7.0 AIR QUALITY AND CLIMATE

7.1 Introduction

7.1.1 Background

Golder Associates Ireland Ltd (Golder) have been commissioned to prepare this Air Quality and Climate Chapter as part of a remedial Environmental Impact Assessment Report (rEIAR) to assesses the impacts of the previous activities relating to the development and operation at Windmillhill, Rathcoole, Co. Dublin (the "Site") between 1990 and the present day. The existing Development use, owned by Laurence Behan (LBAR), is for the quarrying and production of aggregates and is registered in accordance with Section 261, Planning & Development Act 2000 (Quarry Ref. No. QS1054). This chapter considers the potential effects of the historic operation of the Site on air quality and climate.

The choice of team members for each study has been informed by the experience of the relevant lead specialist in their area of technical interest. The air quality and climate assessment has been prepared by Rachel Lansley (BSc, MSc). Rachel is a Chartered Scientist (CSci), a Member of the Institution of Environmental Sciences (IES), and a Member of the Institute of Air Quality Management (IAQM) and has more than 14 years' experience in air quality and climate assessment.

A detailed description of the Site and its location can be found in Chapter 2 of this rEIAR (Project Description).

7.1.2 Project Overview

This rEIAR has been prepared to accompany a substitute consent application for an existing quarry at Windmillhill, Rathcoole, Co. Dublin.

The substitute consent application is to be made concurrent with an application for further development of the quarry for extraction to be made under S.37L of the Planning and Development Act, 2000 as amended that is accompanied by an Environmental Impact Assessment report (EIAR).

The lands the subject of this rEIAR extend to 46.14 ha. that reflect historic operational Site information including the extractable area declared under S.261 quarry registration in 2005. The quarry area that makes up the application for substitute consent planning unit currently extends to approximately 28.8 ha. at the centre of the EIA project area that is generally bounded by the N7 to the north and the local Windmillhill Road to the south. The eastern and western EIA project boundaries are demarcated by the Windmillhill townland boundary that consists of field boundaries and the entrance to a dwelling called 'Four Winds' that is within the ownership of the substitute consent applicant to the east; and the former local Steelstown Road to the west.

The current quarry Site is accessed toward the centre of its northern boundary from the N7 and has been accessed from that road since grant of planning permission for stone quarrying on Site in 1968. The current quarry void is centrally located within the EIA unit and roughly rectangular is shape with an east – west orientation, parallel to the N7 and local Windmillhill Road. At the centre of the current quarry area is the existing administration and processing plant area over approximately 5 ha.

At baseline in 1990 the quarried area has been determined in the Land, Soils and Geology Section of this rEIAR to extend to 10.1 ha. and at 2021 to have expanded laterally to 28.8 ha. with an average working depth of 173 mAOD.

This section of the rEIAR considers and assesses potential significant effects resulting from quarrying related activities that have been carried out on the Site and on its surrounding environment.

7.1.3 Scope & Methodology

This chapter presents an assessment of the potential air quality and climate effects associated with the historic operation of the Site. The effects have been assessed in the context of relevant national, regional and local air quality policies.

A qualitative assessment of dust impacts from the quarrying activities has been undertaken in line with Institute of Air Quality Management (IAQM); Guidance on the Assessment of Mineral Dust Impacts for Planning, 2016. The detailed assessment is included in Appendix 7.1.

A traffic screening and quantitative operational phase assessment of effects from road traffic emissions has been undertaken in accordance with the Environmental Protection UK/Institute of Air Quality Management guidance document 'Land –Use Planning & Development Control: Planning for Air Quality' (EPUK/IAQM 2017). Detailed dispersion modelling using ADMS-Roads has been undertaken to determine the effect of the Proposed Development on traffic derived pollutants, nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), at nearby sensitive receptors. The detailed assessment is included in Appendix 7.2.

An assessment of combustion emissions from the on-Site asphalt manufacturing plant has been undertaken using the latest version (Version 5.2.2) of CERC ADMS5 dispersion modelling software, to predict concentrations of NO_x, NO_2, SO_2, PM_{10} and $PM_{2.5}$ at identified sensitive receptors. The detailed assessment is included in Appendix 7.3.

7.1.3.1 Operational Phase Significance Methodology

The Institute of Air Quality Management (IAQM) provides advice on descriptors of the impact of the change in air quality as a consequence of development (IAQM/EPUK 2017). The impact assessment criteria have been adopted in this study and are presented in Table 7.1.

Table 7.1: IAQM Impact Significance Descriptors

Long Term Average Concentration at Receptor	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	<1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110 or more of AQAL	Moderate	Substantial	Substantial	Substantial

The EPUK/IAQM guidance includes seven explanatory notes to accompany the assessment of effects. In particular, it is noted that descriptors are for individual receptors only and that the overall significance should be determined using professional judgement. Additionally, it is noted that it is *"unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainly which is why there is a category that has a range around the [AQS], rather than being exactly equal to it".*

The guidance sets out that a change in the predicted annual mean concentration of less than 0.5% (equating to 0.2 µg/m^3 for NO_2 and PM_{10}, and 0.12 µg/m^3 for $PM_{2.5}$) is considered negligible, regardless of the long-term average concentration. A negligible change would not be capable of having a direct effect on local air quality that could be considered to be significant.

The AQS values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, the elderly or the unwell. Therefore, the sensitivity of all identified receptors is considered equal and no further subdivision in terms of sensitivity is necessary.

The classification of all reported effects is then considered in overall terms. The potential for the development site to contribute to, or interfere with, the successful implementation of policies and strategies for the management of local air quality is considered, as relevant, but the principal focus is any change in the likelihood of maintaining future compliance with the AQS.

In terms of the consequences of any adverse effects, an effect is reported as being either 'not significant' or as being 'significant'. If the overall effect of the development site on local air quality and the majority of receptors within the study area is found to be 'moderate' or 'substantial' this will be deemed to be 'significant'. Effects found to be 'slight' at the majority of receptors within the study area are considered to be 'not significant', although they may be a matter of local concern. Effects classed are 'negligible' are considered to be 'not significant'.

7.1.4 Sources of Emissions to Air

7.1.4.1 Particulates

The main potential impact on ambient air quality associated with extraction activities and aggregate processing is that associated with deposition of dust generated by the rock extraction and material transfer operations.

Potential dust emissions associated with quarry workings are:

- Mechanical handling operations, including crushing and grading processes where in general the more powerful the machinery and the greater the volumes of material handled the greater the potential for dust emission;
- Haulage, where the weight of vehicles, their speed of passage and number of wheels in contact with the ground, and the nature and condition of road surfaces or haul routes affect the amount of dust emitted:
- Shot hole drilling;
- Blasting;
- Wind blow from paved areas, material stockpiles, unsurfaced internal haul roads and quarry floors; and
- Import of soils for quarry restoration including transport and void filling.

7.1.4.2 Traffic Emissions

Historical traffic data for the Site indicates that annual traffic movements were between 39 and 880 Annual Average Daily traffic (AADT) with 70% HDV movements. For conservatism, the maximum value of 880 AADT has been applied for each of the assessment years.

7.1.4.3 Combustion Emissions

The asphalt plant was manufactured by the Marini Fayat Group and has a maximum output capacity of 150 tonnes/hour. The asphalt plant process involves the coating of bitumen onto the surfaces of dried stone aggregates. Combustion gases including SO_2, NO_2, PM_{10} and $PM_{2.5}$ may have historically been emitted during the process.

7.1.4.4 Odour

Inert materials have historically been excavated from the Site, which are not odorous. There is the potential for minor odour emissions to have arisen from bitumen storage associated with the asphalt manufacturing plant. To control the emissions of bitumen fumes generated from the bitumen tanks, temperature control has been historically monitored in the production plant in accordance with BAT requirements. Regular inspections of the tank vents have been undertaken to ensure any odours are not detectable beyond the Site boundary. Therefore, odour emissions from the historical operation of the Site are considered Not Significant.

7.2 Policy & Legislation Context

7.2.1 European Air Quality Directives

The European Union (EU) Directive on Ambient Air Quality Assessment and Management came into force in September 1996 (96/62/EC) and defines the policy framework for 12 air pollutants known to have harmful effects on human health and the environment. Air quality limit values (ambient pollutant concentrations not to be exceeded after a given date) for the pollutants are set through a series of Daughter Directives. The first Daughter Directive (1999/30/EC) sets limit values for NO_2 and PM_{10} (amongst other pollutants) in ambient air.

Following the Daughter Directives, EU Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE) came into force in June 2008, consolidating the existing air quality legislation, making provision for Member States to postpone attainment deadlines and allowing exemption from the obligation to limit values for certain pollutants, subject to strict conditions and assessment by the European Commission. Directive 2008/50/EC was transposed into Irish legislation in 2011 through The Air Quality Standards Regulations 2011. The Directive merged the four daughter directives and EU Council decision into a single directive on air quality. The new Directive also introduced a new limit value for $PM_{2.5}$ but does not change the existing air quality standards.

7.2.2 National Air Quality Legislation

The Air Pollution Act (1987) is the primary legislation relating to air quality in Ireland and provides the means for local authorities to take the measures that they deem necessary to control air pollution.

The Air Quality Standards Regulations (2011) transpose the Directive on ambient air quality (2008/50/EC) into Irish law. These regulations establish limit values and thresholds for various pollutants in ambient air.

The Environmental Protection Agency (EPA) monitor the levels of various pollutants against the standards set out in EU and Irish legislation. The EPA are the competent authority for annual reporting to the Minister for the Environment, Heritage and Local Government and the European Commission.

7.2.3 Other Relevant Legislation

Legislative references considered specifically for the assessment of air quality and climate from quarrying activities, and relevant statutory instruments in a planning context include:

- European Communities (Environmental Impact Assessment Regulations) 1989 (S.I. No. 349 of 1989).
- Section 177F of the Planning & Development Act 2000 as amended.
- Directive 2014/52/EU of the European Parliament and of the Council, (amending Directive 2011/92/EU);
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, S.I. 296 of 2018; and
- Planning and Development Regulations 2001 (as amended).

Relevant statutory instruments in the context of quarrying include:

- Mines and Quarry Act 1965, 7 of 1965.

Legislative references considered specifically for the assessment of air quality and climate from combustion emissions include:

- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).

7.2.4 Relevant Guidance

This assessment has been undertaken with guidance from the 'Guidelines on the information to be contained in environmental impact assessment reports', published in 'draft' by the EPA in August 2017; 'Environmental Impact Assessment of projects, guidance on the preparation of the Environmental Impact Assessment Report' published by the European Commission in 2017 and, 'Advice Notes for Preparing Environmental Impact Statements', also published in 'draft' by the EPA in September 2015.

Other guidance documents considered in this assessment include:

- IAQM; Guidance on the Assessment of Mineral Dust Impacts for Planning, 2016;
- EPA; Guideline Document entitled Environmental Management in the Extractive Industries, 2006;
- EPUK; Land-Use Planning and Development Control: Planning for Air Quality, 2017;
- European Commission; Climate Change and Major Projects, 2016;
- South Dublin County Council; Climate Change Action Plan (CCAP) 2019-2024;
- Climate Action Plan, 2019;
- Irish Concrete Federation – Environmental Code 2nd Edition, October 2005;
- Environmental Management in the Extractive Industry, EPA 2004;
- Quarries and Ancillary Activities – Guidelines for Planning Authorities – DOEHLG, April 2004;
- Process Guidance Note 3/16 (04) – Secretary of State's Guidance for Mobile Crushing and Screening, DEFRA (UK), June 2004;
- Process Guidance Note 3/8 (04) – Secretary of State's Guidance for Quarry Processes, DEFRA (UK), June 2004;
- Safe Quarry – Guidelines to the Safety, Health and Welfare at Work (Quarries) Regulations 2005 – Health and Safety Authority, 2006; and
- Environmental Protection Agency's Annual Air Quality in Ireland Report 2013.

7.2.5 Air Quality Standards

Table 7.2 below shows the limit or target values, specified by the CAFE Directive 2008/50/EC, relevant to this assessment.

7.2.5.1 Gaseous Pollutants

Table 7.2: Air Quality Standards

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
		24 hours	125	Not to be exceeded more than 3 times in a calendar year
	Protection of vegetation	Calendar year	20	Annual mean
		1 Oct to 31 Mar	20	Winter mean
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year
		Calendar year	40	Annual mean
NO_2 + NO	Protection of ecosystems	Calendar year	30	Annual mean
PM_{10}	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year
		Calendar year	25	Annual mean
PM2.5 Stage 1	Protection of human health	Calendar year	25	Annual mean
PM2.5 Stage 2		Calendar year	20	Annual mean

7.2.5.2 Coarse Particulates

The impact of dust is usually monitored by measuring rates of dust deposition. According to the Environmental Protection Agency (EPA) Guideline Document entitled Environmental Management in the Extractive Industries (April 2006), applicable during the assessment period for this rEIAR, there are no Irish statutory standards relating specifically to dust deposition thresholds for inert mineral dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standards (TA Luft, 1986) specify a method of measuring dust deposition – the Bergerhoff Method (German Standard VDI 2119, 1972) – with dust nuisance.

On this basis, the EPA recommend a dust deposition limit value of 350 mg/m^2/day (Table 7.3)(when averaged over a 30-day period) be adopted at Site boundaries associated with quarrying related activities. This limit value has been applied in this assessment.

Table 7.3: Dust Limit Values

Procedures	Monitoring Frequency	Standard
Dust Emissions	Monthly	<350 mg/m^2/day; Bergerhoff Method

7.3 Existing Environment

7.3.1 The Site and Surrounds

Since 1990, the development use has been for the quarrying and production of aggregates located in Co. Dublin.

The surrounding lands are largely agricultural with varying degrees of intensity. There are a number of isolated houses and farmhouses along the N7 and to the south. During the assessment period, the nearest dwelling is 120 m to the south of the Site and the nearest school, which was developed in 1981, is located just over 1 km east of the Site in Rathcoole.

Rathcoole is a small town situated just off to the south of the N7 National Primary Route. The population of the town in accordance with the 2016 census is 4,351. There are primary schools and a second level community school. There are a number of shops and pubs in the area. There is a church at the north end of the town.

The quarry was first developed in the 18th century and expanded in the 1960s.

The Site boundary is detailed in Figure 7.1 below.

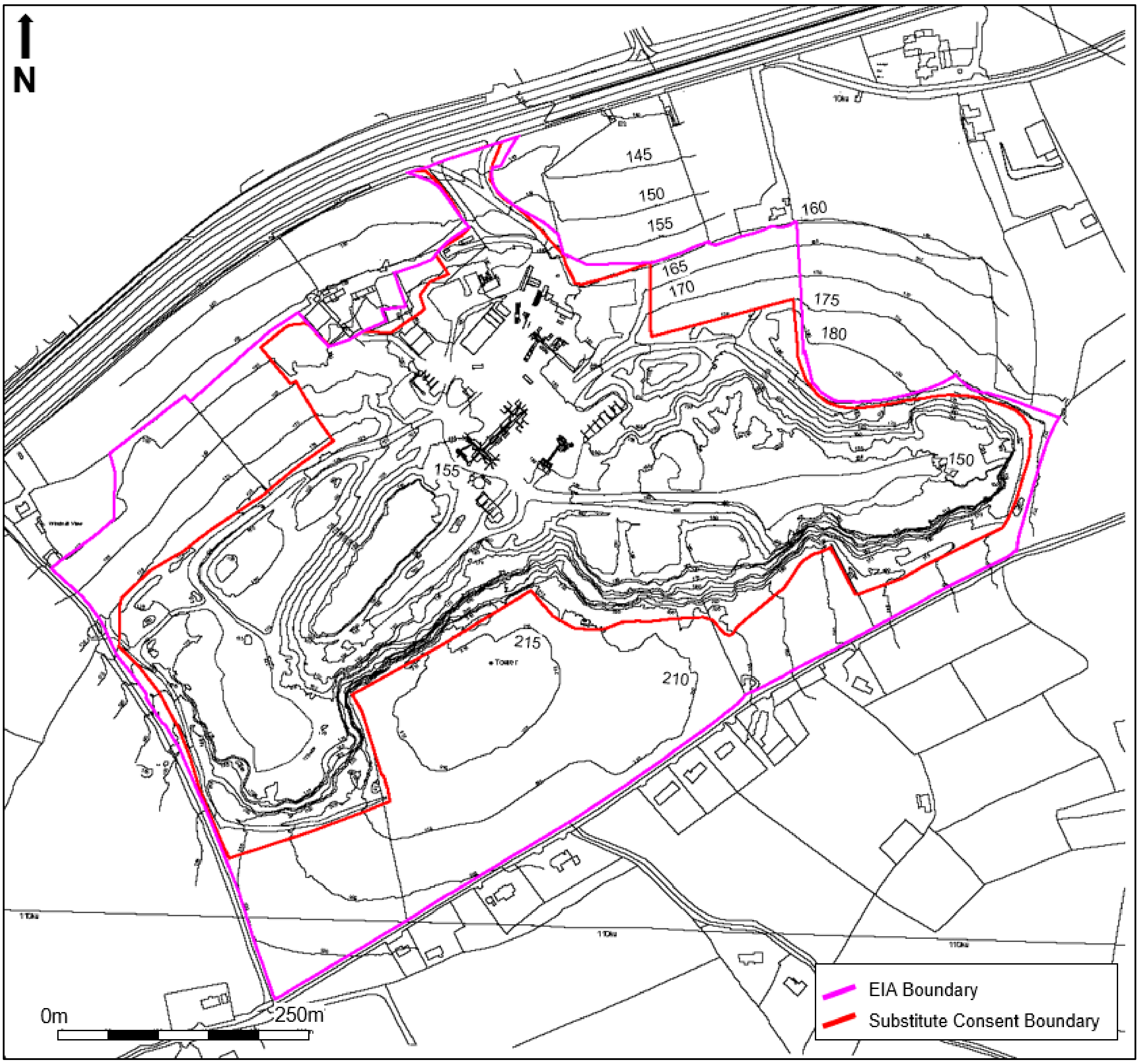

Figure 7.1: Plan showing Site with existing topography and lateral extent

7.3.2 Study Area

7.3.2.1 Particulates

It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are considered. The guidance states that it is commonly accepted that the greatest impacts from particulates will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of particulates on the access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016) has been considered. This guidance states that human receptors within 50 m of the routes used by vehicles for 350 m from the Site exit point should be considered. For this reason, the haul road has been subject to a 50 m buffer, which then extends 350 m out onto the N7 main road to account for the possibility of trackout from exiting vehicles. A 350 m length buffer has been applied from the point at which the Site exits onto the N7 public road.

7.3.2.2 Traffic Emissions

The study area for human receptors extends to 200 m either side of all 'affected roads' – i.e. those meeting the screening criteria set out in the EPUK/IAQM 2017 guidance.

For ecological receptors, Highways England's Design Manual for Roads and Bridges (DMRB) states that a quantitative impact assessment [of road source emissions] may be required if Natura 2000 Sites (e.g. SPAs and SACs) are within 200 m of affected roads. No such protected sites are located within 200 m of the 'affected roads' and therefore impacts of operational traffic on ecological receptors are deemed Not Significant.

7.3.2.3 Combustion Emissions

The study area for the modelling of combustion emissions from the operation of the asphalt manufacturing plant extends 200 m from the Site boundary and includes both residential and commercial receptors. As mentioned in Section 7.3.2.2 above, as there are no ecological receptors located in close proximity to the Site, a detailed assessment of ecological impacts resulting from combustion emission is not required and impacts have therefore been deemed Not Significant. The full assessment is contained in Appendix 7.3 of this report.

7.3.3 Receptors

All receptors present during 1990 to the present day have been included in the assessment.

Historical and current receptors identified for the purpose of the traffic assessment detailed in Section 7.3.2.2 above are shown in Figure 7.2. Historical and current receptors identified for the purpose of the assessment of particulates/ dust emissions and combustion emissions resulting from the previous operation of the quarry and the asphalt manufacturing plant are shown below in Figure 7.3. Three residential receptors located in the vicinity of the Site are owned by the applicant (LBAR properties).

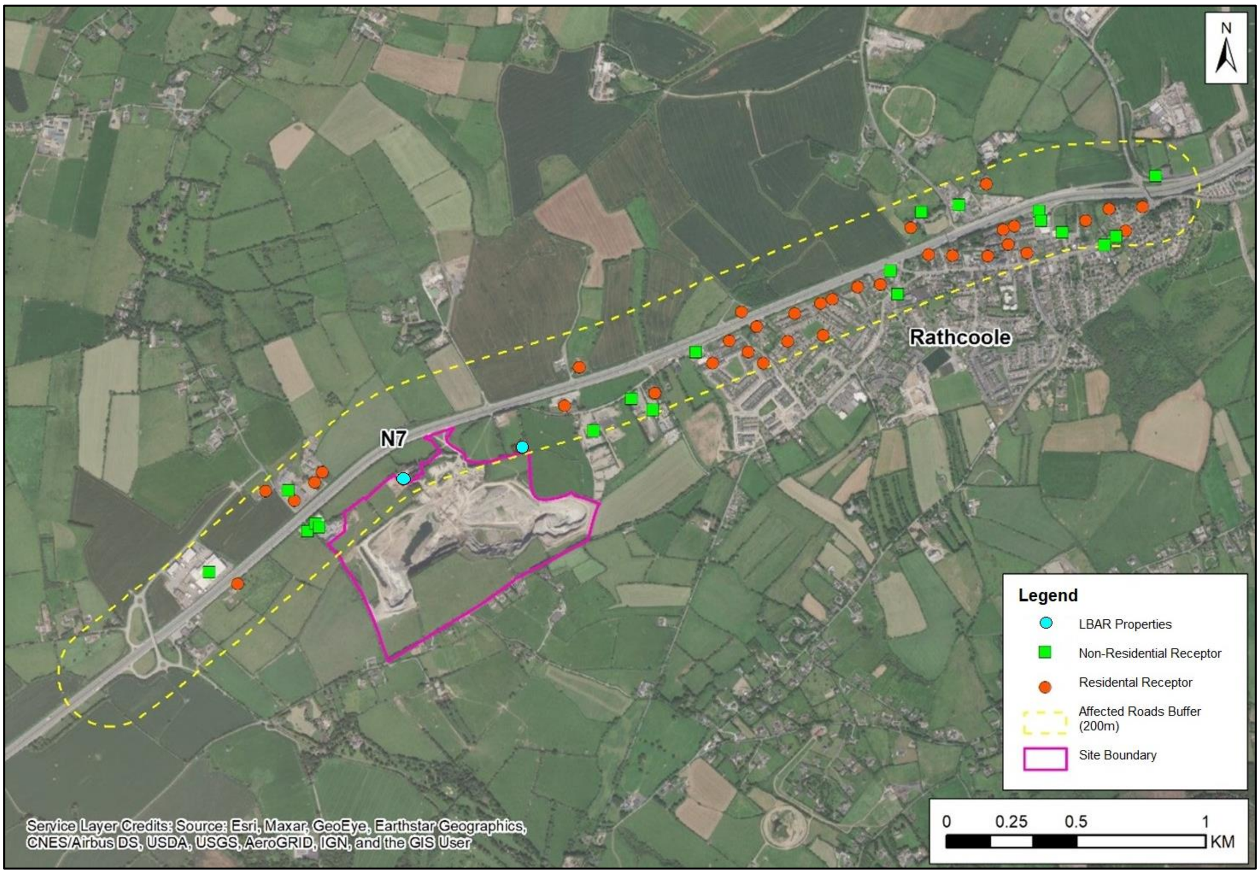

Figure 7.2: Plan showing identified Receptors within 200 m of affected roads.

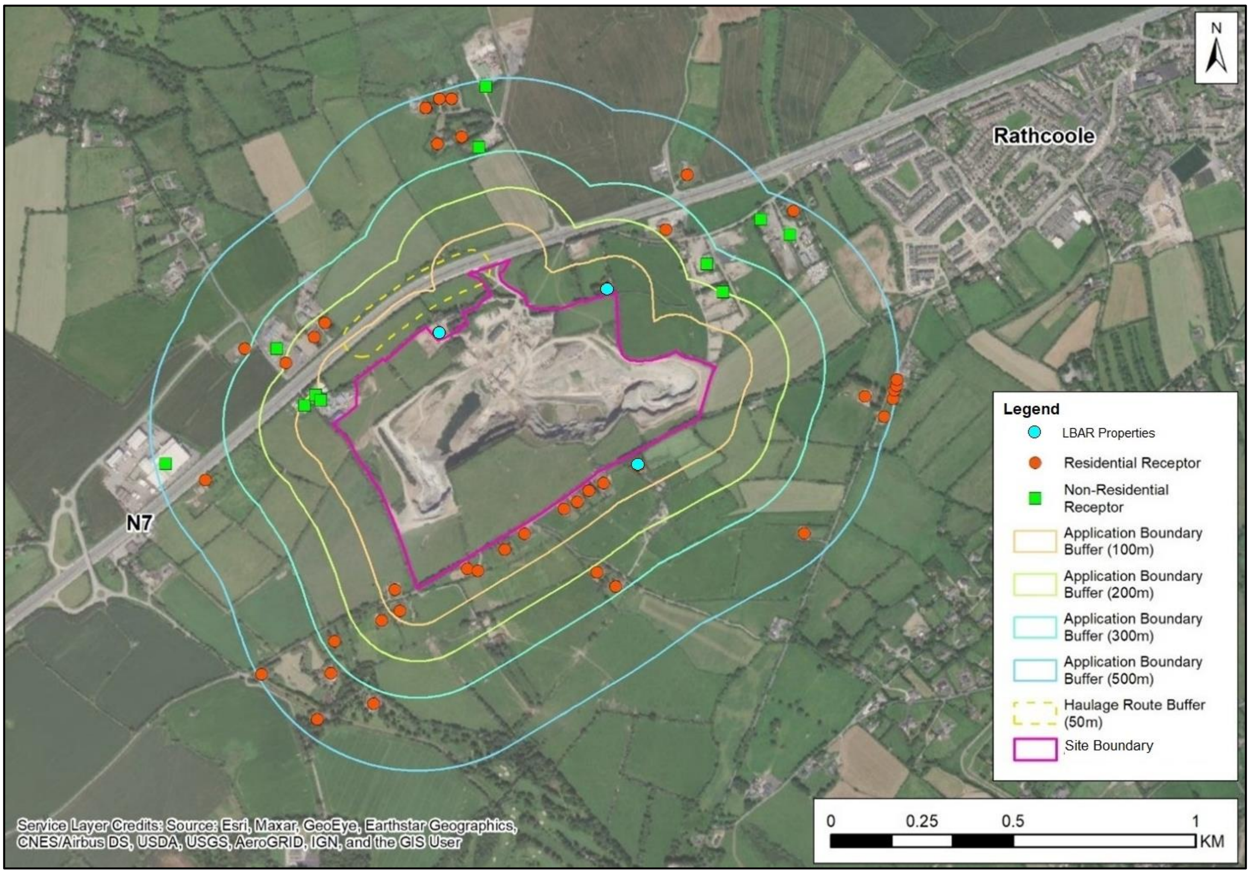

Figure 7.3: Identified Receptors within 500 m of the Site Boundary.

7.3.4 Climate at the Site

The Irish climate is subject to strong maritime influences, the effects decreasing with increasing distance from the Atlantic coast. The climate in the area of the Site is typical of the Irish climate, which is temperate maritime.

The closest and most representative Met Éireann station is located at Casement Aerodrome, Baldonnell, Co. Dublin, ca. 5.5 km northeast of the Site. Monthly historical data between 1990 and 2020 have been averaged and are presented in Table 7.4.

Table 7.4: Casement, Co. Dublin Monthly Averaged Monthly Climate Information 1990 to 2020.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Air Temperature (°C)	5.3	5.2	6.4	8.0	10.6	13.2	15.0	14.7	12.7	9.9	7.0	5.3
Maximum Air Temperature (°C)	12.9	12.6	14.5	17.2	20.6	23.0	23.9	23.2	21.4	17.6	14.6	13.0
Minimum Air Temperature (°C)	-4.1	-4.0	-3.2	-2.3	0.7	3.9	6.4	5.7	3.1	-0.1	-2.7	-4.6
Mean Maximum Temperature (°C)	8.2	8.3	10.0	12.1	14.9	17.4	19.1	18.8	16.6	13.3	10.0	8.2
Mean Minimum Temperature (°C)	2.4	2.1	2.8	3.9	6.4	8.9	10.9	10.6	8.7	6.6	4.1	2.5
Precipitation (mm)	65.5	52.4	46.8	50.7	54.5	62.4	55.4	68.5	57.9	81.1	80.3	73.7
Grass Minimum Temperature (°C)	-7.9	-7.3	-6.8	-5.2	-2.5	0.7	3.2	2.7	-0.2	-3.2	-5.7	-7.7
Mean Wind Speed (knots)	12.6	11.8	10.9	9.3	8.7	8.2	8.2	8.4	8.8	9.9	10.6	11.5
Highest Gust (knots)	56.9	50.9	48.6	45.7	41.6	37.8	36.7	38.1	41.8	45.9	48.2	53.3
Sunshine Duration (hours)	54.2	71.7	102.2	150.7	181.0	162.0	151.2	149.1	120.8	97.9	64.1	46.0

The information presented in Table 7.4 above provides an overview of the climatic conditions at the Site. Over the time period for which data is provided, the wettest months in terms of total rainfall for the period are October and November. High rainfall in these months provides natural dampening for potential dust emissions. The opposite impact occurs in dry and windy months, when there is increased potential for dust to be mobilised. The months with the highest mean wind speed are December to February and the driest months in the Site area are March and April.

An important meteorological parameter with regard to the dilution and dispersal of air pollutants is wind speed and direction. A full annual wind-rose for the Casement Aerodrome station is presented in Figure 7.4 for the period 01 January 2019 to 31 December 2020. The prevailing winds are from a south-westerly direction.

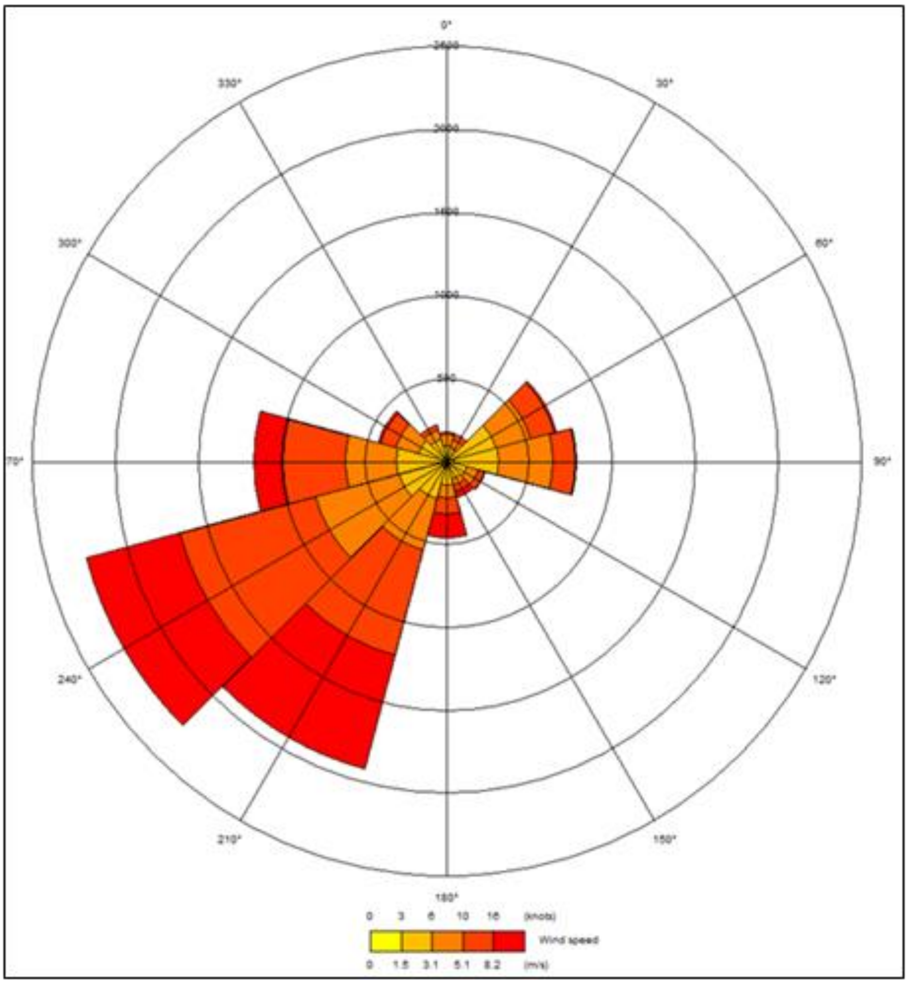

Figure 7.4: Annual dominant wind direction at Casement Aerodrome using Hourly Wind Data (Assessment Period 1 January 2019 to 1 December 2020)

7.3.5 Background Air Quality

7.3.5.1 Primary Data - Site Monitoring Data

Dust monitoring has been undertaken historically at the Site between 2007 and 2015, and more recently during 2020 and 2021, all using the Bergerhoff method at 4 different monitoring locations. Descriptions of the dust monitoring locations are presented in Table 7.5 and their locations are shown in Figure 7.5.

Table 7.5: Description of Dust Monitoring Locations

Location	Description
D1	Located at the north of the Site along the access road.
D2	Located between the N7 and north west corner of the Site
D3	Located at the eastern tip of the Site.
D4	Located south of the Site adjacent to the residential dwellings.

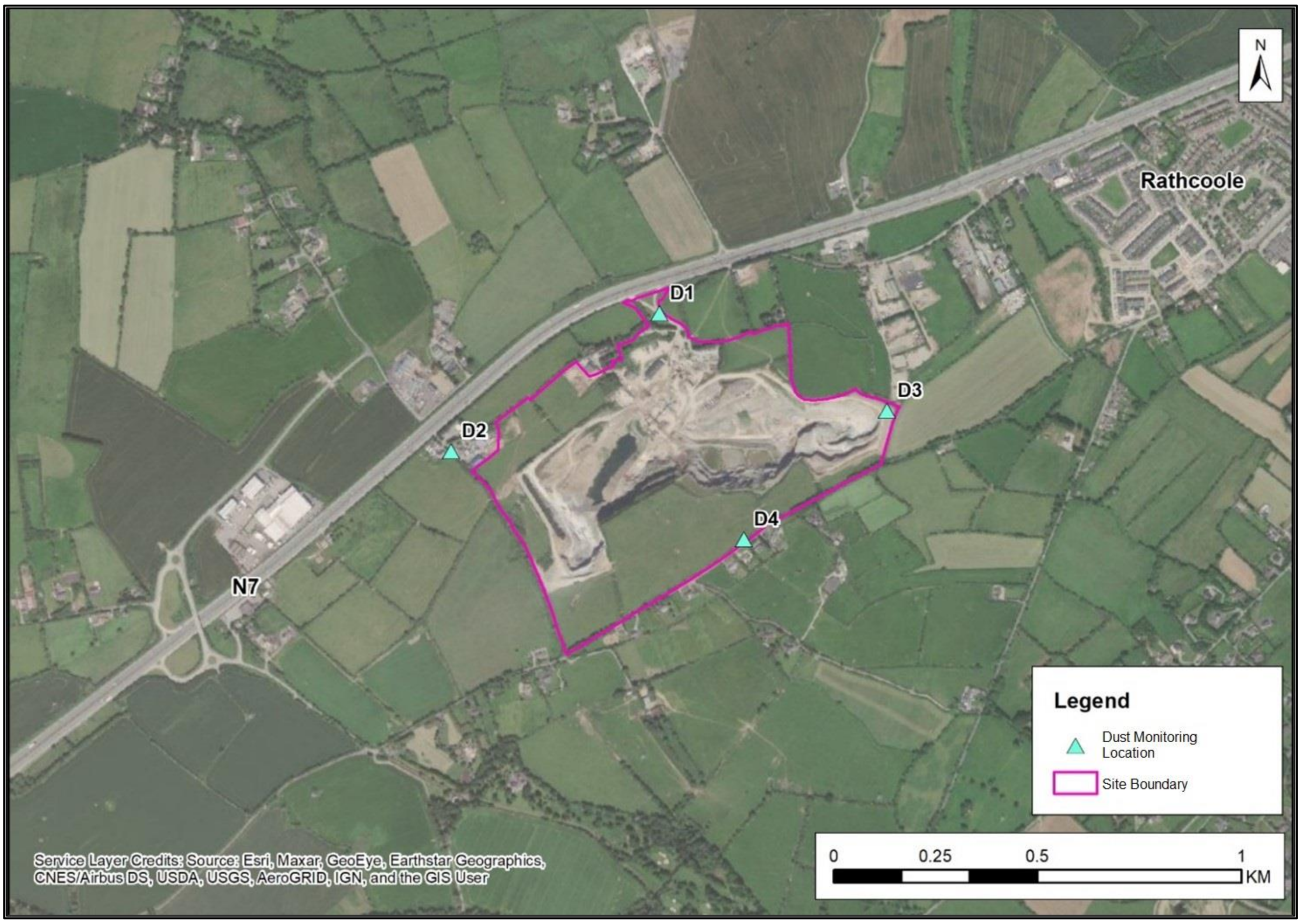

Figure 7.5: Plan Showing Dust Monitoring Locations

The historical dust deposition monitoring undertaken at the Site used Bergerhoff dust gauges. The recommended dust deposition limit value when using the Bergerhoff method is 350 mg/m^2/day, as specified in Table 7.3 of this assessment. This value is recommended by the EPA in their guidance - Environmental Management in the Extractive Industries (April 2006). The results of monitoring for 2007 to 2015 are shown in Table 7.6 and Figure 7.6. Additional monitoring was undertaken in 2020 and 2021 by independent laboratories over two periods, using standard Bergerhoff gauges. The results of this monitoring are shown in Table 7.7 and are also included in Figure 7.7.

Table 7.6: 2007-2015 dust deposition monitoring results

Year	Dust Deposition Rate Annual Range (mg/m^2/day)
2007	56-348
2008	49-207
2009	49-121
2010	69-125
2011	56-101
2012	52-84
2013	59-159
2014	49-210
2015	48-137

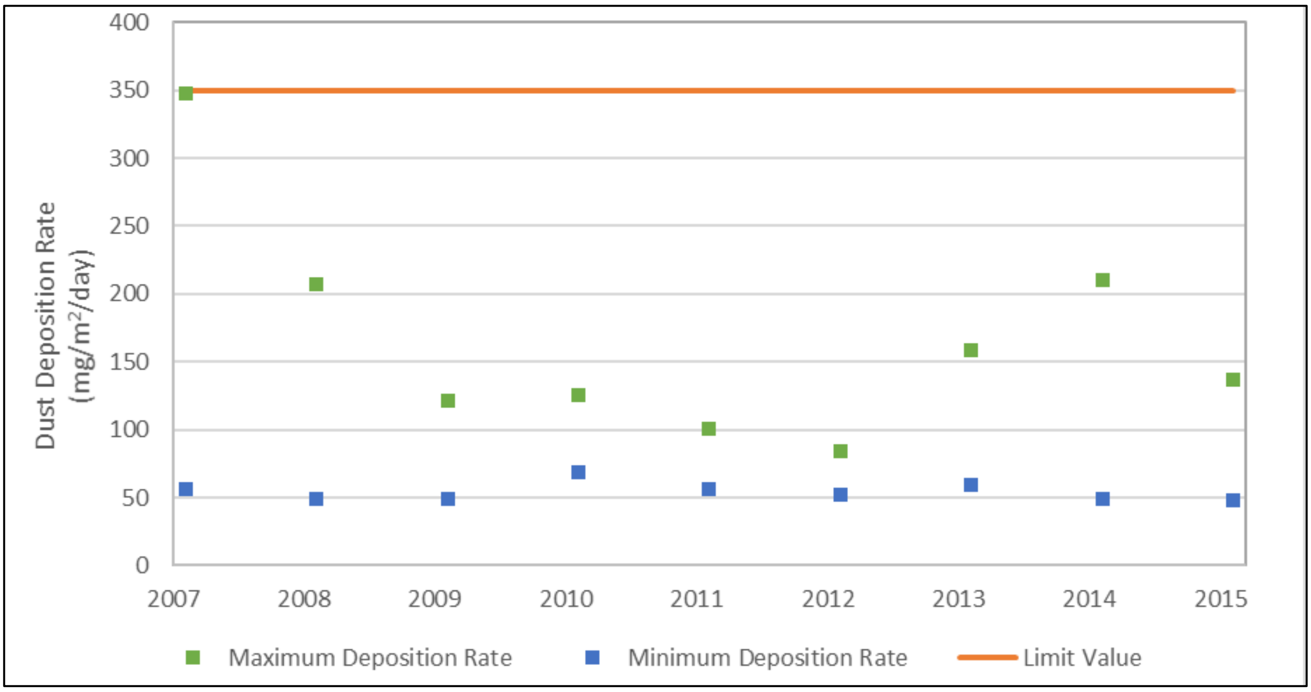

Figure 7.6: 2007-2015 dust deposition monitoring results

Table 7.7: Recorded Deposited Dust (mg/m^2/day) at Monitoring Locations during 2020/2021

Monitoring Period	Monitoring Location			
	D1	D2	D3	D4
04/03/20 – 03/04/2020	85	341	*	146
03/04/2020 - 30/04/2020	61	88	183	39
19/06/2020 - 20/07/2020	675.7	61.9	*	404.3
10/09/2020 – 09/10/2020	424.9	203.0	520.3	56.4
07/12/2020 – 11/01/2021	141.9	46.0	71.8	224.2
11/01/2021 – 10/02/2021	110.1	97.4	67.8	54.4

* Sample contamination meaning results are not reported.

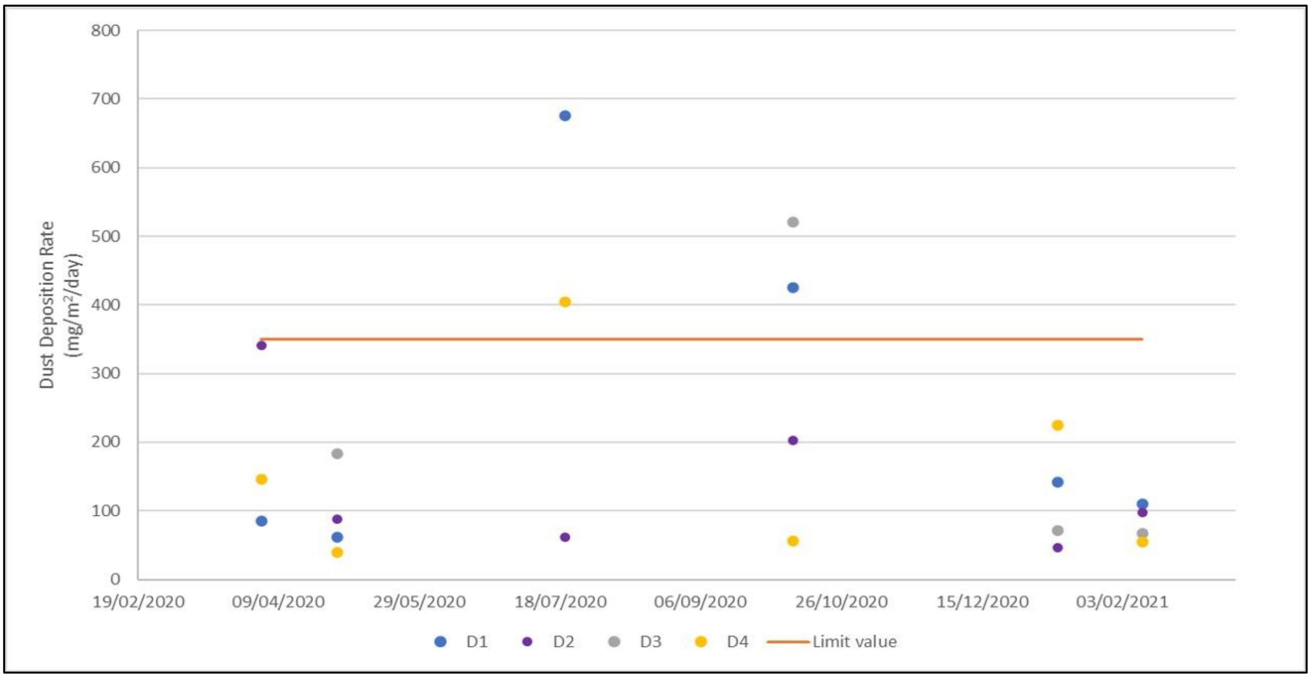

Figure 7.7: 2020/2021 dust deposition monitoring results

7.3.5.1.1 Commentary on Concentrations greater than the Limit Value

Between 2007 and 2015 all values are below the daily limit value of 350 mg/m^2/day, however during the 2020 sampling four samples are greater than the limit value. Two occur during the sampling period 19/06/2020 - 20/07/2020 at location D1, with a value of 675.7 mg/m^2/day, and D4, with a value of 404.3 mg/m^2/day. Two occur during the sampling period 10/09/2020 – 09/10/2020 at location D1, with a value of 424.9 mg/m^2/day, and at D3, with a value of 520.3 mg/m^2/day.

The monitoring was undertaken during national lockdown due to COVID-19, when there were reduced personnel on Site. Potentially reduced work practices and dust suppression coupled with the dry weather may have contributed to the high concentrations.

7.3.5.2 Secondary Data - EPA Monitoring

There are 4 air quality zones in Ireland, defined for the purposes of air quality management and assessment. Highly populated areas are classified as Zone A, with sparsely populated areas as Zone D. The Site is located in a semi-rural area bordering the Greater Dublin area, and it is therefore deemed reasonable to characterise the area as a Zone C area due to its location. A review of publicly available information identifies that the Irish EPA do not operate background air quality monitoring within Rathcoole or the immediate surrounds.

A review of publicly available information identifies that the Irish EPA historically undertook background monitoring at three Zone C locations; Celbridge (8 km north of the Site), Naas (12 km south west of the Site) and Newbridge (22 km south west of the Site) in Kildare. None of these are currently active and none are located in the vicinity of the Development. The most recent monitoring was undertaken at Celbridge, located approximately 8 km north from the Development, although monitoring at this location ceased in 2011. The last reported data from EPA, Ambient Air Monitoring at Celbridge Co. Kildare 12th July 2010- 10th April 2011 (http://www.epa.ie/pubs/reports/air/monitoring/ambientairmonitoringcelbridge.html) is summarised in Table 7.8 below. No $PM_{2.5}$ monitoring was undertaken at this location.

Table 7.8: 2010/ 2011 Background Monitoring Data for PM_{10} at Celbridge

	Averaging period	Concentration (µg/m³)
PM_{10}	Annual Average	19.5
	90.4%ile daily average	37.3

In the absence of local background data, the most recent annual mean data (2019) and historical data for NO_2, NO_x, SO_2, PM_{10} and $PM_{2.5}$ from suburban monitoring locations in Zone C areas throughout Ireland are presented in Table 7.9. These locations are part of the EPA National Ambient Air Quality Monitoring Network and data is reported to Europe. All monitored concentrations are below the annual AQS. Due to the location of these monitoring sites throughout Ireland and not in the vicinity of the Site, the average of the available historical data is reported and used in the assessment.

Table 7.9: Annual Mean Monitoring Data for Suburban Dublin Zone C Stations

	Year	Monitoring Location	Concentration (µg/m³)
NO_2	2019	Meath Navan	23
		Portlaoise	11
	2010	Celbridge	12
	2007	Navan*	16
	Average		**15.5**
NO_x	2019	Meath Navan	72.5†
		Portlaoise	14.8
	2010	Celbridge	17
	2007	Navan*	32
	Average		**21.3**
SO_2	2019	Portlaoise	1.3
	2010	Celbridge	2
	2007	Navan*	4
	Average		**2.4**
PM_{10}	2019	Portlaoise	15
		Carlow Town	11
	2010	Celbridge‡	18
	2007	Navan*	23
	Average		**16.8**
$PM_{2.5}$	2019	Carlow Town	8
		Meath Navan	11
	Average		**9.5**

* Zone D in 2007. Measurements undertaken by mobile monitoring in 2007.

†Data omitted due to extreme concentration when compared to NO_2 value and other Zone C NO_x values.

‡Data different to Table 11 as only 2010 data considered.

Data from: https://www.epa.ie/pubs/reports/air/quality Accessed 3/3/21.

7.4 Assessment Methodology

7.4.1.1 Particulates

The IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning (2016) has been used for assessing the impacts of deposited dust. It follows a standard source-pathway-receptor methodology.

The residual source emissions are characterised based on the scale of the operations and the Site activities and are classified as either small, medium or large. Guidance on the appropriate scale of the residual source is provided in the IAQM guidance, Appendix 4 (2016). This source characterisation includes consideration of the routine management and mitigation measures which have or will be undertaken at the Site.

The pathway from the source to the receptor is assessed considering the distance and direction of receptors to the source relative to the prevailing wind and local meteorology. The local meteorological data is also used to assess the frequency of the winds in each direction. It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are considered. The guidance states that it is commonly accepted that the greatest impacts will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of the access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016) has been considered. This guidance states that human receptors within 50 m of the routes used by vehicles for 350 m from the Site exit point should be considered. For this reason, the haul road was subject to a 50 m buffer, which extended 350 m out onto the N7 main road to account for the possibility of trackout from exiting vehicles. For conservatism, a 350 m length buffer was applied from the point at which the Site exits onto the N7 public road.

The full assessment is provided in Appendix 7.1 of this report.

7.4.1.2 Traffic Emissions

A traffic screening and quantitative operational phase assessment of effects from road traffic emissions has been undertaken in accordance with the Environmental Protection UK/Institute of Air Quality Management guidance document 'Land –Use Planning & Development Control: Planning for Air Quality' (EPUK/IAQM 2017). Detailed dispersion modelling using ADMS-Roads has been undertaken to determine the effect of the historical operation of the Site on traffic derived pollutants, nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), at nearby sensitive receptors. The detailed assessment is included in Appendix 7.2.

7.4.1.3 Combustion Emissions

Combustion emissions from the on-site Asphalt Plant were modelled previously as part of the rEIS in 2013. The modelling was undertaken using Breeze Screen3 software and screened the predicted emissions of SO_2, NO_2 and particulate matter against the relevant air quality standards. The results of this modelling concluded that under a worst-case scenario where the maximum emissions were used, the asphalt stack would not exceed the specified air quality standards and therefore would not cause adverse impacts on local air quality.

For the purposes of this rEIAR, the asphalt stack emissions have been re-modelled using the latest version (Version 5.2.2) of the CERC ADMS5 Air Dispersion Model software. The assessment has considered the Emission Limit Values (ELVs) for the asphalt stack so as to provide a conservative scenario for previous emissions and has used meteorological data from Casement Aerodrome for 2020.

The full assessment is provided in Appendix 7.3 of this report.

7.4.1.4 Combined Emissions

The output of the assessment of each of the three sources will be combined with the background data and compared to the relevant AQS to consider the cumulative impacts of all of the Site activities when operational at the same time.

7.5 Potential Effects

7.5.1.1 Particulates

7.5.1.1.1 Coarse Particulates

An assessment of the potential effects of deposited dust from the operation of the Site between 1990 and the present day is provided in Appendix 7.1 of this report. This assessment has been undertaken in accordance with the IAQM Guidance on the Assessment of Mineral Dust Impacts for Planning (2016), as described in Section 7.4.1.1 above.

The assessment defined residual source classifications to activities on Site since 1990 and used these to assign a magnitude to the dust effects likely to have been experienced at identified receptors. Consideration was given to mitigation measures which have consistently been in place. Based on the magnitude of dust effects and the mitigation employed on Site, an overall significance of the effects of dust was assigned to key sources: excavation, transfer on haul roads, transfer on public roads, and dust from on-site processing. For each of these sources, the significance for Site activities since 1990 was defined as 'moderate' without mitigation, and 'slight' with the employed mitigation.

Dust impacts during the construction phase (i.e. initial stripping of overburden) may have had the potential to have been greater than those experienced during the operation phase. This is due to the nature of the materials, as soils contain finer particulates than rock and therefore can be carried further in the air. However, as mentioned, the mitigation measures employed at the Site have been in place, and therefore it is not expected, and neither is there evidence for, there being an increased impact during the construction phase.

With the application of the site-specific mitigation measures, it is therefore considered that the residual effects associated with the operation of the Site since 1990 have been Not Significant.

7.5.1.1.2 Fine Particulates

The IAQM recommend that if the PM_{10} background concentration is less than 17 µg/m^3 there is little risk that the process contribution (PC) from the Site would lead to an exceedance of the annual-mean objective. The background data from other equivalent Zone C areas is detailed in Section 7.3.5.2. The annual average of the historic Zone C stations is 16.8 µg/m^3 which is less than 17 µg/m^3. It is unlikely that the PC from the Site would lead to an exceedance of the AQS.

Fine particulate PC can be assessed using the calculation of concentration with distance from source as detailed in LAQM TG03. The guidance document also states that the likely PM_{10} contribution from fugitive dusts, stockpiles, quarries and construction is variable but up to 5 µg/m^3. Therefore, the likely concentration at the receptor locations can be estimated using the calculation considering the distance from source. As $PM_{2.5}$ is a sub-fraction of PM_{10}, the contribution of $PM_{2.5}$ will be lower but if it is conservatively assumed that all of the PM_{10} is $PM_{2.5}$, the increase in concentration due to the changed location of the extraction area is low.

When combining the likely concentration with the average historical background value (16.8 µg/m^3) for Zone C areas, the maximum annual PM_{10} predicted environmental concentration (PEC) would be 18.3 µg/m^3 which is approximately 73% of the AQS and the annual $PM_{2.5}$ PEC would be 73% of the Stage 1 AQS and 91% of the Stage 2 AQS, at the closest receptor (which is owned by the applicant). For the closest privately owned receptor the PEC would be 71% of the PM_{10} AQS. The PEC would be less than this for all other receptors in the vicinity of the Site. The PEC is predicted to be below the annual AQS, with headroom. The impact from fine particle

PC from the Site is considered to be Negligible to Slight prior to mitigation which would reduce to negligible due to the mitigation measures employed historically by the Site.

7.5.1.2 Traffic Emissions

Following a traffic screening using the criteria defined in the Environmental Protection UK/Institute of Air Quality Management guidance document 'Land –Use Planning & Development Control: Planning for Air Quality' (EPUK/IAQM 2017) a detailed assessment of air quality impacts from traffic was required. An air dispersion modelling assessment is provided in Appendix 7.2 of this report. It uses the latest version of CERC ADMS-Roads (5.0.0.1) dispersion modelling software, to predict concentrations of NO_2, PM_{10} and $PM_{2.5}$ at identified sensitive receptors between 1990 and 2020 (the last full year of assessment).

The assessment follows the methodology set out in Defra's Local Air Quality Management Guidance (LAQM 2018) and quantifies total pollutant concentrations for the following scenario:

- 1990 - 2020 Scenario: assuming 2020 vehicle emissions data, the maximum historical background pollutant concentrations and modelled using 2020 meteorological data as the most recent full calendar year available.

The modelling results show that for the 1990 - 2020 Scenario, which used the highest AADT traffic data in this period, the predicted annual NO_2 PC is no more than 0.09 µg/m^3 across the Study Area.

For PM_{10}, the model results indicate a predicted annual PC of no more than 0.03 µg/m^3 across the Study Area.

For $PM_{2.5}$, the model results indicate a predicted annual PC of no more than 0.02 µg/m^3 across the Study Area.

The change in traffic linked to the historical operation of the Site had an impact on air quality but has not significantly change the pollutant concentrations in the area:

- For NO_2, the model indicates that concentrations have historically been below the annual mean objective of 40 µg/m^3 for all receptors, with worst case concentrations below 58% of the AQS. As the PC is less than 0.5% of the AQS, the predicted impact is classified as negligible.
- For PM_{10}, the model indicates that concentrations have historically been below the annual mean objective of 40 µg/m^3 for all receptors, with concentrations below 58% of the AQS. As the PC is less than 0.5% of the AQS, the predicted impact is classified as negligible.
- For $PM_{2.5}$, the model indicates that concentrations have historically been below the annual mean objective of 25 µg/m^3 for all receptors, with concentrations below 45% of the AQS. As the PC is less than 0.5% of the AQS, the predicted impact is classified as negligible.

7.5.1.3 Combustion Emissions

Combustion emissions from the historical operation of the asphalt manufacturing plant were modelled using the CERC ADMS5 Air Dispersion Modelling software as outlined in Section 7.4.1.3.

The results of the modelling presented in Appendix 7.3 show that the maximum predicted off-Site concentrations for hourly SO_2, hourly NO_2, annual NO_2, 24-hourly PM_{10}, annual PM_{10}, and annual $PM_{2.5}$ are all below the relevant AQS limit values. This means that there has been no unacceptable or significant impact at any off-Site location within the modelled domain as a result of the operation of the plant between 1990 and the present day.

The results of the modelling for 24-hourly SO_2 predict that, the maximum off Site concentration may have been greater than the relevant AQS limit value, with the maximum modelled PEC being 166.7% of the relevant AQS limit of 125 µg/m^3. The gridded receptor location where this concentration was predicted to have occurred is situated along the northern Site boundary, to the east of the access road. It is noted that there are a small number of other gridded off-Site receptors where the predicted concentrations of 24-hourly SO_2 were also greater than the AQS. These are all located in the same area as the maximum modelled concentration and are either at the Site boundary, or within a maximum distance of 128m from the Site boundary. It is further noted that none of the gridded receptor locations with predicted concentrations exceeding the AQS are located near any of the identified historical or current discrete sensitive receptors, and there are no exceedances of the AQS at any of the discrete receptor locations. The shortest distance between a sensitive (residential) receptor, and an identified gridded receptor point with a predicted 24-hour average SO_2 concentration above the AQS is approximately 528 m.

In terms of the significance of the modelled exceedances in 24-hourly SO_2, it is noted that at this averaging period, a person would have required the full 24-hour exposure time at one of the exceeding locations in order to have been subject to the predicted concentration of SO_2. Due to the location of the exceeding gridded receptor points, which are either on the Site boundary or within a maximum distance of 128 m from the Site boundary and at least 528 m from any sensitive receptors, it is considered very unlikely that a person would have been in any of these locations for a period of 24 hours. The gridded receptor locations identified as exceeding the AQS are also not located along a public footpath or right of way, so no direct permissible access would have been possible, even for a shorter time period. It is noted that the predicted 1-hour average concentrations of SO_2 are not outside of the relevant AQS limit value at any off-Site gridded or sensitive receptor. This means that any short-term presence at the gridded receptor locations exceeding the 24-hour limit value would not have had any associated risk for human health. Also, this assessment is very conservative. The model uses both the maximum emission limit values as the emitted concentrations, and the asphalt plant is modelled as having been operational for 365 days a year on a 24 hour basis (where in reality it would have only been operational during the Site operating hours of 5.00 am and 21.00 pm Monday to Friday and between 5.00 am and 14.00 pm Saturday, with no activities occurring during Sundays and Bank Holidays). Considering all of the above information, the predicted exceedances of the specified AQS for 24-hour SO_2 at a limited number of gridded receptor points which are either in close proximity to or on the Site boundary are not considered to have posed an unacceptable risk to human health, given both the conservative nature of the model and the inaccessible locations at which these higher concentrations are predicted at.

7.5.1.4 Combined Effects

This assessment has considered the potential emissions to air and impacts on receptors from particulates, traffic emissions and combustion emissions from each source. As these activities will be undertaken at the same time, there is a need to consider the potential combined/ cumulative impacts of these. In accordance with the significance criteria in Table 7.1, the impact is assessed in Table 7.10 and Table 7.11 for the annual impacts on the nearby sensitive receptor locations. Two receptors have been considered as the closest residential receptor is owned by the applicant.

Table 7.10: Assessment of Significance at Closest residential Receptor (owned by Applicant)

Assessment	Annual PM_{10} (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual NO_2 (µg/m^3)
Fine Particulates	1.5	1.5	n/a
Traffic Emissions	0.03	0.02	0.09
Combustion Emissions	6.42	6.42	7.15
Total PC	7.95	7.94	7.24
PC as % of AQS	32	32	18
Background	16.8	9.5	15.5
Background % of AQS	67	38	39

Assessment	Annual PM_{10} (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual NO_2 (µg/m^3)
PEC (PC + background)	24.75	17.44	22.74
AQS	25	25	40
PEC as % of AQS	99	70	57
Impact (prior to mitigation)	Moderate	Moderate	Moderate

Table 7.11: Assessment of Significance at Closest residential Receptor (not owned by Applicant)

Assessment	Annual PM_{10} (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	Annual NO_2 (µg/m^3)
Fine Particulates	0.9	0.9	n/a
Traffic Emissions	0.03	0.02	0.09
Combustion Emissions	0.82	0.82	3.56
Total PC	1.75	1.74	3.65
PC as % of AQS	7	7	9
Background	16.8	9.5	15.5
Background % of AQS	67	38	39
PEC (PC + background)	18.55	11.24	19.15
AQS	25	25	40
PEC as % of AQS	74	45	48
Impact (prior to mitigation)	Slight	Slight	Slight

The closest residential receptor is owned by the applicant. All other receptors are either located upwind (and therefore or located downwind but further away from the receptor assessed in Table 7.11. The assessment of impacts demonstrates that there will have been an impact on Air Quality during the historic operation of the Site but the impact will have been slight or less. Due to the conservative nature of the assessment which has been undertaken it is likely that the impacts will have been negligible to slight. Therefore, the historic operation of the Site is considered to be Not Significant in terms of Air Quality.

7.6 Climate Factors

The Behans Development is not considered to be of a sufficient scale to have had the potential to impact the regional or local climate in any significant manner. In addition, the operation of plant and traffic movements at the Site are estimated to have generated less than 11.39 kt CO2e per annum, equalling approximately 342 kt CO_{2e} over the 30- year assessment period. The Site has not had any significant effects on local prevailing weather conditions, nor has the Development increased the potential of flooding in the surrounding area. Therefore, the historical impacts on climate and climate change are considered to be Not Significant.

7.7 Cumulative Effects

The assessment of impacts on air quality and climate considers the potential historical cumulative impacts. The assessment of combustion emissions from the asphalt plant, traffic emissions and the combined emissions from all of the emission sources uses background data which accounts for the cumulative impact of the Site activities and any developments occurring in the vicinity during the assessment period.

With regard to cumulative impacts of dust emissions, research has shown that the greatest proportion of dust predominantly deposits within the first 100 m away from the source (The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO 1995) as dust has a higher deposition velocity than finer particles (i.e. PM_{10} and $PM_{2.5}$). The finer particles of less than 10 microns aerodynamic diameter may remain airborne for longer and therefore travel larger distances, although a large proportion may still deposit within 200 m of the source. There are no other identified operations in close proximity to the Site which may have generated significant dust emissions.

7.8 Summary & Conclusion

This rEIAR chapter has assessed the potential impacts of the operation of the Site between 1990 and the present day on Air Quality and Climate. The possible sources of emissions to air were identified as particulates, traffic emissions, and combustion emissions resulting from the operation of the on- Site asphalt manufacturing plant.

The impact of coarse particulates (dust) on the surrounding area as a result of the previous activities at the Site is considered to have been 'slight' and therefore Not Significant. The assessment considered the employed mitigation measures which have been and will continue to be in place. With regards to fine particulates, it is considered that there may have been the potential for an increase in PM_{10} and $PM_{2.5}$ concentrations at the residential receptors downwind in the vicinity of the Site, due to the moving of the extraction area, but the PEC is still predicted to be below the annual AQS, with headroom. The impact of fine particle PC from the Site is therefore considered to be imperceptible and therefore Not Significant.

The assessment of traffic impacts predicted that vehicle movements associated with the historical operation of the Site has had an impact on air quality but has not significantly changed the pollutant concentrations in the area. In all cases the predicted change in air quality concentrations is considered negligible.

The impact of the previous operation of the asphalt manufacturing plant on the surrounding area is predicted to have likely been Not Significant, as the maximum predicted off-Site concentrations for hourly SO_2, hourly NO_2, annual NO_2, 24-hourly PM_{10}, annual PM_{10}, and annual $PM_{2.5}$ are all below the relevant AQS limit values. This means that there has been no unacceptable impact at any off-Site location within the modelled domain as a result of the operation of the plant between 1990 and 2021. An exceedance of the 24-hour SO_2 AQS was predicted, however given both the conservative nature of the model assessment and the inaccessible locations at which these higher concentrations were predicted, it is considered unlikely that any unacceptable impact has resulted in the affected areas.

When considering all of the emissions to air associated with the historical operation of the Site, the historical impacts are considered to be Not Significant.

APPENDIX 7.1

Dust Assessment

DUST ASSESSMENT

1.0 INTRODUCTION

1.1 Background

This appendix supports the Air Quality chapter of the rEIAR and considers the potential effects of historical activities relating to the development and operation at Windmillhill, Rathcoole, Co. Dublin (the "Site") on the receiving (air) environment between 1990 and the present day.

The existing Development use, owned by L. Behan Aggregates & Recycling Ltd (LBAR), is for the quarrying and production of aggregates and is registered in accordance with Section 261, Planning & Development Act 2000 (Quarry Ref. No. QS1054).

1.2 Report Context

This report forms an Appendix to the rEIAR Air Quality Assessment and should be read in conjunction with that report.

The report sets out a qualitative assessment of dust impacts (coarse particles for deposited dust and fine particles for human health) from the historical operation of the Site, which has been undertaken in line with IAQM 'Guidance on the assessment of Mineral Dust Impacts for Planning (IAQM 2016).

2.0 ASSESSMENT METHODOLOGY

The following section details the IAQM methodology used for assessing the impacts of deposited dust and fine particulates from the extraction activities. It follows a standard source-pathway-receptor methodology.

The residual source emissions are characterised based on the scale of the operations and the Site activities and are classified as either small, medium or large. Guidance on the appropriate scale of the residual source is provided in the IAQM guidance, Appendix 4 (2016). This source characterisation includes consideration of the routine management and mitigation measures which will be undertaken at the Site.

The pathway from the source to the receptor is assessed considering the distance and direction of receptors to the source relative to the prevailing wind and local meteorology. The local meteorological data is also used to assess the frequency of the winds in each direction. It has been found that deposited dust does not generally travel beyond 400 m (IAQM, Appendix 2, 2016), therefore all receptors within 500 m of the Site boundary are considered. The guidance states that it is commonly accepted that the greatest impacts will occur within 100 m of the source, with the potential for travel up to 400 m.

For full consideration of the effects of the access road, in the absence of any methodology within the IAQM minerals guidance, the IAQM Guidance on the Assessment of Dust from Demolition and Construction (2016) has been considered. This guidance states that human receptors within 50 m of the routes used by vehicles for 350 m from the Site exit point should be considered. For this reason, the haul road will be subject to a 50 m buffer, which will then extend 350 m out onto the N7 main road to account for the possibility of trackout from exiting vehicles. For conservatism, a 350 m length buffer has been applied from the point at which the Site exits onto the N7 public road.

The criteria for the categorisation of the frequency of potentially dusty winds (Table 1) and the receptor distance from source (Table 2) is used to define the pathway effectiveness (Table 3).

The residual source emissions and the pathway effectiveness are combined to predict the Dust Impact Risk as shown in Table 4.

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Table 1: Categorisation of Potentially Dusty Winds

Pathway Effectiveness	Criteria
Infrequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are less than 5%
Moderately Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 5% and 12%
Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 12% and 20%
Very Frequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are greater than 20%

Table 2: Categorisation of Receptor Distance from Source

Category	Criteria
Distant	Receptor is between 200 m and 400 m from the dust source
Intermediate	Receptor is between 100 m and 200 m from the dust source
Close	Receptor is less than 100 m from the dust source

Table 3: Pathway Effectiveness

		Frequency of Potentially Dusty Winds			
		Infrequent	Moderately Frequent	Frequent	Very Frequent
Receptor Distance Category	Close	Ineffective	Moderately Effective	Highly Effective	Highly Effective
	Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
	Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

Table 4: Estimation of Dust Impact Risk

		Residual Source Emissions		
		Small	Medium	Large
Pathway Effectiveness	Highly Effective Pathway	Low Risk	Medium Risk	High Risk
	Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
	Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

The final step is to assess the likely magnitude of the dust effects since 1990 (Table 5). This is determined using both the dust impact risk and the receptor sensitivity. Receptor sensitivity is classified as either low, medium or high based on the receptor type.

Table 5: Descriptors for Magnitude of Dust Effects

		Receptor Sensitivity		
		Low	Medium	High
Dust Impact Risk	High Risk	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
	Medium Risk	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
	Low Risk	Negligible Effect	Negligible Effect	Slight Adverse Effect
	Negligible Risk	Negligible Effect	Negligible Effect	Negligible Effect

3.0 SOURCES

The activities associated with the operations at the Site between 1990 and the present day that are the most likely dust generating sources are listed below:

- Earthmoving operations during the overburden stripping phase;
- Transport of materials to screening areas;
- Mechanical handling operations, including crushing and grading processes where in general the more powerful the machinery and the greater the volumes of material handled the greater the potential for dust emission;
- Haulage, where the weight of vehicles, their speed of passage and number of wheels in contact with the ground, and the nature and condition of road surfaces or haul routes all affect the amount of dust emitted:
- Shot hole drilling;
- Blasting;
- Wind blow from paved areas, material stockpiles, unsurfaced internal haul roads, quarry floor
- Import of soils for quarry restoration including transport and void filling.

The following residual source classifications can be attributed based on the identified sources and management and assessment methodology outlined above and in Appendix 4 of the IAQM guidance (2016).

Site preparation is classified as a large magnitude source due to the size of the working area. The land subject to this rEIAR extends approximately 46.14 ha. reflecting historic operational site information including the extractable area declared under S.261 quarry registration in 2005. The actual working area may have been smaller, but this conservative value has been used in the assessment.

Mineral extraction is classified as a medium to large magnitude source due to the annual extraction rate being up to 1,000,000 t/yr of aggregate within the working area (annual maximum between 1990 and 2021) and a medium dust potential as the extraction material is primarily calcareous greywacke siltstones and shales which have a low porosity and do not store much water.

Materials handling is classified as a large magnitude source as it has been conservatively assumed that there have been up to 20 heavy plant operating within different areas of the quarry void and on a high volume of material with medium dust potential.

On-site transportation is classified as a large magnitude source as are >250 (616) on-site HDV trips per day. A 7 m wide haulage road is present from the Site entrance to the yard area and Conveyer belt systems are also used to transport material on site, and there are also other unsealed roadways and surfaces on the Site.

Mineral processing is classified as a large magnitude source due to up to ca. 1,000,000 t/yr of material being processed with low moisture content and there being mobile processing plant on the pit floor processing rock.

Stockpiles (of aggregate) and exposed surfaces are classified as a medium magnitude source due to the annual quarry production of up to 1,000,000 t per annum, combined with the fact that stockpiles will be temporary and located within the pit floor and surface aggregate processing area.

Off-site transportation is classified as a large magnitude source as the movements since 1990 are consistent with the current AADT, (approximately 308 outward HDV movements per day), and the fact that the wheel wash has been in use for all exiting HDVs.

4.0 ASSESSMENT

4.1 Site Parameters

The risks of potential dust emissions associated with the Site being transported off-site are largely determined by the local atmospheric conditions surrounding the Site and distance from the source to the receptor.

The conditions considered in the assessment include:

- Wind speed, to determine the likely occurrence of particles travelling beyond the Site boundary; and
- Wind direction, to identify the areas over which particles are likely to travel.

As detailed in the main Air Quality & Climate Chapter 7, the closest Met Éireann station to the Site is located at Casement, Co. Dublin, ca. 5.5 km northeast of the Site. Wind speed and wind direction are measured hourly by the station and a wind-rose has been presented in Figure 1 covering the period 01 January 2020 to 31 December 2020.

The prevailing wind direction is from the southwest, with a large portion of mid wind speeds between 3 - 7 m/s and some higher wind speeds of >7 m/s.

The receptors identified in Table 6 and presented in Figure 1, with their associated distance and direction, are located within 500 m of the Site boundary. This is a conservative approach to the assessment as Site activities were not undertaken directly at the boundary in all directions. Residential receptors have been categorised as high sensitivity receptors.

The remaining non-residential (industrial/ commercial) receptors have been categorised as medium sensitivity receptors. The category of receptor distance is defined based on the criteria in Table 2 of the methodology and the frequency of dusty winds is determined based on the criteria in Table 1 of the methodology.

The receptor distance category and the frequency of dusty winds are then combined using Table 3 of the methodology to define the pathway effectiveness.

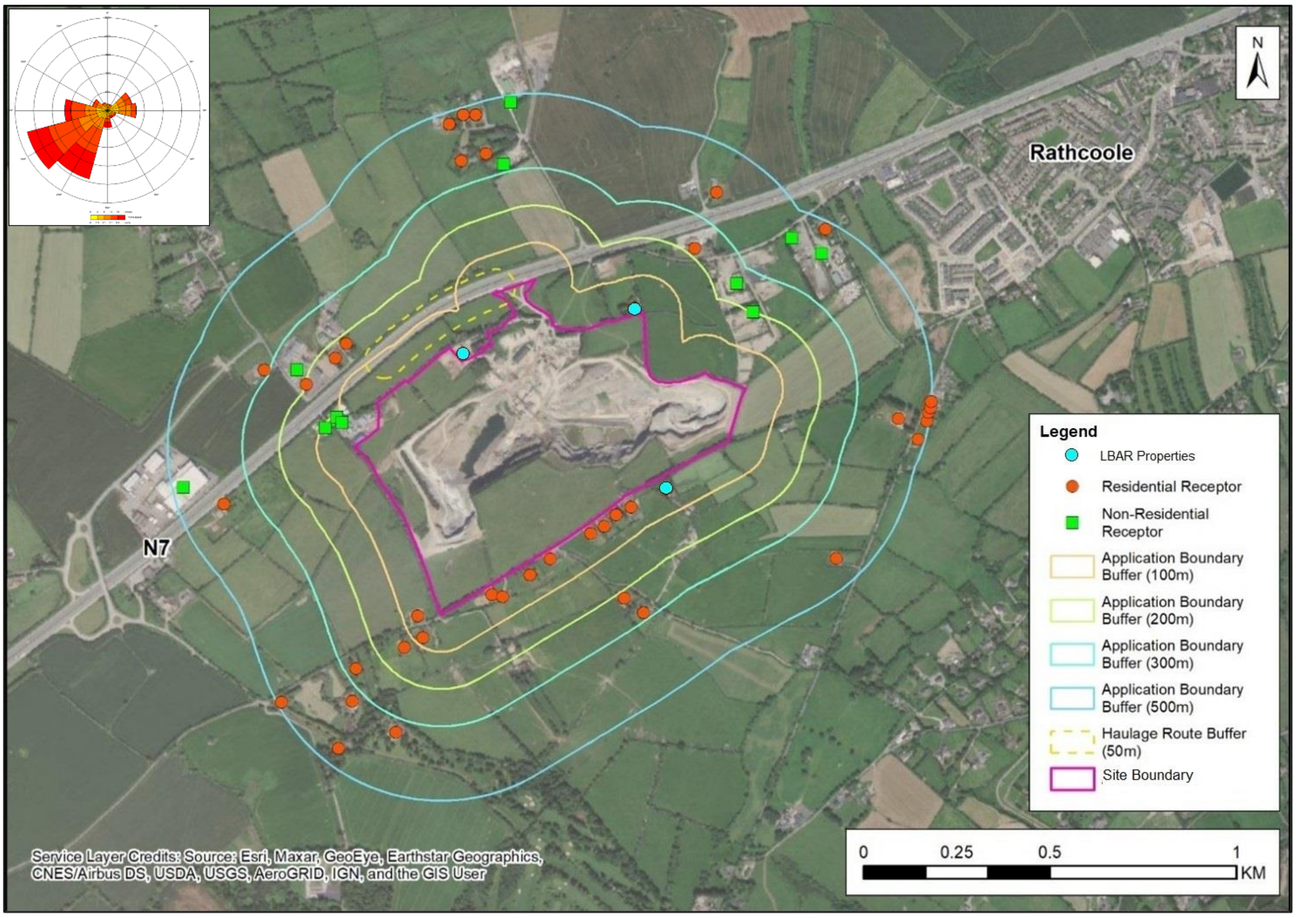

Figure 1: Location of receptors within 500 m of the Site (including Site Boundary) and within 50 m of the Haulage Route (extending 350 m from the point of exit of the Site Boundary).

Table 6: Receptors within 500 m of the Site Boundary

Receptor Type and Distance Band from Site Boundary	Number of Receptors in Group	Category of Receptor distance	Number of Receptors in Prevailing Wind Direction (NE of Boundary or haul route)	Frequency of dusty winds	Pathway Effectiveness
Residential within 50 m (of haul route)	0	Close	0	Moderate	Moderate
Residential within 100 m	13	Close	1	Moderate	Moderate
Residential within 100 m - 200 m	4	Intermediate	0	Moderate	Moderate
Residential within 200 m - 300 m	4	Distant	1	Moderate	Ineffective
Residential within 300 m - 500 m	19	Distant	2	Moderate	Ineffective
Non-Residential within 50 m (of haul route)	0	Close	0	Moderate	Moderate
Non-Residential within 100 m	3	Close	0	Moderate	Moderate
Non-Residential within 100 m – 200 m	0	Intermediate	0	Moderate	Moderate

Receptor Type and Distance Band from Site Boundary	Number of Receptors in Group	Category of Receptor distance	Number of Receptors in Prevailing Wind Direction (NE of Boundary or haul route)	Frequency of dusty winds	Pathway Effectiveness
Non-Residential within 200 m – 300 m	3	Distant	2	Moderate	Ineffective
Non-Residential within 300 m – 500 m	5	Distant	2	Moderate	Ineffective

4.2 Assessment of Coarse Particles

Assessment of the dis-amenity dust associated with the operation of the Site between 1990 and March 2021 is summarised for each receptor in Table 7. Following the IAQM guidance, the nature of the activities at the Site and the existing mitigation measures (outlined in Section 5.0) suggest that the magnitude of any deposited dust effects will range from 'moderately adverse' to 'negligible', with the majority of receptors receiving 'slight adverse' effects.

Table 7: Assessment of Dust Dis-amenity Effects at Receptors

Receptor Type and Distance Band from Site Boundary	Maximum Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effects
Residential within 100 m	Large	Moderate	Medium risk	High	Moderate Adverse effect
Residential within 100 m - 200 m	Large	Moderate	Medium risk	High	Moderate Adverse effect
Residential within 200 m - 300 m	Large	Ineffective	Low risk	High	Slight Adverse effect
Residential within 300 m - 500 m	Large	Ineffective	Low risk	High	Slight Adverse effect
Non-Residential within 100 m	Large	Moderate	Medium risk	Medium	Slight Adverse effect
Non-Residential within 200 m – 300 m	Large	Ineffective	Low risk	Medium	Negligible effect
Non-Residential within 300 m – 500 m	Large	Ineffective	Low risk	Medium	Negligible effect

4.3 Assessment of Fine Particles

The IAQM recommend that if the PM_{10} background concentration is less than 17 µg/m^3 there is little risk that the process contribution (PC) from the Site would lead to an exceedance of the annual-mean objective. The background data from other equivalent Zone C areas is detailed in Section 7.3.5.2 of the rEIAR chapter.. The annual average of the historic Zone C stations is 16.8 µg/m^3 which is less than 17 µg/m^3. It is unlikely that the PC from the Site would lead to an exceedance of the AQS.

Fine particulate PC can also be assessed using the calculation of concentration with distance from source (for conservatism the site boundary is used) as detailed in LAQM TG03. The guidance document also states that the likely PM_{10} contribution from fugitive dusts, stockpiles, quarries and construction is variable but up to 5 µg/m^3. Therefore, the likely concentration at the receptor locations can be estimated using the calculation considering the distance from source. As $PM_{2.5}$ is a sub-fraction of PM_{10}, the contribution of $PM_{2.5}$ will be lower but if it is conservatively assumed that all of the PM_{10} is $PM_{2.5}$, the increase in concentration due to the changed location of the extraction area is low. The assessment assumes that no mitigation is applied, where in reality the Site has historically employed a number of mitigation measures.

When combining the likely concentration with the average historical background value (16.8 µg/m^3) for Zone C areas, the maximum annual PM_{10} predicted environmental concentration (PEC) would be 18.3 µg/m^3 which is approximately 73% of the AQS and the annual $PM_{2.5}$ PEC would be 73% of the Stage 1 AQS and 91% of the Stage 2 AQS, at the closest receptor (which is owned by the applicant). For the closest privately owned receptor the PEC would be 70.8% of the PM_{10} AQS. The PEC would be less than this for all other receptors in the vicinity of the Site. The PEC is predicted to be below the annual AQS, with headroom. The impact from fine particle PC from the Site is considered to be Negligible to Slight prior to mitigation which would reduce to negligible due to the mitigation measures employed historically by the Site.

Table 8: Assessment of Fine Particulates at Closest Downwind Receptors

Receptor Type and Distance Band	Number of Receptors in Distance Band	Number of Receptors in Prevailing Wind Direction	Distance from source (m)	Relative concentration (with fallout from source)	Estimated concentration (µg/m^3) at receptor band, assuming source emission of 5 µg/m^3
Residential within 0 m - 100 m of source	13	1[1]	50	30%	1.5
Residential within 100 m - 200 m	4	0	100	18%	0.9
Residential within 200 m - 300 m	4	1	200	8%	0.4

5.0 MITIGATION

Since 1990, the Site has had a number of mitigation measures in place which aimed to reduce the impact of dust emissions on the surrounding area and identified sensitive receptors. These mitigation measures are as follows:

- Dust monitoring at designated monitoring locations;
- The timing of operations is optimised in relation to meteorological conditions;
- A water bowser is available on Site for dust suppression/dampening to minimise dust blow during working hours;
- Crushing and screening equipment in plant area are fitted with dust suppression systems;
- Stockpiles are located within the quarry floor to take advantage of shelter from the wind.
- Plant is regularly maintained;
- On site speed restrictions (<15 kph) are maintained in order to limit the generation of fugitive dust emissions; and
- A wheel wash system is in place along the Site haul road for all vehicles to use prior to exit onto the N7.

Table 9 assesses the potential impacts from the operation of the Site since 1990 on the local air quality both with and without the establishment of appropriate mitigation measures detailed above based on the IAQM, 2016 guidance and the application of expert judgement. The duration of these effects will have occurred in the medium term during the quarry's phased operations (i.e. during stripping and extraction). Definitions of effect significance are as defined in the EPA's 2017 'Guidelines on the information to be contained in environmental impact assessment reports'.

Without mitigation measures it is considered that dust impacts from extraction activities may not have affected the character of the environment but would have had noticeable changes. Through the implementation of the ongoing environmental management programme, it is likely that the dust from various activities has had an effect capable of measurement but without noticeable consequences to the environment.

Table 9: Assessment of Impacts to Local Air Quality and Mitigation Measures Employed (based on IAQM 2016 guidance and expert judgement)

Impact	With / Without the establishment of Mitigation Measures	Type of Effect	Quality of Effects	Significance of Effects	Duration of Effects
Dust from excavation	Without	Direct	Negative	Moderate	Medium Term (7-15 years)
Dust from excavation	With	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from transfer on haul roads	Without	Direct	Negative	Moderate	Medium Term (7-15 years)
Dust from transfer on haul roads	With	Direct	Negative	Slight	Medium Term (7-15 years)
Dust from transfer on public roads	Without	Direct	N/A	Moderate	Medium Term (7-15 years)
Dust from transfer on public roads	With	Direct	N/A	Slight	Medium Term (7-15 years)
Dust from on-site processing (crushing and screening)	Without	Direct	Negative	Moderate	Medium Term (7-15 years)
Dust from on-site processing (crushing and screening)	With	Direct	Negative	Slight	Medium Term (7-15 years)

6.0 RESIDUAL IMPACTS

Residual impacts of deposited dust and particulates generated during the operations at the Site since 1990 on air quality are considered to be slight. During long spells of dry weather, dust emissions may have had the potential to be elevated, however dust nuisance from the operation is expected to have been unlikely as the above mitigation measures were implemented during construction and operation. The overall impact from the operation of the Site since 1990, in terms of dust emissions and particulates, is considered 'slight' to the air environment and Not Significant.

7.0 CUMULATIVE IMPACTS

Research has shown that the greatest proportion of dust predominantly deposits within the first 100 m away from the source (The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO

1995) as dust has a higher deposition velocity than finer particles (i.e. PM_{10} and $PM_{2.5}$). The finer particles of less than 10 microns aerodynamic diameter may remain airborne for longer and therefore travel larger distances, although a large proportion may still deposit within 200 m of the source.

The assessment undertaken has considered publicly available background monitoring data and incorporated this into the assessment, therefore the assessment includes a consideration for other Sites operating in the area.

There are no other identified operations in close proximity to the Site which may have generated significant emissions to air. Therefore, there have been no opportunities for significant cumulative impacts to arise as a result of the activities at the Site since 1990.

8.0 REFERENCES

Environmental Protection UK / Institute of Air Quality Management (EPUK/IAQM, 2017) Land-Use Planning and Development Control: Planning for Air Quality,v1.2, 2017.

Institute of Air Quality Management (IAQM, 2016) Guidance on the assessment of mineral dust for Planning.

The Environmental Effects of Dust from Surface Mineral Workings, Volume 1 DETR, HMSO 1995.

APPENDIX 7.2

Traffic Modelling Assessment

AIR DISPERSION TRAFFIC MODELLING REPORT

1.0 INTRODUCTION

1.1 Background

This Air Dispersion Modelling Appendix has been prepared to support the Air Quality chapter of the rEIAR (rEIAR Chapter 07) dated May 2021 and considers the potential effects of the previous activities relating to traffic movements associated with the development and operation at Windmillhill, Rathcoole, Co. Dublin (the "Site") post 1990 on the receiving (air) environment.

The existing Development use, owned by L. Behan Aggregates & Recycling Ltd (LBAR), is for the quarrying and production of aggregates and is registered in accordance with Section 261, Planning & Development Act 2000 (Quarry Ref. No. QS1054).

In accordance with EPUK/IAQM guidance "Land-Use Planning and Development Control: Planning for Air Quality" (IAQM 2017 Guidance), a quantitative assessment of effects from road traffic emissions for the operational phase of the development has been undertaken.

The assessment has been undertaken to predict concentrations of the road transport derived pollutants, principally nitrogen dioxide (NO_2), particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) and to determine whether road traffic emissions occurring during the operation of the Site between 1990 and 2021 may have generated significant effects on local air quality.

1.2 Study Area

The Study Area for this assessment extends to 200 m either side of the Site access road and the N7 in the vicinity of the Site. Six road links were identified as 'affected roads' – i.e. those meeting the assessment criteria set out in the IAQM 2017 Guidance. The assessed roads for the operational phase are detailed below.

- Link 001 – N7, towards Naas, east of the site
- Link 002 – Entrance road into the site
- Link 003 – Two way access road on site
- Link 004 – Exit road from the site
- Link 005 – N7, towards Naas, west of the site
- Link 006 – N7, towards Rathcoole

For ecological receptors, DMRB guidance states that a quantitative impact assessment of road source emissions may be required if Natura 2000 Sites (e.g. Special Protection Areas and Special Areas of Conservation) are within 200 m of 'affected roads'. No such protected sites are located within 200 m of the roads and therefore impacts of operational traffic on ecological receptors are deemed Not Significant.

1.3 Legislation and Guidance

European Air Quality Directives

The European Union (EU) Directive on Ambient Air Quality Assessment and Management came into force in September 1996 (96/62/EC) and defines the policy framework for 12 air pollutants known to have harmful effects on human health and the environment. Air quality limit values (ambient pollutant concentrations not to be exceeded after a given date) for the pollutants are set through a series of Daughter Directives. The first Daughter Directive (1999/30/EC) sets limit values for NO_2 and PM_{10} (amongst other pollutants) in ambient air.

Following the Daughter Directives, EU Council Directive 2008/50/EC came into force in June 2008, consolidating the existing air quality legislation, making provision for Member States to postpone attainment deadlines and allowing exemption from the obligation to limit values for certain pollutants, subject to strict conditions and assessment by the European Commission. Directive 2008/50/EC was transposed into Irish legislation in 2011 through The Air Quality Standards Regulations 2011. The directive merged the four daughter directives and EU Council decision into a single directive on air quality. The new Directive also introduced a new limit value for $PM_{2.5}$ but does not change the existing air quality standards.

National Air Quality Legislation

The Air Pollution Act (1987) is the primary legislation relating to air quality in Ireland and provides the means for local authorities to take the measures that they deem necessary to control air pollution.

The Air Quality Standards Regulations (2011) transpose the Directive on ambient air quality (2008/50/EC) into Irish law. These regulations establish limit values and thresholds for various pollutants in ambient air.

The Environmental Protection Agency (EPA) monitor the levels of various pollutants against the standards set out in EU and Irish legislation. The EPA are the competent authority for annual reporting to the Minister for the Environment, Heritage and Local Government and the European Commission.

The Air Quality Standards (AQSs) – the background pollutant levels considered acceptable for human health and the environment – for nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) when measured as annual mean concentrations, are as follows:

- NO_2 - 40 µg/m^3;
- PM_{10} - 40 µg/m^3; and
- $PM_{2.5}$ - 25 µg/m^3.

There are 4 air quality zones in Ireland, defined for the purposes of air quality management and assessment. Highly populated areas are classified as Zone A, with sparsely populated areas as Zone D. The Site is located in a semi-rural area bordering the Greater Dublin area, and it is therefore deemed reasonable to characterise the area as a Zone C area. A review of publicly available information identifies that the Irish EPA do not operate background air quality monitoring within Rathcoole or the immediate surrounds.

A detailed air quality assessment, including air dispersion modelling using ADMS-Roads (v.5.0.0.1), has been undertaken. In the absence of relevant Irish guidance, the assessment follows the methodology set out in Defra's Local Air Quality Management Guidance Technical Guidance (TG16) (LAQM 2018).

ADMS-Roads has been used to predict the NO_2, PM_{10} and $PM_{2.5}$ Process Contribution (PC) resulting from road traffic associated with the operation of the Site between 1990 and the present day. This value has then been combined with the available background data to generate the Predicted Environmental Concentration (PEC) and compared to the appropriate AQS.

The findings of the modelling study and conclusions reached are presented in terms of predicted impact on local air quality sensitive receptors (i.e. residential receptors, locations where the general public may be present for sufficient periods of time and ecological designated sites) located within the area surrounding the Site (further discussed in Section 4.3).

2.0 EXISTING AIR QUALITY

2.1 Baseline Sources

The Site is located on the edge of the Dublin Zone A area bordering Zone D and is also located in close proximity to the Celbridge Zone C area. Due to the location of the Site, it has been characterised using the Zone C data. A review of publicly available information identifies that the Irish EPA do not operate background air quality monitoring within Rathcoole or the immediate surrounds. However, the EPA do operate several continuous monitoring stations within Zone C areas.

In the absence of local background data, the most recent annual mean data (2019) and historical data for NO_2, NO_x, PM_{10} and $PM_{2.5}$ from suburban monitoring locations in Zone C are presented in Table 1. These locations are part of the EPA National Ambient Air Quality Monitoring Network and data is reported to Europe. All monitored concentrations are below the annual AQS.

Table 1: Annual mean monitoring data for Zone C stations with averages and maximum of all pollutants shown.

	Year	Monitoring Location	Concentration (µg/m³)
NO_2	2019	Meath Navan	23
		Portlaoise	11
	2010	Celbridge	12
	2007	Navan*	16
	Maximum		**23**
	Average		**15.5**
NO_x	2019	Meath Navan	72.5†
		Portlaoise	14.8
	2010	Celbridge	17
	2007	Navan*	32
	Maximum		**32**
	Average		**21.3**
PM_{10}	2019	Portlaoise	15
		Carlow Town	11
	2010	Celbridge‡	18
	2007	Navan*	23
	Maximum		**23**
	Average		**16.8**
$PM_{2.5}$	2019	Carlow Town	8
		Meath Navan	11
	Maximum		**11**
	Average		**9.5**

*Zone D in 2007. Measurements undertaken by mobile monitoring in 2007.

†Data omitted due to extreme concentration when compared to NO_2 value and other Zone C NO_x values.

‡Data different to Table 11 as only 2010 data considered.

Data from: https://www.epa.ie/pubs/reports/air/quality Accessed 3/3/21

2.2 Project Specific Monitoring

There is no historical diffusion tube data for the site. A baseline NO_2 diffusion tube monitoring study would usually be undertaken at a number of roadside locations surrounding the site, to use for the validation of the modelling (should it be required). No historic data is available and due to travel restrictions attributed to the current Coronavirus (COVID-19) crisis a survey could not be undertaken. It is also likely that traffic flows are currently reduced compared to the pre-COVID levels and therefore any monitoring would not be a true reflection of pre or post COVID conditions. As a result, no Site visits were undertaken for Air Quality and Climate.

The assessment undertaken therefore considers an un-validated PC and considers the average Zone C background data when making a comparison with the AQS.

2.3 Background Data Used in this Assessment

Due to the absence of monitoring data for the Site or specific roadside location monitoring, the historic Zone C annual monitoring data have been used to represent the background air quality. The data used in the assessment is the maximum of the monitoring data, as presented in Table 1 and below:

- NO_2 average background – 23 µg/m^3
- NO_x average background – 32 µg/m^3
- PM_{10} average background – 23 µg/m^3
- $PM_{2.5}$ average background – 11 µg/m^3

The Zone C background concentrations are below the relevant AQSs.

3.0 EMISSIONS SOURCES AND SCENARIOS

3.1 Background

The emissions sources considered in the assessment comprise the network of roads in the vicinity of the Site and background concentrations of pollutants, as calculated from the Zone C monitoring data.

Traffic data for the purposes of the air quality assessment was provided based on historical traffic movements. The maximum historical 24-hour Annual Average Daily Traffic (AADT) and Heavy Goods Vehicle (HGV) flows from 1990 to 2021 were considered for the links shown in Figure 1 .

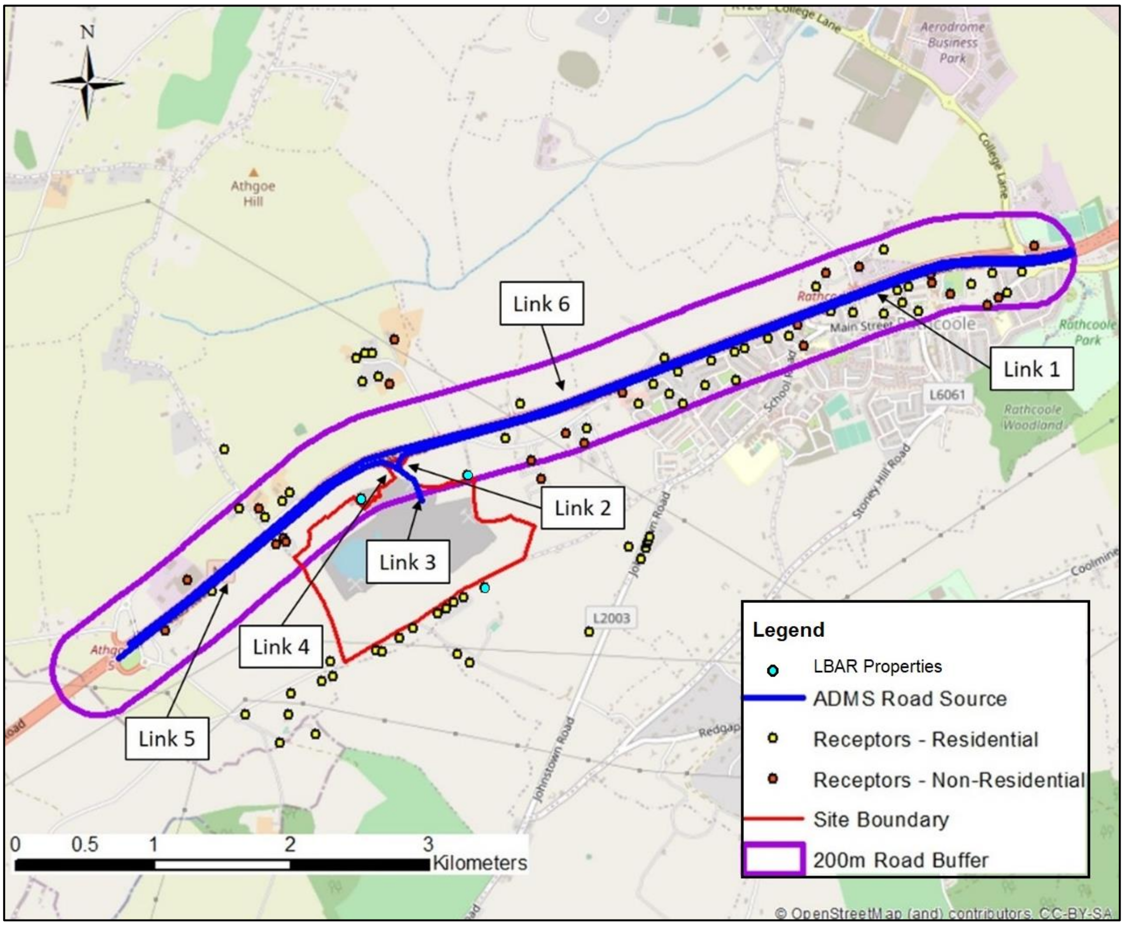

Figure 1: Modelled Traffic Links

3.2 Operational Sources

Data was provided between 1990 and 2021, for conservativeness the highest total AADT of 880 with 70% Heavy Duty Vehicles (HDV) and 30% Light Duty Vehicles (LDV), recorded in 2020, has been used in the model. The flows for the 1990-2021 Scenario for each road link are provided in Table 2. Half of the AADT movements are incoming and half are outgoing movements, therefore this has been represented in the modelled roads, which are all one way roads apart from the small length of Site access road (Link 003).

Table 2: Sources included in the modelled operational scenario.

Affected Road Link ID	Light Duty Vehicle 24-hour AADT	Heavy Duty Vehicle 24-hour AADT
	1990-2021 Scenario	1990-2021 Scenario
Link 001	132	308
Link 002	132	308
Link 003	264	616
Link 004	132	308
Link 005	132	308
Link 006	132	308

3.3 Model Scenarios

A quantitative local air quality assessment has been undertaken using the latest version of CERC ADMS-Roads dispersion modelling software, to predict concentrations of NO_2, PM_{10} and $PM_{2.5}$ at identified sensitive receptors.

The assessment follows the methodology set out in Defra's Local Air Quality Management Guidance (LAQM 2018) and quantifies total pollutant concentrations for the following scenario:

- 1990 - 2021 Scenario: assuming 2020 vehicle movements and emissions data, the maximum historical background pollutant concentrations and modelled using 2020 meteorological data.

3.4 Justification of Atmospheric Dispersion Model

Pollutant emissions were modelled using the advanced atmospheric dispersion modelling software ADMS-Roads 5.0.0.1 (utilising emissions factor toolkit UK EFTv9.0). ADMS-Roads is an advanced dispersion model that allows multiple road and industrial sources (including point, line, area and volume sources) to be modelled simultaneously. The model uses a number of input parameters to simulate the dispersion of pollutant emissions, predicting ambient pollutant concentrations. The input parameters include information on pollutant emissions, local meteorological conditions and background pollutant concentrations. ADMS-Roads is regularly used in detailed assessment dispersion modelling studies for the purposes of EIA.

3.5 General Model Assumptions

Details of the applied general model assumptions are provided in Table 3.

Table 3: General ADMS-Roads Model Assumptions

Variables	ADMS-Roads Model Input
Surface roughness at source	0.5 (Parkland and open suburbia)
Minimum Monin-Obukhov length (urban)	10
Terrain types	Flat
Receptor locations	See Table 9 and Figure 5
Emissions	NO_x (converted to NO_2 for reporting), PM_{10} and $PM_{2.5}$
Emissions factors	Emission Factor Toolkit v9.0
Meteorological data	Casement, 2020
Model Outputs	Long-term annual mean NO_x concentrations (converted to NO_2 for reporting)
	Long-term annual mean PM_{10} concentrations
	Long-term annual mean $PM_{2.5}$ concentrations

Modelled NO_x values were converted to NO_2 using the Defra 'NOx to NO_2' calculator version 7.1, released in April 2019 (Last accessed 1 March 2021, Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html). This version has been used as it corresponds with using EFTv9.0 in the model.

3.6 Receptors

Modelled Domain

The extent of the modelled domain is provided in Table 4.

Table 4: Extent of the Modelled Domain

Point	X (WGS)	Y (WGS)
Southwest corner	-726919	7031825
Northeast corner	-718686	7036517

Discrete Receptors

The assessment required the modelling of pollutant concentrations at identified sensitive human receptors between 1990 and 2021, within 200 m of the roads. These were identified as discrete receptors in the model and represented areas of population and other locations where there is likely to be relevant public exposure to the emissions (e.g., schools, health facilities and leisure facilities). All receptors were modelled at a height of 1.5 m, which is equivalent to breathing height. The discrete receptors included in the model are listed in Table 5 and shown in Figure 2.

Table 5: Discrete Receptors in 1990 - 2021 Scenario Model

Receptor ID	Description	X Coordinate (m)	Y Coordinate (m)
ADM1	Residential	-723137	7034364
ADM2	Residential	-724708	7033968
ADM3	Residential	-724757	7033904
ADM4	Residential	-724889	7033788
ADM5	Residential	-724185	7033913
ADM6	Residential	-722552	7034436
ADM7	Residential	-723035	7034613
ADM8	Residential	-723416	7034098
ADM9	Residential	-725268	7033258
ADM10	Residential	-725076	7033856
ADM11	Residential	-722176	7034619
ADM12	Residential	-722067	7034763
ADM13	Residential	-721945	7034686
ADM14	Residential	-721886	7034850
ADM15	Residential	-721641	7034930
ADM16	Residential	-721692	7034749
ADM17	Residential	-721461	7034786
ADM18	Residential	-721851	7034614
ADM19	Residential	-721472	7034990
ADM20	Residential	-721398	7035015
ADM21	Residential	-721233	7035091
ADM22	Residential	-721083	7035104
ADM23	Residential	-720771	7035291
ADM24	Residential	-720879	7035465
ADM25	Residential	-720389	7035738
ADM26	Residential	-720616	7035282
ADM27	Residential	-720388	7035273

Receptor ID	Description	X Coordinate (m)	Y Coordinate (m)
ADM28	Residential	-720286	7035442
ADM29	Residential	-720213	7035463
ADM30	Residential	-720256	7035346
ADM31	Residential	-720136	7035287
ADM32	Residential	-719753	7035488
ADM33	Residential	-719602	7035561
ADM34	Residential	-719386	7035570
ADM35	Residential	-719496	7035418
ADM36	Residential	-721982	7034946
ADM37	Non-Residential	-722954	7034202
ADM38	Non-Residential	-724929	7033854
ADM39	Non-Residential	-724807	7033592
ADM40	Non-Residential	-722704	7034401
ADM41	Non-Residential	-722570	7034328
ADM42	Non-Residential	-724756	7033640
ADM43	Non-Residential	-725447	7033338
ADM44	Non-Residential	-725611	7032965
ADM45	Non-Residential	-724183	7033930
ADM46	Non-Residential	-724732	7033615
ADM47	Non-Residential	-722284	7034695
ADM48	Non-Residential	-721016	7035193
ADM49	Non-Residential	-720809	7035567
ADM50	Non-Residential	-720566	7035608
ADM51	Non-Residential	-720051	7035556
ADM52	Non-Residential	-720039	7035495
ADM53	Non-Residential	-719905	7035417
ADM54	Non-Residential	-719637	7035329
ADM55	Non-Residential	-719560	7035382
ADM56	Non-Residential	-720975	7035041
ADM57	Non-Residential	-719295	7035766

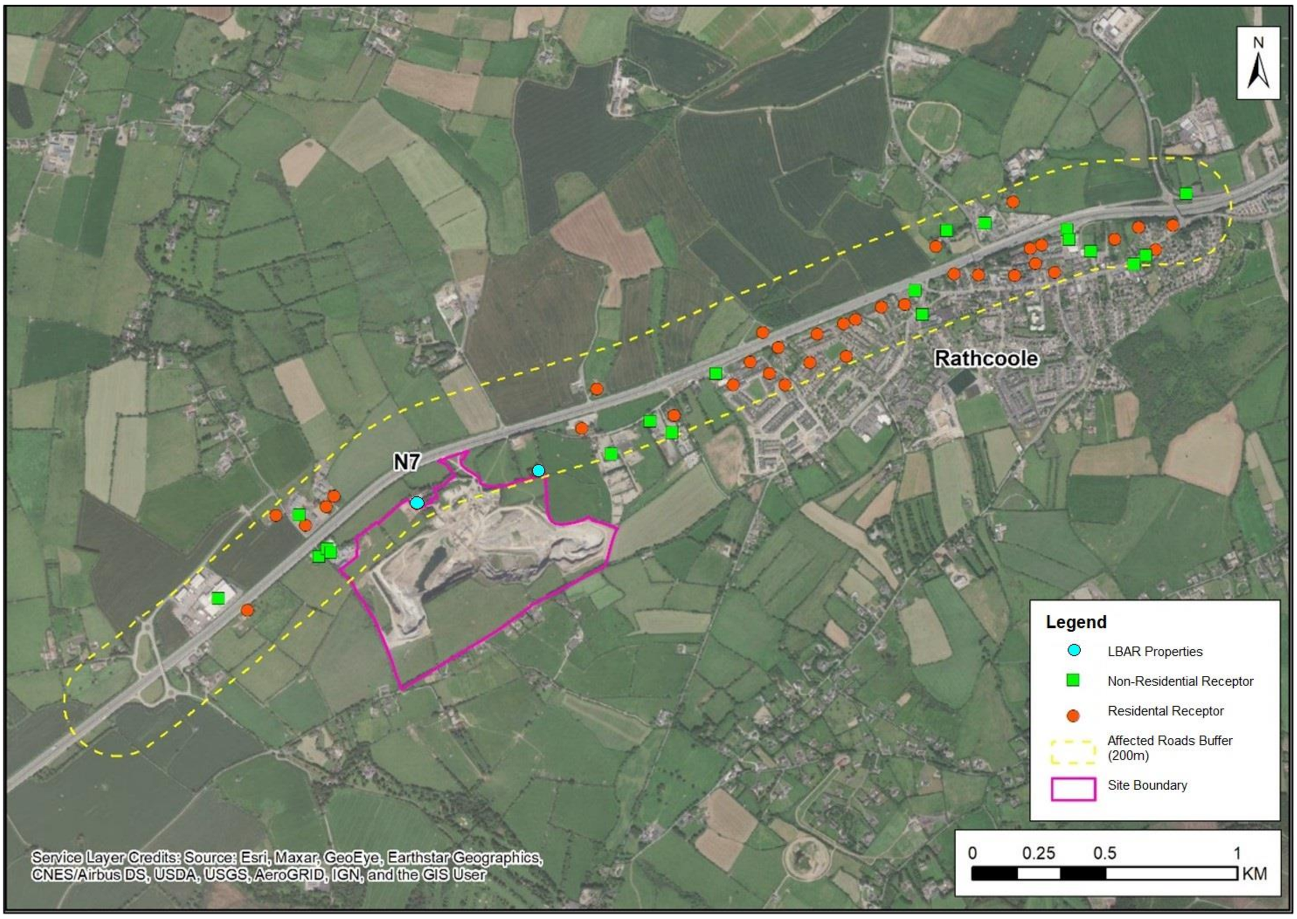

Figure 2: Discrete receptors in 1990 - 2021 Scenario Model

3.7 Meteorology

Meteorological Characteristics

Meteorological data from Casement Aerodrome was used in this assessment. The Casement Aerodrome meteorological station lies approximately 5.5 km to the north east of the Site and is the closest representative operational meteorological station with a full year of recent data. The dataset used was for 2020 and included the following hourly sequential data (Table 6).

The wind rose for the meteorological data used is presented in Figure 3.

Table 6: Hourly sequential readings used in the 2020 meteorological dataset.

Parameter	Units
Wind speed	m/s
Wind direction	Degrees measured clockwise from North
Cloud cover	oktas
Surface temperature	˚C
Relative humidity	%

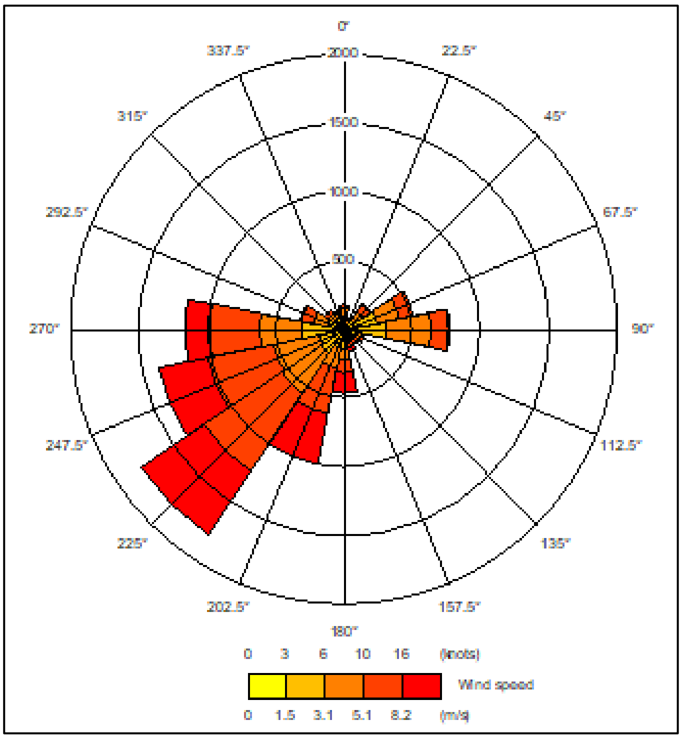

Figure 3: Casement Aerodrome Windrose for 2020

Surface Characteristics

The characteristics of the land use are based on default values for surface roughness contained within ADMS-Roads. A surface roughness value of 0.5 m is used at the dispersion site (the Site) and a value of 0.1 m is used at the meteorological measurement site (Casement Aerodrome) to account for the nature of the site as an airfield.

3.8 Road Traffic Emissions

Atmospheric emissions from road traffic were calculated by the model based on information on traffic flows and the latest in-built database of vehicle emission factors, UK Emission factor toolkit (EFT) v.9.0. The EFT does not have specific data for Ireland; therefore, the Northern Ireland data has been used in the assessment. Historical information on traffic flows on roads was obtained between 1990 and 2021 as described in Section 3.1 of this report, with the worst case scenario of 2020 being used in the model. Traffic speeds were estimated from national speed limits as no speed data were available.

Traffic count data were converted into ADMS-Roads format, which requires the data to be input as vehicle counts per hour, vehicle speed, and road type. The data was further classified into the ADMS-Roads two-category vehicle classes, light vehicles and heavy vehicles. As data were supplied as 24-hour AADT, the data was converted to hourly vehicle data.

ADMS-Roads uses the hourly emissions files and the information from the in-built emissions factors database (EFTv.9.0) to calculate an overall pollutant emission for each road in grams/km/second. The emission factors depend in part on assumptions made of vehicle types for different types of road.

NO_X to NO_2 Conversion

DEFRA publish a NO_x to NO_2 converter v7.1 (DEFRA, 2019) which is made available as a tool to calculate the road source NO_2 contribution from modelled road source NO_x contributions. The tool comes in the form of a Microsoft Excel spreadsheet and uses local authority area specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_x. This tool was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_x contribution and associated background concentration. Due to the location of the Site, the setting for all non-urban traffic was selected. The tool does not contain information for local authorities in Ireland and therefore data for Belfast was applied in the model. Although the population data for Belfast is lower than that of Dublin, the Development is located on the outskirts of Dublin.

3.9 Terrain

No terrain data was input into the model due to there being only small changes in elevation across the study area.

3.10 Special Treatments

No special treatments in excess of those previously outlined in the preceding sections were incorporated into the study.

3.11 Predicting the Number of Times per Year the NO_2 Hourly Mean Objective is Exceeded

Research projects completed on behalf of DEFRA and the Devolved Administrations (Laxen and Marner (2003) and AEAT (2008)) have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less than 60 µg/m^3.

In 2003, Laxen and Marner concluded: "…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m^3 and above."

The findings presented by Laxen and Marner (2003) are further supported by AEAT (2008), who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are: "Local authorities should continue to use the threshold of 60 µg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean NO_2 objective."

The assessment considers the likelihood of exceeding the hourly mean NO_2 objective by comparing predicted annual mean NO_2 concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3 NO_2. Where predicted concentrations are below this value, it can be concluded with confidence that the hourly mean NO_2 objective (200 µg/m^3 NO_2, not to be exceeded more than 18 times per year) will be achieved at all relevant commercial properties. Although the assessment includes and refers to commercial property receptors, the findings would be applicable to all receptor types.

4.0 MODEL VERIFICATION

When using air dispersion modelling to predict pollutant concentration, it is necessary to make a comparison between the modelled predictions and measured concentrations at the same location, to ensure that the model is reproducing concentrations as actually observed.

In this instance, it was not possible to verify the data with model outputs with the monitoring data available as no comparable diffusion tube monitoring was undertaken due to COVID-19, as outlined in Section 2.2. Therefore, the focus of the assessment is on the PC from the impact of traffic movements related to the historical operation of the site in the 1990 – 2021 Scenario.

5.0 MODEL RESULTS

5.1 Model Coverage

The maximum modelled results at the sensitive receptors, detailed in Section 4.3, identified for the 1990 - 2021 Scenario considered for NO_2, PM_{10} and $PM_{2.5}$ are presented in this section.

5.2 1990 - 2021 Scenario

The maximum predicted NO_2 concentration is presented in Table 7.

Table 7: Maximum Predicted concentrations calculated from annual average NO_2 concentrations µg/m³, 2019 emission factors

Receptor ID	NO_2 µg/m³ PC	PC as % AQS	NO_2 background	NO_2 PEC	PEC as % AQS
ADM36 & ADM51	**0.09**	**0.2**	23	**23.09**	**57.7**

Table 7 shows the maximum NO_2 PC from the impact of traffic movements related to the historical operation of the site between 1990 and 2021 is 0.09 µg/m³ and maximum PEC is 23.09 µg/m³, which is less than 58% of the AQS.

This value is below the 60 µg/m³ threshold mentioned in Section 4.8 regarding the trigger for considering a likely exceedance of the hourly mean NO_2 objective. The model results indicate the impact of NO_2 concentrations from traffic movements related to the historical operation of the site is negligible.

The maximum predicted PM_{10} concentration is presented in Table 8.

Table 8: Maximum Predicted concentrations calculated from annual average PM_{10} concentrations µg/m³, 2019 emission factors

Receptor ID	PM_{10} µg/m³ PC	PC as % AQS	PM_{10} background	PM_{10} PEC	PEC as % AQS
ADM51	**0.03**	**<0.1**	23	**23.03**	**57.6**

Table 8 shows the maximum PM_{10} process contribution from the impact of traffic movements related to the historical operation of the site between 1990 and 2021 is 0.03 µg/m³ and maximum concentration is 23.03 µg/m³, which is less than 58% of the AQS.

The model results indicate the impact of PM_{10} concentrations from traffic movements related to the historical operation of the site is negligible.

The maximum predicted $PM_{2.5}$ concentration is presented in Table 9

Table 9: Maximum Predicted concentrations calculated from annual average $PM_{2.5}$ concentrations µg/m³, 2019 emission factors

Receptor ID	$PM_{2.5}$ µg/m³ PC	PC as % AQS	$PM_{2.5}$ background	$PM_{2.5}$ PEC	PEC as % AQS
ADM36 & ADM51	**0.02**	**<0.1**	11	**11.02**	**44.1**

Table 9 shows the maximum $PM_{2.5}$ process contribution from the impact of traffic movements related to the historical operation of the site between 1990 and 2021 is 0.02 µg/m³ and maximum concentration is 11.02 µg/m³, which is less than 45% of the AQS.

The model results indicate the impact of $PM_{2.5}$ concentrations from traffic movements related to the historical operation of the site is negligible.

6.0 ASSESSMENT OF IMPACTS

6.1 Operational Phase

The modelling results presented show that for the 1990 - 2021 scenario, which used the highest AADT traffic data in this period, gives a predicted PC of no more than 0.09 µg/m^3 annual average NO_2 concentrations across the Study Area. The impact of traffic movements related to the historical operation of the site is considered negligible.

For PM_{10}, the model results indicate a predicted process contribution of no more than 0.03 µg/m^3 annual average concentrations across the Study Area. The impact of traffic movements related to the historical operation of the site on PM_{10} is considered negligible.

For $PM_{2.5}$, the model results indicate a predicted process contribution of no more than 0.02 µg/m^3 annual average concentrations across the Study Area. The impact of traffic movements related to the historical operation of the site on $PM_{2.5}$ is considered negligible.

An assessment of the impact of the change in air quality is assessed in accordance with the criteria set out in Section 1.5. In all cases the predicted change in air quality concentrations is considered negligible.

7.0 REFERENCES

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APPENDIX 7.3

Asphalt Plant Assessment

AIR DISPERSION MODELLING REPORT FOR ASPHALT MANUFACTURING PLANT

1.0 INTRODUCTION

1.1 Background

This Air Dispersion Modelling Appendix has been prepared to support the Air Quality chapter of the remedial Environmental Impact Assessment Report (rEIAR) and considers the potential effects of the previous activities relating to the development and operation at Windmillhill, Rathcoole, Co. Dublin (the "Site") on the receiving (air) environment between 1990 and the present day.

The existing Development use, owned by L. Behan Aggregates & Recycling Ltd (LBAR), is for the quarrying and production of aggregates and is registered in accordance with Section 261, Planning & Development Act 2000 (Quarry Ref. No. SDQU05A/4). The Development includes an aggregate processing plant comprising of primary, secondary and tertiary crushing units, aggregate screening units, an asphalt manufacturing plant, and site infrastructure including weighbridges, wheel wash, car parking, offices/canteen/toilets and storage and maintenance sheds.

The assessment has been undertaken to predict concentrations of the pollutants emitted as a result of the operation of the asphalt manufacturing plant since 1990, principally nitrogen dioxide (NO_2), sulphur dioxide SO_2, particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) and to determine whether likely emissions which may have occurred during the operation of the Site are predicted to have generated significant effects on local air quality.

1.2 Legislation and Guidance

European Air Quality Directives

The European Union (EU) Directive on Ambient Air Quality Assessment and Management came into force in September 1996 (96/62/EC) and defines the policy framework for 12 air pollutants known to have harmful effects on human health and the environment. Air quality limit values (ambient pollutant concentrations not to be exceeded after a given date) for the pollutants are set through a series of Daughter Directives. The first Daughter Directive (1999/30/EC) sets limit values for NO_2 and PM_{10} (amongst other pollutants) in ambient air.

Following the Daughter Directives, EU Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE) came into force in June 2008, consolidating the existing air quality legislation, making provision for Member States to postpone attainment deadlines and allowing exemption from the obligation to limit values for certain pollutants, subject to strict conditions and assessment by the European Commission. Directive 2008/50/EC was transposed into Irish legislation in 2011 through The Air Quality Standards Regulations 2011. The Directive merged the four daughter directives and EU Council decision into a single directive on air quality. The new Directive also introduced a new limit value for $PM_{2.5}$ but does not change the existing air quality standards.

National Air Quality Legislation

The Air Pollution Act (1987) is the primary legislation relating to air quality in Ireland and provides the means for local authorities to take the measures that they deem necessary to control air pollution.

The Air Quality Standards Regulations (2011) transpose the Directive on ambient air quality (2008/50/EC) into Irish law. These regulations establish limit values and thresholds for various pollutants in ambient air.

The Environmental Protection Agency (EPA) monitor the levels of various pollutants against the standards set out in EU and Irish legislation. The EPA are the competent authority for annual reporting to the Minister for the Environment, Heritage and Local Government and the European Commission.

The Air Quality Standards (AQSs) – the background pollutant levels considered acceptable for human health and the environment – for nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) when measured as annual mean concentrations, are as follows:

- NO_2 - 40 µg/m^3;
- PM_{10} - 40 µg/m^3; and
- $PM_{2.5}$ - 25 µg/m^3.

There are four air quality Zones in Ireland, defined for air quality management and assessment purposes. Highly populated areas are classified as Zone A, with sparsely populated areas as Zone D. Given the location of the Site in a semi-rural area bordering the Greater Dublin area, it is reasonable to characterise the area as requiring a Zone C area Assessment Method.

A detailed air quality assessment, including air dispersion modelling using ADMS5 (v.5.2.2), has been undertaken. ADMS5 has been used to predict NO_2, SO_2, PM_{10} and $PM_{2.5}$ concentrations. The outputs of the modelled scenario have been compared to appropriate long-term and short-term standards set to protect human health, to assess compliance.

The findings of the modelling study and conclusions reached are presented in terms of predicted impact on local air quality sensitive receptors present during 1990 and 2021 (i.e. residential receptors, locations where the general public may be present for sufficient periods of time and ecological designated sites) located within the area surrounding the Site, as well as commercial receptors (further discussed in Section 2.6).

1.3 Air Quality Standards

The AQS objective values applied in relation to the emissions in this assessment, as specified by the CAFE Directive 2008/50/EC, are detailed in Table 1 below.

Table 1: Air Quality Standards

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year
		24 hours	125	Not to be exceeded more than 3 times in a calendar year
	Protection of vegetation	Calendar year	20	Annual mean
		1 Oct to 31 Mar	20	Winter mean
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year
		Calendar year	40	Annual mean
NO_2 + NO	Protection of ecosystems	Calendar year	30	Annual mean
PM_{10}	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year
		Calendar year	25	Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
PM2.5 Stage 1	Protection of human health	Calendar year	25	Annual mean
PM2.5 Stage 2		Calendar year	20	Annual mean

2.0 MODEL SETUP

2.1 Justification of Atmospheric Dispersion Model

Pollutant emissions have been modelled using the advanced atmospheric dispersion modelling software ADMS-5, Version 5.2.2. ADMS5 is an advanced dispersion model that allows industrial sources (including point, line, area and volume sources) to be modelled simultaneously. The model uses a number of input parameters to simulate the dispersion of pollutant emissions, predicting ambient pollutant concentrations. The input parameters include information on pollutant emissions, local meteorological conditions, and background pollutant concentrations. ADMS5 is regularly used in detailed assessment dispersion modelling studies for the purposes of EIA

2.2 Model Scenario

The modelled scenario for the asphalt manufacturing plant stack applies the likely applicable emission limit values (ELVs) for the plant. The use of the ELVs in the model is a conservative approach as it assumes that the plant is emitting the maximum emission throughout the assessment period, where in reality it would be less if the plant is not continually operating at full capacity. The assessment also assumes that the asphalt plant will have been operational for 24 hours a day over 365 days a year, where in reality it would have only been operational during the Site operating hours of 5.00 am and 21.00 pm Monday to Friday and between 5.00 am and 14.00 pm Saturday, with no activities occurring during Sundays and Bank Holidays. Modelling of the likely applicable emission limit values also adds conservatism to the assessment, as results will account for and predict the worst-case scenario which is likely to have occurred during previous operation since 1990. In reality, the likely emissions will have been less than the modelled maximum. The scenario has been modelled using 2020 meteorological data for Casement Aerodrome as the most recent full calendar year available at the closest meteorological station to the Site.

2.3 Model Assumptions

The model set up is considered to reflect a conservative worst-case scenario in relation to production time as the following assumptions have been applied:

- All sources have been modelled as having been operational 24 hours per day, 7 days per week. In reality the asphalt plant has only ever been operational between 5.00 am and 21.00 pm Monday to Friday and between 5.00 am and 14.00 pm Saturday, with no activities occurring during Sundays and Bank Holidays; and
- No reduction in emissions has been made in the model for shutdown periods for cleaning, maintenance and repair and other times of non- operation.

2.4 Background Air Quality

There are 4 air quality zones in Ireland, defined for the purposes of air quality management and assessment. Highly populated areas are classified as Zone A, with sparsely populated areas as Zone D. Given the location of the Site in a semi-rural area bordering the Greater Dublin area, it is reasonable to characterise the area as a Zone C area. A review of publicly available information identifies that the Irish EPA do not operate background air quality monitoring within Rathcoole or the immediate surrounds.

A review of publicly available information identifies that the Irish EPA historically undertook background monitoring at three locations in Zone C; Celbridge (8 km north of the Site), Naas (12 km south west of the Site) and Newbridge (22 km south west of the Site) in Kildare. None of these are currently active and none are located in the vicinity of the Development. The most recent monitoring was undertaken at Celbridge, located approximately 8 km north from the Development, although monitoring at this location ceased in 2011. The last reported data from EPA, Ambient Air Monitoring at Celbridge Co. Kildare 12th July 2010- 10th April 2011 (http://www.epa.ie/pubs/reports/air/monitoring/ambientairmonitoringcelbridge.html) is summarised in Table 2 below. No $PM_{2.5}$ monitoring was undertaken at this location.

Table 2: 2010/ 2011 Background Monitoring Data for PM10

	Averaging period	Concentration (µg/m^3)
PM_{10}	Annual Average	19.5
	90.4%ile daily average	37.3

In the absence of local background data, the most recent annual mean data (2019) and historical data for NO_2, NO_x, SO_2, PM_{10} and $PM_{2.5}$ from suburban monitoring locations in Zone C areas throughout Ireland are presented in Table 3. These locations are part of the EPA National Ambient Air Quality Monitoring Network and data is reported to Europe. All monitored concentrations are below the annual AQS. Due to the location of these monitoring sites throughout Ireland and not in the vicinity of the Site, the average of the available historical data is reported and used in the assessment.

Table 3: Annual Mean Monitoring Data for Suburban Dublin Zone C Stations (2019)

Pollutant	Year	Monitoring Location	Concentration (µg/m^3)
NO_2	2019	Meath Navan	23
		Portlaoise	11
	2010	Celbridge	12
	2007	Navan*	16
	Average		15.5
NO_x	2019	Meath Navan	72.5†
		Portlaoise	14.8
	2010	Celbridge	17
	2007	Navan*	32
	Average		**21.3**
SO_2	2019	Portlaoise	1.3
	2010	Celbridge	2
	2007	Navan*	4
	Average		**2.4**

Pollutant	Year	Monitoring Location	Concentration (µg/m³)
PM_{10}	2019	Portlaoise	15
		Carlow Town	11
	2010	Celbridge‡	18
	2007	Navan*	23
	Average		**16.8**
$PM_{2.5}$	2019	Carlow Town	8
		Meath Navan	11
	Average		**9.5**

*Zone D in 2007. Measurements undertaken by mobile monitoring in 2007.
†Data omitted due to extreme concentration when compared to NO_2 value and other Zone C NO_x values.
‡Data different to Table 11 as only 2010 data considered.
Data from: https://www.epa.ie/pubs/reports/air/quality Accessed 3/3/21.

2.5 Emission Parameters

The source parameters used in the model, including emission concentrations and flow rates, are shown in Table 4. The emission concentrations used are the ELVs, and the emission rates have been calculated using available monitoring data for similar plants (Element Materials Technology Environmental UK Ltd; February 2021).

Table 4: Model Inputs for Asphalt Manufacturing Plant Stack

Parameters		Asphalt Stack Values
Stack Location (ITM co-ordinate)		699902, 725922
Stack Height (m)		8.5
Stack Diameter (m)		0.8
Exit Velocity (m/s)		31.83
Exit Temperature (°C)		90
Emission Concentrations (mg/Nm³)	SO_2	500
	NO_2	450
	Particulates (PM_{10} and $PM_{2.5}$)	50
Emission Rate (g/s)	SO_2	4.25
	NO_2	2.68
	NO_x	1.34
	Particulates (PM_{10} and $PM_{2.5}$)	0.43
Meteorological Data		Casement Aerodrome (2020 full year)

2.6 Receptors

2.6.1 Modelled Domain

The extent of the modelled domain is provided in Table 5.

Table 5: Extent of the Modelled Domain

Point	X (ITM)	Y (ITM)
Southwest corner	698900	724700
Northeast corner	700900	726700

2.6.2 Discrete Receptors

A number of discrete receptors present between 1990 and 2021 have been identified in the vicinity of the Site, as shown in Table 6. These were identified as discrete receptors in the model and represented areas of population and other locations where there is likely to have been relevant public exposure to the emissions (e.g., residential areas, commercial areas, schools, health facilities and leisure facilities) since Site activities commenced in 1990. All receptors were modelled at a height of 1.5 m, which is equivalent to breathing height. The identified receptors cover the full period from 1990 to 2021.

Table 6: Discrete Receptors in ADMS5 Model

Receptor ID	Description	X Coordinate (ITM)	Y Coordinate (ITM)	Approximate Distance (m) from Site Boundary	Direction from Site
R1	Residential	700679	6725385	875	SE
R2	Residential	700843	725765	425	E
R3	Residential	700238	725556	100	S
R4	Residential	700126	725513	100	S
R5	Residential	700089	725494	125	S
R6	Residential	700061	725470	150	S
R7	Residential	700034	725448	175	S
R8	Residential	699918	725381	250	S
R9	Residential	699862	725346	275	S
R10	Residential	699788	725284	275	S
R11	Residential	699758	725288	250	S
R12	Residential	700116	725281	325	S
R13	Residential	700164	725249	375	S
R14	Residential	699559	725236	275	SW
R15	Residential	699570	725177	325	SW
R16	Residential	699525	725149	375	SW
R17	Residential	699399	725092	475	SW
R18	Residential	699394	725000	550	SW
R19	Residential	699498	724919	600	SW
R20	Residential	699034	725530	500	W
R21	Residential	699262	725847	300	NW

Receptor ID	Description	X Coordinate (ITM)	Y Coordinate (ITM)	Approximate Distance (m) from Site Boundary	Direction from Site
R22	Residential	699340	725931	300	NW
R23	Residential	699367	725960	300	NW
R24	Residential	699144	725893	425	NW
R25	Residential	699734	726492	75	S
R26	Residential	699673	726464	425	N
R27	Residential	699712	726577	525	N
R28	Residential	699686	726574	525	N
R29	Residential	699638	726551	525	N
R30	Residential	700365	726367	500	NE
R31	Residential	700670	726245	475	NE
R32	Residential	700304	726198	325	NE
R33	Commercial	700421	726131	275	NE
R34	Commercial	700473	726040	225	NE
R35	Commercial	700563	726239	425	NE
R36	Commercial	700648	726202	425	NE
R37	Commercial	699790	726457	425	N
R38	Commercial	699238	725895	350	NW
R39	Commercial	699313	725730	200	W
R40	Commercial	699380	725730	125	W
R41	Commercial	699357	725750	150	W
R42	Commercial	699401	725713	100	W

There were no identified sensitive ecological receptors within the proximity of the Site, therefore the screening of predicted emissions is against the specified AQS values for human health only. Impacts on ecological receptors from the operation of the Asphalt Plant are deemed to be not Significant.

2.6.3 Receptor Grid

A Cartesian receptor grid has been used in this dispersion modelling assessment. A fine grid with a resolution of 20 m extends across the full model domain, extending 1000 m in all directions from the centre of the Site, i.e. 2000 x 2000 m square grid.

2.7 Meteorology

2.7.1 Meteorological Characteristics

Meteorological data from Casement Aerodrome was used in this assessment. The Casement Aerodrome meteorological station lies approximately 10 km to the north of the Site and is the closest representative operational meteorological station with a full year of recent data. The dataset used was for 2020 and included the following hourly sequential data (Table 7).

The wind rose for the meteorological data used is presented in Figure 1.

Table 7: Hourly sequential readings used in the 2020 meteorological dataset.

Parameter	Units
Wind speed	m/s
Wind direction	Degrees measured clockwise from North
Cloud cover	oktas
Surface temperature	˚C
Relative humidity	%

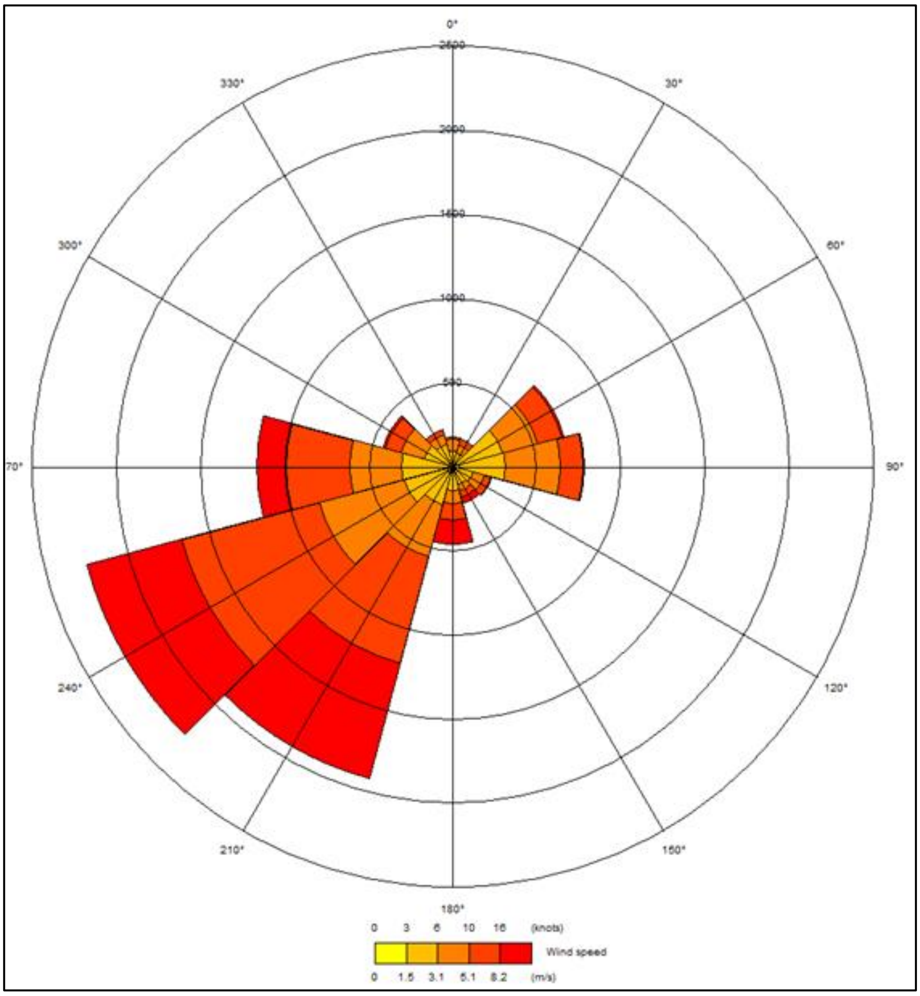

Figure 1: Casement Aerodrome Windrose for 2020

2.7.2 Treatment of Terrain

No terrain data was input into the model due to there being only small changes in elevation across the study area.

2.7.3 Surface Characteristics

The characteristics of the land use are based on default values for surface roughness contained within ADMS-Roads. A surface roughness value of 0.5 m is used at the dispersion site (the Site) and a value of 0.1 m is used at the meteorological measurement site (Casement Aerodrome) to account for the nature of the site as an airfield.

2.7.4 Special Treatments

The scope of the assessment did not warrant the inclusion of any special treatments (e.g. short-term/puff releases, coastal models, fluctuations, photochemistry, wet/dry deposition or flare releases) in the model.

3.0 MODEL RESULTS

The predicted maximum off Site concentrations for each modelled pollutant are presented in Table 8. This provides the predicted maximum off-Site Process Contribution (PC) concentration, and Predicted Environmental Concentration (PEC) which is the PC plus the background concentration. The maximum modelled off-Site PCs and PECs are also provided as a percentage of the relevant Air Quality Standard as provided. Note that the modelled concentrations have been considered for the full off-Site model domain, i.e., all gridded receptor locations as well as the identified discrete receptor locations.

Table 8: Modelled Maximum off Site PC and PEC Concentrations for each Pollutant

Pollutant	Averaging Period	AQS	Max PC	Max PC as % AQS	Background Concentration	Max PEC	Max PEC as % AQS
SO_2	1 hour (99.7th %ile)	350	212.3	61	4.8	217.1	62
	24-hour (99th %ile)	125	206.9	166	2.8	209.7	168
NO_2	1 hour (99.79th %ile)	200	46.2	23	31.0	77.2	39
	Annual average	40	20.5	51	15.5	36	90
PM_{10}	24-hour (90.4th %ile)	50	12.6	25	19.8	32.4	65
	Annual average	25	4.7	19	16.8	21.5	86
$PM_{2.5}$	Annual average	25	4.7	19	9.5	14.2	57

[1] Hourly (Short term) NO_2 background value taken as double the annual (long term) background value.

[2] 24-hour background value taken as 59% of the hourly (short term) background value (https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit).

The results presented above in Table 8 show that for SO_2, the modelled maximum hourly average PC from the asphalt plant is 212.3 µg/m^3 (61% of the AQS), and the maximum PEC is 217.1 µg/m^3 (62% of the AQS).

The modelled maximum 24-hour average PC for SO_2 is 206.9 µg/m^3 (166% of the AQS), and the maximum PEC is 209.7 µg/m^3 (168% of the AQS). This result exceeds the AQS and is discussed further in Section 4.1 below.

The modelled maximum hourly average PC for NO_2 is 46.2 µg/m^3 (23% of the AQS), and the maximum PEC is 77.2 µg/m^3 (39% of the AQS).

The modelled maximum annual average PC for NO_2 is 20.5 µg/m^3 (51% of the AQS), and the maximum PEC is 36.0 µg/m^3 (90% of the AQS).

The modelled maximum 24-hour average PC for PM_{10} is 12.6 µg/m^3 (25% of the AQS), and the maximum PEC is 32.4 µg/m^3 (65% of the AQS).

The modelled maximum annual average PC for PM_{10} is 4.7 µg/m^3 (19% of the AQS), and the maximum PEC is 21.5 µg/m^3 (86% of the AQS).

The modelled maximum annual average PC for $PM_{2.5}$ is 4.7 µg/m^3 (19% of the AQS), and the maximum PEC is 14.2 µg/m^3 (57% of the AQS).

4.0 ASSESSMENT OF IMPACTS

4.1 Model Result Discussion

The predicted impact of emissions from the asphalt manufacturing plant at the Site between 1990 and 2020 has been assessed using the ADMS 5.2 atmospheric dispersion model. In the absence of actual monitored data from the stack, the model utilised the assumed applicable emission limit values for all pollutants, therefore providing a conservative assessment of potential emissions. Further to this, the asphalt plant has been modelled as operational for 24 hours per day, 365 days per year. In reality, the plant has only ever been operational within the specified working hours permitted at the Site (5.00 am and 21.00 pm Monday to Friday and between 5.00 am and 14.00 pm Saturday, with no activities occurring during Sundays and Bank Holidays), and variation in market demand will have limited use of the asphalt manufacturing plant during the last 30 years of operation.

The modelling results presented in Section 3.0 show that the maximum predicted off-Site concentrations likely to have occurred since 1990 for hourly SO_2, hourly NO_2, annual NO_2, 24-hourly PM_{10}, annual PM_{10}, and annual $PM_{2.5}$ are all below the relevant AQS limit values. This means that there was no unacceptable impact shown at any off-Site location within the modelled domain.

The modelling results show that for 24-hourly SO_2, the maximum predicted off Site concentration is greater than the relevant AQS limit value, with the maximum modelled PEC being 166.7% of the relevant AQS limit of 125 µg/m^3. The gridded receptor location where this concentration has been predicted is situated along the northern Site boundary, to the east of the access road. It is noted that there are a small number of other gridded off-Site receptors where the predicted concentrations of 24-hourly SO_2 are also greater than the AQS. These are all located in the same area as the maximum modelled concentration and are either at the Site boundary, or within a maximum distance of 128 m from the Site boundary. It is further noted that none of the gridded receptor locations with predicted concentrations greater than the AQS are located near any of the identified discrete sensitive receptors, and there are no exceedances of the AQS at any of the discrete receptor locations. The shortest distance between a sensitive (residential) receptor, and an identified gridded receptor point with a predicted 24-hour average SO_2 concentration above the AQS is approximately 528 m.

In terms of the significance of the modelled exceedances in 24-hourly SO_2, it is noted that at this averaging period, a person would require the full 24-hour exposure time at one of the exceeding locations in order to have been subject to the predicted concentration of SO_2. Due to the location of the exceeding gridded receptor points, which are either on the Site boundary or within a maximum distance of 128 m from the Site boundary and at least 528 m from any sensitive receptors, it is considered very unlikely that a person would have been in any of these locations for a continuous period of 24 hours. The gridded receptor locations identified as exceeding the AQS are also not located along a public footpath or right of way, so no direct permissible access is possible, even for a shorter time period. It is noted that the predicted 1-hour average concentrations of SO_2 are below the relevant AQS limit value at any off-Site gridded or sensitive receptor. The means that any short-term presence at the gridded receptor locations exceeding the 24-hour limit value would not have had any associated risk for human health. As mentioned previously, this assessment is very conservative. The model uses both the maximum emission limit values as the emitted concentrations, and the asphalt plant is modelled as having been operational for 365 days a year on a 24 hour basis (where in reality it would have only been operational during the Site operating hours of 5.00 am and 21.00 pm Monday to Friday and between 5.00 am and 14.00 pm Saturday, with no activities occurring during Sundays and Bank Holidays). Considering all of the above information, the predicted exceedances of the specified AQS for 24-hour SO_2 at a limited number of gridded receptor points which are either in close proximity to or on the Site boundary are not considered to have posed an unacceptable risk to human health since 1990, given both the conservative nature of the model and the inaccessible locations at which these higher concentrations are predicted at.

4.2 Residual Impacts

The operation of the asphalt manufacturing plant has given rise to air emissions, which have been assessed by air dispersion modelling in this assessment. The modelling identified a small number of gridded off-Site receptors which exceeded the specified AQS for 24-hour average for SO_2. These gridded receptors are located close or on the Site boundary and away from any sensitive receptors. The likely impact to human health as a result of the small number of locations exceeding the AQS is considered to be Not Significant given their location, and the conservatism of the model.

Overall, it is not perceived that any significant residual impacts on the receiving air environment have arisen from the previous operation of the Site since 1990.

4.3 Cumulative Impacts

The air dispersion modelling of emissions from the asphalt manufacturing plant has included the background concentrations of modelled pollutants, and therefore accounts for the cumulative impact of the Site activities and any developments occurring in the vicinity during the assessment period. It is noted that all modelled pollutants, excluding 24-hour SO_2, have predicted off-Site concentrations which are below the relevant AQS values when the process contributions are considered alongside the background concentrations. With regards to the identified exceedances of the relevant AQS for 24-hour SO_2, due to both the averaging time used, and the small number of isolated gridded receptor points which are greater than the AQS, there is no further anticipated cumulative impact that may have resulted from the limited exceedances identified in this dispersion modelling assessment.

5.0 REFERENCES

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