 6.5 km from the proposed development.

The climate impact of traffic associated with 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 (CO2). 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.

11.2.4.3 Operational Phase Power Equipment

CO_2 (which is a Greenhouse Gas) generated due to the electricity power demand of the proposed project 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 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 2020 SEAI Energy Emissions Report states that the carbon intensity of electricity was 324gCO_2/kWh in 2019 which was based on 36.5% of the national grid electricity being generated from renewable sources (SEAI 2020). A provisional 2020 carbon intensity figure of 295.1 gCO_2/kWh has been published the SEAI website (SEAI 2021). 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 Project. Future carbon intensities related to changes in the proportion of renewables are not currently available.

Roof mounted solar panels will be installed on the following roof areas within the proposed development:

- Materials Recovery Facility (MRF) Building;
- Administration Building.

The installation of roof mounted solar panels will lead to an estimated output capacity of 104,000 kWh on the proposed MRF building and administration building roofs.

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 2021).

11.3 Baseline Environment

11.3.1 Sensitive Receptors

The site is located in a largely rural setting with limited industrial/commercial activity in the wider area. A piggery is located immediately north/north-west of the development site. Access to this pig farm is via a private access road which bounds the development site to the east and north. An active quarry is located c.80m west of the site (at its closest point).

The nearest sensitive receptor consists of a one-off dwelling and is situated ca. 755 metres to the south of the development site. Other one-off dwellings are located ca. 760 metres to the south west of the site and 770 metres to the south of the site and ca. 890 metres to the southwest of the site as shown in Figure 11.1. There are no other sensitive receptors within 1 km of the proposed development site.

There are no designated ecological sites within 5km of the proposed development.

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 Casement Aerodrome, which is approximately 56 km east of the application area.

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 Casement Aerodrome Meteorological Station (Met Eireann, 2021) identified that typically 183 days per annum are "wet". Thus, approximately 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 north-westerly to southerly, thereby predominantly dispersing any potential dust emissions to the south-east and north of the site (see Figure 11.2). The mean monthly wind speed was approximately 5.5 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, 2021).

11.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2019*" (EPA, 2020a). 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, 2021).

As part of the implementation of the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2021). 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. The proposed development is located in Zone D.

NO_2 monitoring was carried out at two rural Zone D locations in recent years, Emo and Kilkitt and in two urban areas, Enniscorthy and Castlebar (EPA, 2020). The NO_2 annual average in 2019 for both rural sites, Emo and Kilkitt was 4 µg/m^3 and 5 µg/m^3 respectively; with the results for Castlebar averaging 8 µg/m^3. Hence long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m^3. The 1-hour NO_2 limit value of 200 µg/m^3 (measured as a 99.8th percentile, i.e., it must not be exceeded more than 18 times per year) has not been exceeded in any year with average concentrations well below the limit (Table 11-6). The average results over the last five years at a range of Zone D locations suggests an upper average of no more than 10 µg/m^3 as an annual mean background concentration for a purely urban area and 5 µg/m^3 for a purely rural area. Based on the above information, a conservative estimate of the current background NO_2 concentration, for the region of the proposed development is 7 µg/m^3.

Table 11-6: Annual Mean and 99.8th Percentile of 1-Hour NO_2 Concentrations – Zone D

Station	Averaging Period Notes 1, 2	Year				
		2015	2016	2017	2018	2019
Castlebar	Annual Mean NO_2 (µg/m^3)	8	9	7	8	8
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	66	60	60	59
Kilkitt	Annual Mean NO_2 (µg/m^3)	2	3	2	3	5
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	26	17	22	42
Emo	Annual Mean NO_2 (µg/m^3)	3	4	3	3	4
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	36	28	42	28
Enniscorthy	Annual Mean NO_2 (µg/m^3)	9	10	-	-	-
	99.8th %ile 1-hr NO_2 (µg/m^3)	-	72	-	-	-

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

Note 2 1-hour limit value – 200 µg/m^3 as a 99.8th%ile, i.e., not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Long-term PM_{10} monitoring was carried out at the urban Zone D locations of Castlebar, Enniscorthy and Claremorris in recent years. The average annual mean concentration measured at Castlebar and Claremorris in 2019 were 16 μg/m^3 and 11 μg/m^3 respectively Table 11-7). Long-term PM_{10} measurements carried out at the rural Zone D location in Kilkitt in 2019 gave an average level of 7 μg/m^3 (EPA, 2020b). The maximum 24-hour concentration (as a 90th%ile) at each of the Zone D locations is shown in Table 11-7. The long-term 24-hour concentration (measured as a 90th%ile) is 22 μg/m^3 for the urban sites or 13 μg/m^3 for the rural location. The average results over the last five years at a range of Zone D locations suggests an upper average of no more than 19 μg/m^3 as an annual mean background concentration for a purely urban area and 10 μg/m^3 for a purely rural area. Based on the above information a conservative estimate of the current background PM_{10} concentration for the region of the proposed development is 10 μg/m^3.

Table 11-7: Annual Mean and 90th Percentile 24-hr PM_{10} Concentrations – Zone D

Station	Averaging Period Notes 1, 2	Year				
		2015	2016	2017	2018	2019
Castlebar	Annual Mean PM_{10} (μg/m^3)	13	12	11	11	16
	90th %ile 24-hr PM_{10} (μg/m^3)	22	20	19	20	24
Kilkitt	Annual Mean PM_{10} (μg/m^3)	9	8	8	9	7
	90th %ile 24-hr PM_{10} (μg/m^3)	18	15	14	15	13
Claremorris	Annual Mean PM_{10} (μg/m^3)	10	10	11	12	11
	90th %ile 24-hr PM_{10} (μg/m^3)	17	17	17	20	20
Enniscorthy	Annual Mean PM_{10} (μg/m^3)	18	17	-	-	18
	90th %ile 24-hr PM_{10} (μg/m^3)	34	32	-	-	-

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

Note 2 24-hour limit value – 50 μg/m^3 as a 90.4th%ile, i.e., not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

11.3.4 Climate Baseline

Anthropogenic emissions of greenhouse gases in Ireland included in the EU 2020 strategy are outlined in the most recent review by the EPA which details final emissions up to 2019 (EPA 2021a). The data published in 2021 states that Ireland has exceeded its 2019 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC1 by 6.85 Mt. For 2019, total national greenhouse gas emissions are 59.78 million tonnes carbon dioxide equivalent (Mt CO_2eq) with 45.58 MtCO_2eq of emissions associated with the ESD sectors for which compliance with the EU targets must be met. Agriculture is the largest contributor in 2019 at 35.3% of the total, with the transport sector accounting for 20.3% of emissions of CO_2.

GHG emissions for 2019 are 4.4% lower than those recorded in 2018. Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for four years in a row. Emissions from 2016 – 2019 exceeded the annual EU targets by 0.29 MtCO_2eq, 2.94 MtCO_2eq, 5.57 MtCO_2eq and 6.85 MtCO_2eq respectively.

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

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

11.4 Potential Impacts

11.4.1 'Do Nothing' Impacts

Under the Do-Nothing Scenario the proposed development would not occur, and the site would remain as it is currently with the existing site agricultural sheds and structures remaining. The predicted impacts of odour, NO_2, PM_{10} and $PM_{2.5}$ and GHG emissions as well as traffic emissions would not occur, and pollutant concentrations would remain similar to baseline levels. The Do-Nothing scenario is considered neutral in terms of odour, air quality and climate.

11.4.2 Construction Phase Impacts

11.4.2.1 Odour

Materials with the potential for odorous emissions will not be brought onto the site until the operational phase, therefore there is no potential for significant construction phase odour impact.

11.4.2.2 Air Quality

There are no sensitive human or ecological receptors within the study area set in Section 11.2.3.1 with respect to construction phase dust impacts. Therefore, as no receptors are within the study area, the impact of potential dust emissions is considered negligible. In order to maintain good practices, some high-level dust mitigation measures are recommended to be put in place during the construction phase in accordance with the low-level risk designation from IAQM (IAQM 2016).

The construction stage traffic did not meet the above scoping criteria set out in Section 11.2.3.3 as there are no impacts within 200m of a sensitive receptor and are below the scoping criteria. Therefore, traffic impacts during the construction phase have been scoped out from any further assessment as there is no potential for significant impacts to air quality.

11.4.2.3 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. It is expected that construction phase will last approximately 12 months, but the most intensive period occurring over the first six-month timeframe during site clearance, demolition of existing site and removal of excess soil/stone materials, followed by the importation of steel and concrete for the base slab, retaining walls and superstructure.

For the purposes of this assessment, it is proposed that concrete & stone materials required will be supplied from Kilmurray Precast Concrete adjacent to the site. Soil/stone will be excavated as part of the construction phase ground works. It is expected that the required 111 tonnes of portal frames will be required for the proposed development be delivered by flatbed trucks (24 tonnes capacity per truck) and sourced regionally. 2,600m^3 of concrete will also be required as part of the proposed development (8m^3 capacity per truck).

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 and an operational lifespan of 50 years. The predicted embodied emissions can be averaged over the full construction phase and the lifespan 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 (32 Mtonnes CO_2eq) (set out in Regulation EU 2018/842 of the European Parliament and of the Council).

The total construction phase embodied emissions totals 1,437 tonnes CO_2e, this is 0.004% of Ireland's 2030 GHG emission 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

Stage	Construction Phase Embodied Emissions (tonnes CO_2e)
Manufacture of materials	1,317.71
Material transport	6.60
Site Clearance	0.34
Construction Waste Disposal	74.92
Construction Activities	37.66
Total Construction Phase Emissions	1,437.22
Total Annual Emissions as % of Irelands 2030 GHG emission target	0.0043%

11.4.3 Operational Phase Impacts

11.4.3.1 Odour

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 2016 to 2020 based on the USEPA approved AERMOD model (version 21112). The worst-case scenario for the 98th%ile of 1-hour concentrations occurs in 2017 where the maximum off-site concentrations is less than 1% of the guideline value 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 facility for the worst-case year of 2017.

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 (OUE/m^3)

Model Scenario / Meteorological Year	Averaging Period	Predicted Odour Concentration (OU_E/m^3)	Guideline (OU_E/m^3) Note 1
Phase 2 Operation / 2016	Maximum 1-Hour (as a 98th%ile)	0.0144	1.5
Phase 2 Operation / 2017	Maximum 1-Hour (as a 98th%ile)	0.0160	
Phase 2 Operation / 2018	Maximum 1-Hour (as a 98th%ile)	0.0146	
Phase 2 Operation / 2019	Maximum 1-Hour (as a 98th%ile)	0.0133	
Phase 2 Operation / 2020	Maximum 1-Hour (as a 98th%ile)	0.0110	

Note 1 Guideline limit value based on EPA Guidance AG9 (EPA 2019)

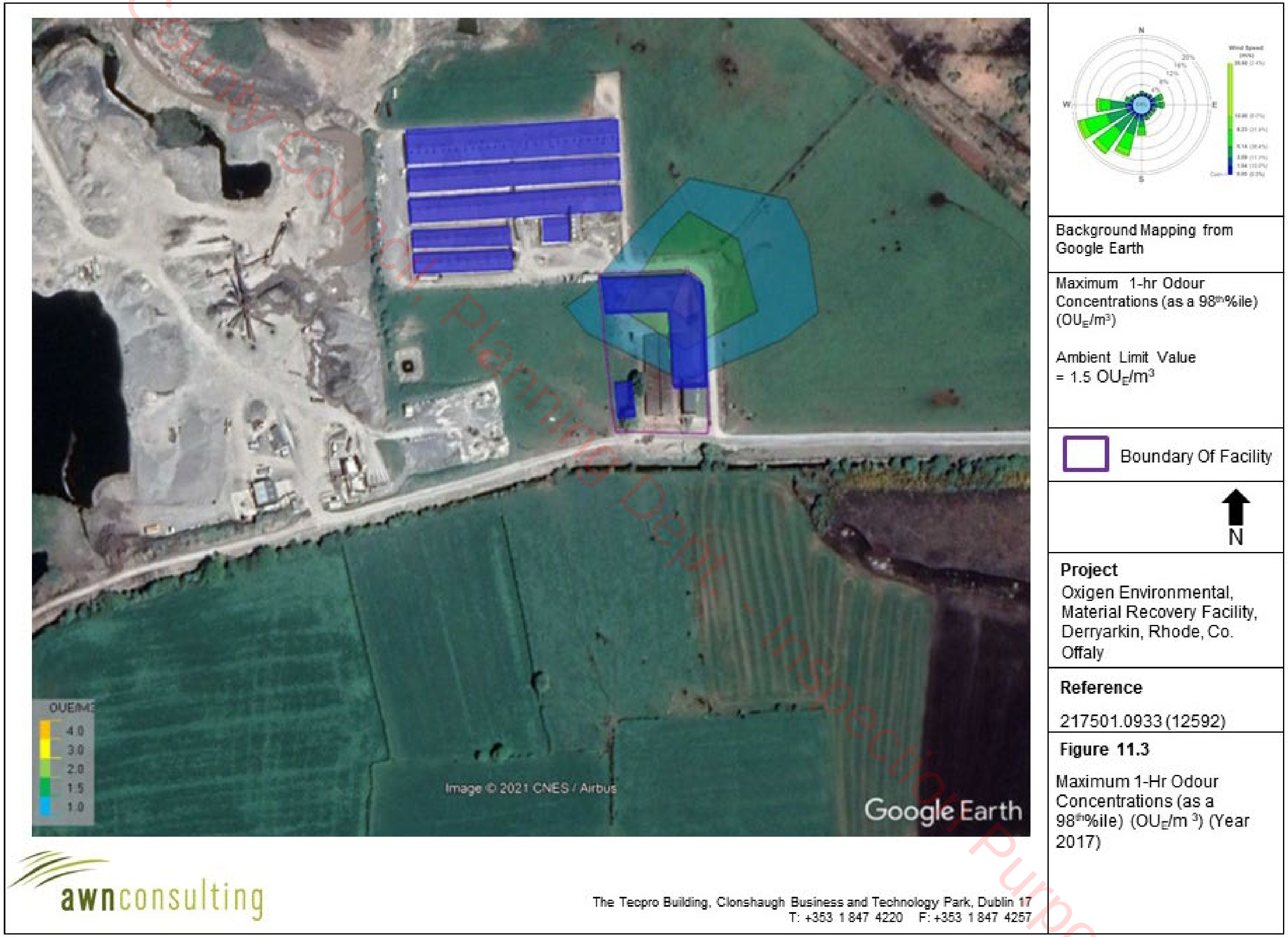

Figure 11.3: Maximum 1-Hr Odour Concentrations (as a 98th%ile)

11.4.3.2 Air Quality

The operational stage traffic did not meet the above scoping criteria set out in Section 11.2.3.3 as there are no impacts within 200m of a sensitive receptor and are below the scoping criteria. Therefore, traffic impacts during the operational phase have been scoped out from any further assessment as there is no potential for significant impacts to air quality.

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 11.2.3.3 and it was determined that there is the potential for some local road links to exceed the screening criteria. The predicted concentrations of CO_2 for the future years of 2024 and 2039 are detailed in Table 11-10. These are significantly less than the 2024 and 2030 targets set out under EU legislation. It is predicted that in 2024 the proposed development will increase CO_2 emissions by 0.0005% of the EU 2020 target. In 2039 CO_2 emissions will increase by 0.0006% of the 2030 target. Therefore, the climate impact of the proposed development is considered negative, long-term and imperceptible.

Table 11-10: Climate Traffic Impact Assessment

Year	Scenario	CO_2 (tonnes/annum)
2024	Do Nothing	4,998
	Do Something	5,202
2039	Do Nothing	5,834
	Do Something	6,042
Increment in 2024		204 Tonnes
Increment in 2039		208 Tonnes
Emission Ceiling (kilo Tonnes) 2024		**40,113**
Emission Ceiling (kilo Tonnes) 2030		**32,860**
Impact in 2024 (%)		0.0005 %
Impact in 2039 (%)		0.0006 %

Note 1 Target under *European Commission Decision 2017/1471 of 10th August 2017 and amending decision 2013/162/EU to revise Member States' annual emissions allocations for the period from 2017 to 2020*

Note 2 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*

The CO_2 generated from the generation of electricity from the national grid can be calculated using the carbon intensity of the fuel. A provisional 2020 carbon intensity figure carbon intensity of electricity from the National Grid of 295.1 gCO_2/kWh has been published the SEAI website (SEAI 2021).

Roof mounted solar panels with an output capacity of 104,000 kWh on the proposed MRF building and administration building roofs. Using the provisional 2020 carbon intensity this has the potential to offset up to 30.67 Tonnes CO_2 annually compared to if this electricity was sourced from the national grid.

The operational phase power demand will be 354MWh annually, 29% of which can be generated by the onsite solar panels. Using the provisional 2020 carbon intensity this will result in 74 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 65,520 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 0.134 Tonnes CO_2 annually.

11.4.4 Cumulative Impacts

11.4.4.1 Cumulative Odour

A piggery is located immediately north/north-west of the development site. Piggeries and waste transfer stations/materials recovery facilities, while both undesirable odours, do not share the same odour characteristics.

The worst-case scenario for the 98^{th}%ile of 1-hour concentrations occurs in 2017 where the maximum off-site concentrations is less than 1% of the guideline value at the worst-case receptor which can be classed as imperceptible. Due to the imperceptible contribution to odour at the nearest sensitive receptor and fact that the odour from the nearby piggery does not share the same odour characteristics as the proposed development, no significant cumulative impact is predicted.

11.4.4.2 Cumulative Air Quality

Potential cumulative effects on air quality between the proposed development and other developments in the vicinity were also considered as part of this assessment.

No significant cumulative impacts in terms of air quality were identified.

11.4.4.3 Cumulative Climate

Potential cumulative effects on climate between the proposed development and other developments in the vicinity were also considered as part of this assessment.

No significant cumulative impacts in terms of climate were identified.

11.5 Mitigation Measures

11.5.1 Construction Phase Mitigation

11.5.1.1 Construction Phase Odour Mitigation

As construction phase impacts due to odour are predicted to be imperceptible no mitigation is proposed.

11.5.1.2 Construction Phase Air Quality Mitigation

Although there are no sensitive receptors within the study area with respect to dust impacts, a dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within 350m of the construction area.

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 4.3, 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. This Plan also addresses Construction Phase Waste Management. This plan will be finalised to take account of relevant conditions attached to any development consent granted.

A detailed dust minimisation plan associated with a low-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.

In summary some of the measures which will be implemented will include:

- 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.
- 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.

As construction phase impacts to air quality traffic emissions are predicted to be imperceptible no mitigation is proposed.

11.5.1.3 Construction Phase Climate Mitigation

To ensure climate impacts are minimised as much as possible during the construction phase of the proposed development, all contractors will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from construction traffic.

Appendix 4.3, Construction Environmental Management Plan, in Volume 3 of this which includes a Construction Phase Waste Management. The minimisation of waste will ensure that the construction phase embodied carbon is minimised. This plan will be finalised to take account of relevant conditions attached to any development consent granted.

The embodied carbon due to the transport of excavated spoil material is minimised due to the use of the adjacent Kilmurray infill site rather than an alternative location that is further away. In addition, sourcing other materials such as the concrete, and soil and stone required for the proposed project from this location also reduces transport related emissions. It also has the potential to reduce wastage of concrete loads due to traffic related delays.

11.5.2 Operational Phase Mitigation

11.5.2.1 Operational Phase Odour Mitigation

As operational phase impacts to air quality are predicted to be imperceptible no mitigation is proposed.

An odour management plan will be developed for the proposed development. This plan includes 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 outside of the proposed operational hours will also be maintained at all times;
- The facility will have a high level of cleanliness. Outdoor surfaces will be swept and cleaned on a regular basis;

- 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 waste 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
- Wash water will drain to foul lines which in turn will direct into underground collection tanks. Wash water collected in these tanks will be periodically tankered off-site and brought to an appropriately authorized wastewater treatment plant for treatment. Due to the underground enclosed nature of the tanks no additional odour is predicted from them.

11.5.2.2 Operational Phase Dust Mitigation

Operations at the proposed facility will be undertaken in accordance with a dust control procedure. The implementation of this procedure will reduce the potential for excessive built up of dust generating wastes and debris on-site.

The site will operate on a clean as you go basis and will be regularly swept by a forklift sweeper. The roadsweeper vehicle possesses wetting capabilities in order to collect/remove and minimise dust and mud from yard and road surfaces. There will be an end-of-day clean up at the site to ensure that all sources of dust and litter are removed and to ensure that there is no off-site nuisance outside of normal operating hours.

Daily site inspections will be undertaken to ensure site cleanliness and prevent the generation of excessive levels of dust generating waste.

Wastes will only be accepted on-site in covered or enclosed vehicles.

The main dust generating waste which will stored on-site is Construction and Demolition waste. This waste will be stored either indoors in the MRF building or within an enclosed bay outdoors. Where necessary (I.e. on dry and/or windy days, or in the case of waste presenting on-site which is particularly light and dispersive) this waste will be lightly wetted to prevent dust generation.

Circulation routes will be wetted during dry and/or windy days to prevent dust generation as a result of traffic movements on-site. A strict 15 kph speed limit will also be in force on-site to prevent the generation of dust associated with harsh HGV and vehicle movements on-site.

Dust deposition monitoring will be undertaken on-site quarterly in accordance with the terms of the WFP and subsequent IE Licence in order to demonstrate that dust does not impact upon any off-site receptors.

Where dust monitoring shows a breach of the relevant dust deposition limit or where there is a complaint made to the site relating to dust generation, a non-conformance will be raised under the company's EMS, root cause analysis will be undertaken and corrective/preventative action will be implemented to identify the source of dust, reasons why dust is being generated and control measures to cease dust generation and prevent future occurrence of dust generation. A record of the above will be maintained for future reference.

11.5.2.3 Operational Phase Air Quality Mitigation

As operational phase impacts to air quality are predicted to be imperceptible no mitigation is proposed.

11.5.2.4 Operational Phase Climate Mitigation

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.

The proposed development will result in the sorting and recovery of C&D and MDR. These wastes will be sent onwards for either recycling or recovery. MSW entering the facility will be pre-treated and sent for energy recovery through incineration which has a significantly lower carbon footprint than landfill (during Phase 2 of operations). Through the diversion of these wastes from landfill. The TII Carbon Tool (TII, 2020) provides emissions for a number of waste types and destinations. The benefits of landfill avoidance is reflected in the substantially reduced emissions per tonne shown below:

Mixed Construction and Demolition Waste embodied carbon comparison:

- Recycled 1.00 kgCO2e per tonne;
- Incineration (With Energy Recovery) 2.00 kgCO2e per tonne;
- Landfill 285.00 kgCO2e per Tonne.

At 30,000 tonnes annually this is a saving of up to 8,520 Tonnes of CO_2 annually if the waste is recycled or incinerated rather than landfilled.

Paper and Cardboard Waste embodied carbon comparison:

- Recycled 21.35 kgCO2e per tonne;
- Incineration (With Energy Recovery) 21.35 kgCO2e per tonne;
- Landfill 1041 kgCO2e per tonne.

At 20,000 tonnes annually this is a saving of up to 16,550 Tonnes of CO_2 annually if the waste is recycled or incinerated rather than landfilled.

General Office 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 20,000 tonnes annually this is a saving of up to 15,682 Tonnes of CO_2 annually if the waste is recycled or incinerated rather than landfilled.

Therefore, while there is the potential to offset the construction embodied carbon of 1,437 Tonnes of CO_2 within the first months of opening of the proposed development. The operational carbon associated with power requirements will be offset by the waste diverted from landfill and sent for recycling/energy recovery due to the proposed development.

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.

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 2017 where the maximum off-site concentration is less than 1% of the guideline value 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 2017) the impacts are considered overall Not Significant and Long-Term.

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