7.0 AIR QUALITY AND CLIMATE

7.1 Introduction

7.1.1 Background

Golder Associates Ireland Ltd (Golder) have been commissioned by Mr Laurence Behan to prepare this Air Quality and Climate Chapter as part of an Environmental Impact Assessment Report (EIAR) to assesses the impacts of the ongoing and future activities relating to the development and operation at Windmill Hill, Rathcoole, Co. Dublin (the "Site") on the receiving (air) environment. The existing development use is for the quarrying and production of aggregates and registered in accordance with Section 261, Planning & Development Act 2000 (Quarry Ref. No. QS1054). This chapter considers the potential effects of the continued 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 EIAR (Project Description).

7.1.2 Project Overview

This EIAR has been prepared to accompany a planning application to be made under S.37L of the Planning and Development Act, 2000 as amended for the continuation of extraction at an existing quarry at Windmillhill, Rathcoole, Co. Dublin.

The application for further development of the quarry is to be made concurrent with an application for substitute consent for the quarry that is accompanied by a remedial rEIAR.

The lands the subject of this EIAR extend to 46.14 ha. that reflect historic operational site information including the extractable area declared under S.261 quarry registration in 2005. The EIA project boundary is generally bounded by the N/M7 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 consist of field boundaries and the entrance to a dwelling called 'Four Winds' that is within the ownership of the planning applicant to the east; and the former local Steelstown Road to the west.

At the centre of the EIAR project boundary is an existing quarry that covers an area of approximately 28.8 ha. with an average working depth of approximately 173 mAOD. The existing quarry is roughly rectangular in shape with an east – west axis parallel to the N/M7 and local Windmillhill Road. The existing quarry has a centrally located administration and processing plant area over approximately 5 ha.

The further quarrying development proposed involves a lateral northward extension of the current quarry void area of 4.1 ha. (requiring a total additional land take of 5.19 ha. for landscaping berms) west and east of an existing dwelling also in the applicant's ownership and a deepening of the western and eastern side of the laterally extended void to a final working depth of approximately 150 mAOD. The further development proposed is for quarrying only and is over an area of approximately 26.87 ha. The material extracted will be processed at the existing central processing area and the existing quarry access will be utilised.

It is anticipated that extraction of the remaining reserve will occur over 10 to 15 years, depending on market conditions with a further 2 to 5 years for restoration that will remediate the quarry void to agricultural /amenity use and remove the quarry processing plant.

7.1.3 Scope & Significance Methodology

This chapter presents an assessment of the potential air quality and climate effects associated with the continued 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), as part of the rEIAR submitted for the Site's Substitute Consent Application. Detailed dispersion modelling using ADMS-Roads was 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 assessment concluded that the impact of traffic on local receptors was not Significant. As there are no proposed changes to traffic flows associated with this application (and vehicle emissions are predicted to improve with time due to improvements in technology and emissions), impacts from traffic emissions are considered to be Not Significant and are therefore not considered further.

A quantitative assessment of combustion emissions related to the asphalt manufacturing site was undertaken as part of the rEIAR. Detailed dispersion modelling was undertaken using the latest version (Version 5.2.2) of CERC ADMS5 dispersion modelling software, to predict concentrations of NOx, NO_2, SO_2, PM_{10} and $PM_{2.5}$ at nearby sensitive receptors. The assessment concluded that the impacts from the operation of the plant on local receptors was Not Significant. As there are no proposed changes to the operation of the asphalt plant at the Site, impacts from the combustion emissions are considered to be not Significant and are therefore not considered further.

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 Odour

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

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).

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; and
- 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
- 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
		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

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m^3	Basis of application Limit
		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
$PM_{2.5}$ Stage 1	Protection of human health	Calendar year	25	Annual mean
$PM_{2.5}$ 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), 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 Emission 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

The existing development use is for the quarrying and production of aggregates located in Co. Dublin.

Currently the site is made up of predominantly quarrying and unimproved grassland currently used for the grazing of sheep. 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. The nearest dwelling is 120 m to the south of the site and the nearest school 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 1960's.

The EIA project boundary is detailed in Figure 7.1 below.

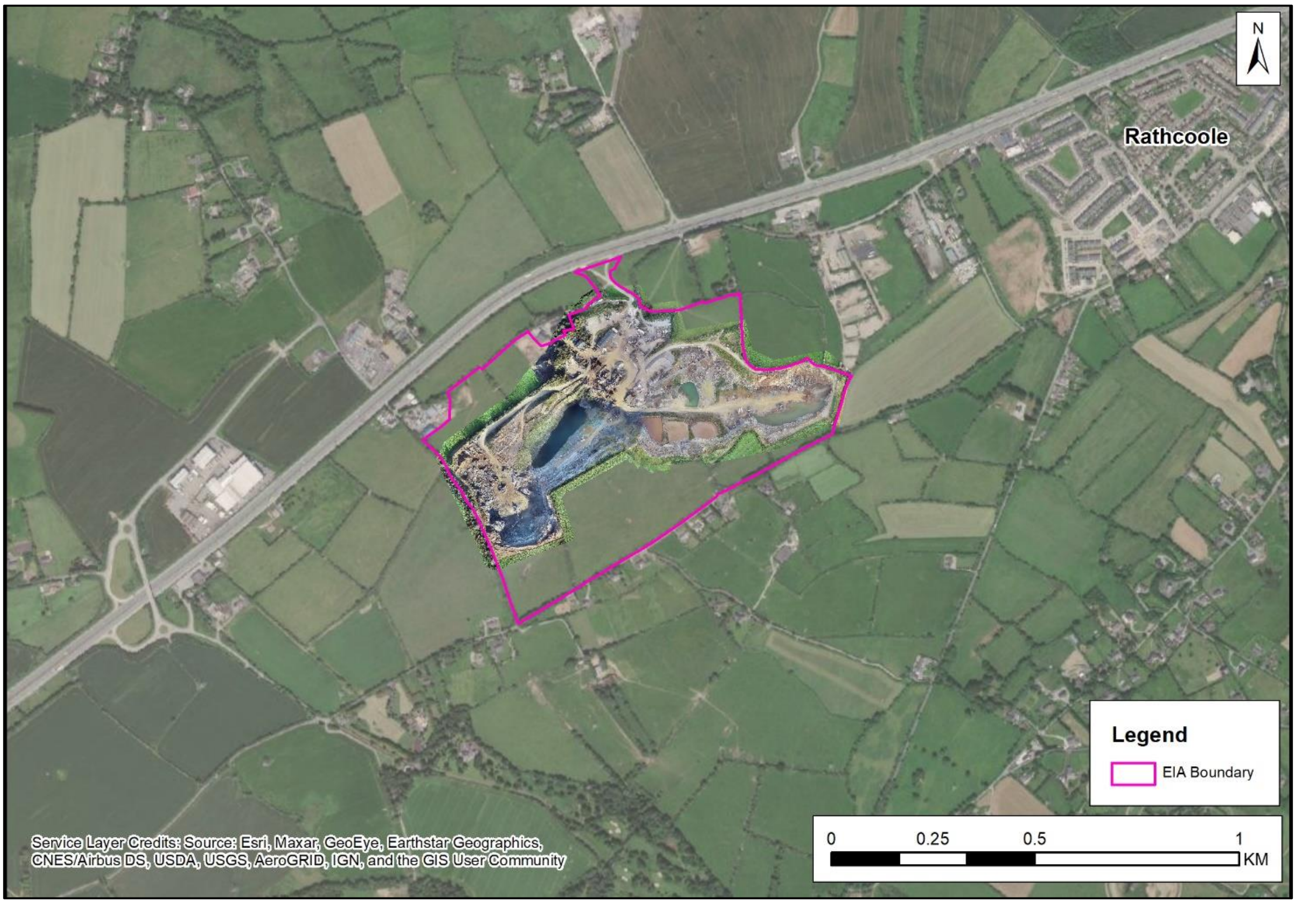

Figure 7.1: EIA Project Boundary.

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 will be subject to a 50 m buffer, which will then extend 350 m out onto the N7 main road in both directions 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. The full assessment in contained in Appendix 7.1 of this report.

7.3.3 Receptors

Receptors identified for the purpose of the assessment of particulates/ dust emissions from the operation of the quarry are shown below in Figure 7.2. Three residential receptors located in the vicinity of the Site are owned by the applicant.

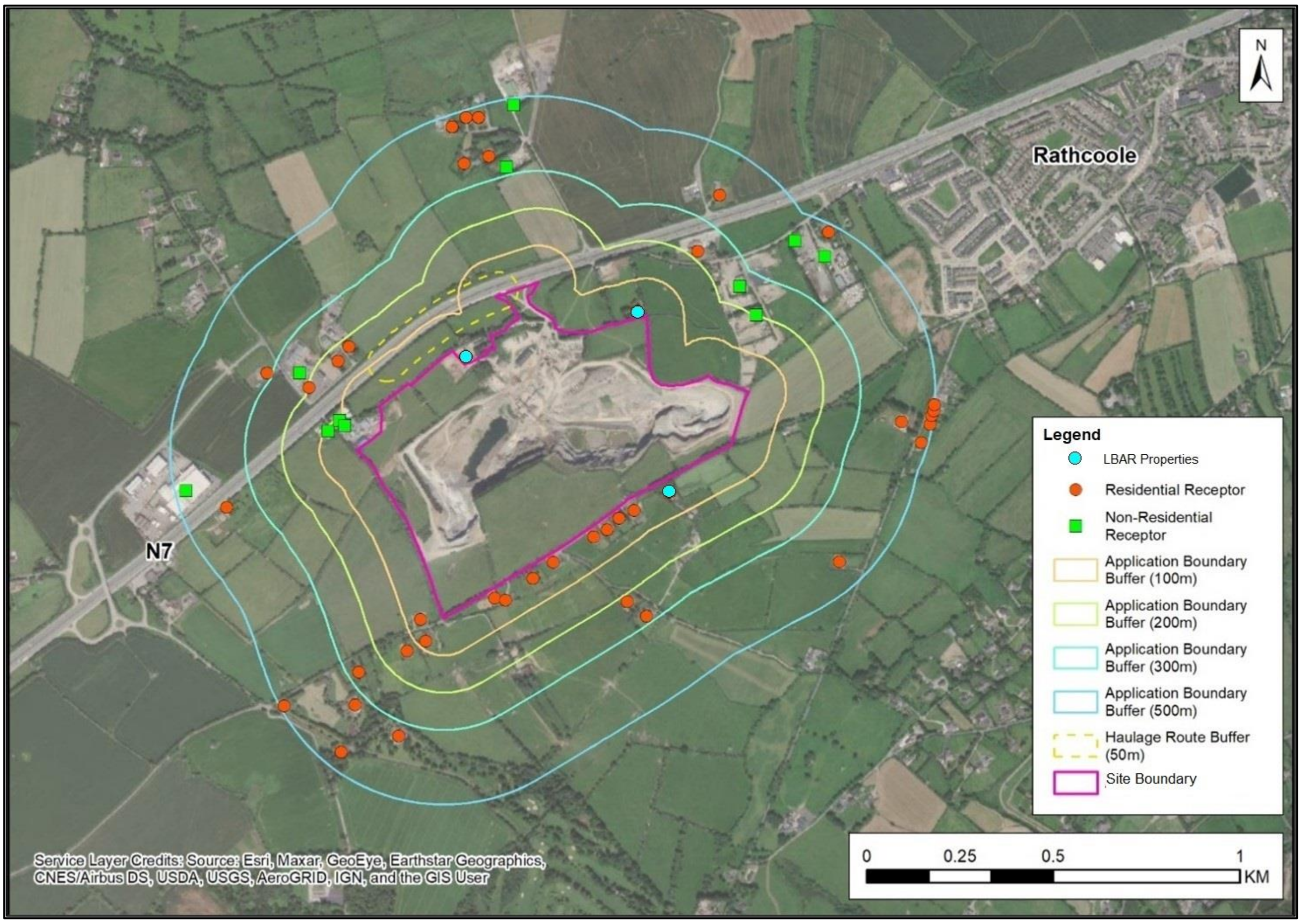

Figure 7.2: Identified Receptors within 500 m of the Site Boundary

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 2016 and 2020 have been averaged and are presented in Table 7.4.

Table 7.4: Casement, Co. Dublin recorded 2016 to 2020 Monthly Average Climate Information

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Air Temperature (°C)	5.6	5.4	6.3	7.9	11.7	14.3	16.0	15.4	13.0	10.0	6.5	6.5
Maximum Air Temperature (°C)	12.6	13.8	15.1	18.5	22.2	25.5	25.8	24.1	22.7	18.0	14.7	13.6
Minimum Air Temperature (°C)	-3.1	-4.6	-2.8	-2.6	0.5	4.2	6.5	6.4	3.3	-1.2	-2.7	-3.4
Mean Maximum Temperature (°C)	8.4	8.8	10.1	12.0	16.3	18.6	20.6	19.6	17.2	13.7	9.6	9.3
Mean Minimum Temperature (°C)	2.9	1.9	2.7	3.9	7.0	10.0	11.5	11.1	8.9	6.4	3.3	3.7
Precipitation (mm)	56.6	67.1	58.5	42.8	43.3	78.5	39.1	71.4	72.8	58.2	91.4	63.0

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grass Minimum Temperature (°C)	-8.1	-8.0	-7.0	-6.2	-3.5	0.4	2.2	2.5	-0.3	-5.1	-6.4	-6.9
Mean Wind Speed (knots)	11.4	11.7	10.7	8.7	7.8	8.1	8.1	9.6	9.7	9.5	9.1	11.2
Highest Gust (knots)	53.4	55.0	50.0	47.0	38.3	40.8	34.8	38.0	43.3	48.0	44.3	49.8
Global Solar Rad. Joules/cm2	55.6	84.8	108.3	131.2	207.3	184.4	182.9	160.3	129.4	101.9	66.7	44.5

The information presented in Table 7.4 provides an overview of the climatic conditions at the Site. Over the time period for which data is provided, the wettest month in terms of total rainfall for the period is November. High rainfall 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 January, February and December and the driest month in the Site area is July.

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 7.3 for the period 01 January 2020 to 31 December 2020. The prevailing winds are from a south-westerly direction.

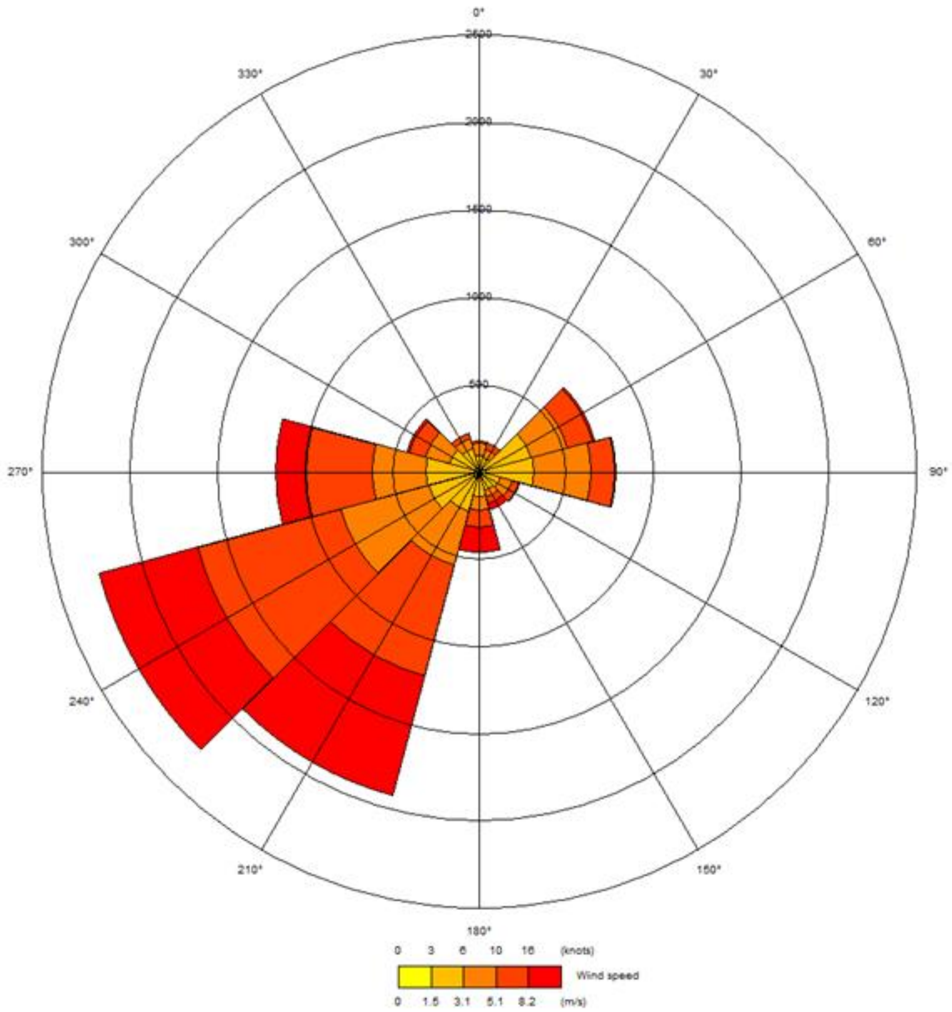

Figure 7.3: Windrose for Casement Aerodrome using Hourly Sequential Wind Data, 01 January 2020 - 31 December 2020

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 during 2020 and 2021 using the Bergerhoff method at 4 different monitoring locations. Data is presented in this assessment for 2020 and 2021, as this is deemed to be the most applicable data relating to the ongoing operation of the Site. Descriptions of the dust monitoring locations are presented in Table 7.5 and their locations are shown in Figure 7.4.

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.

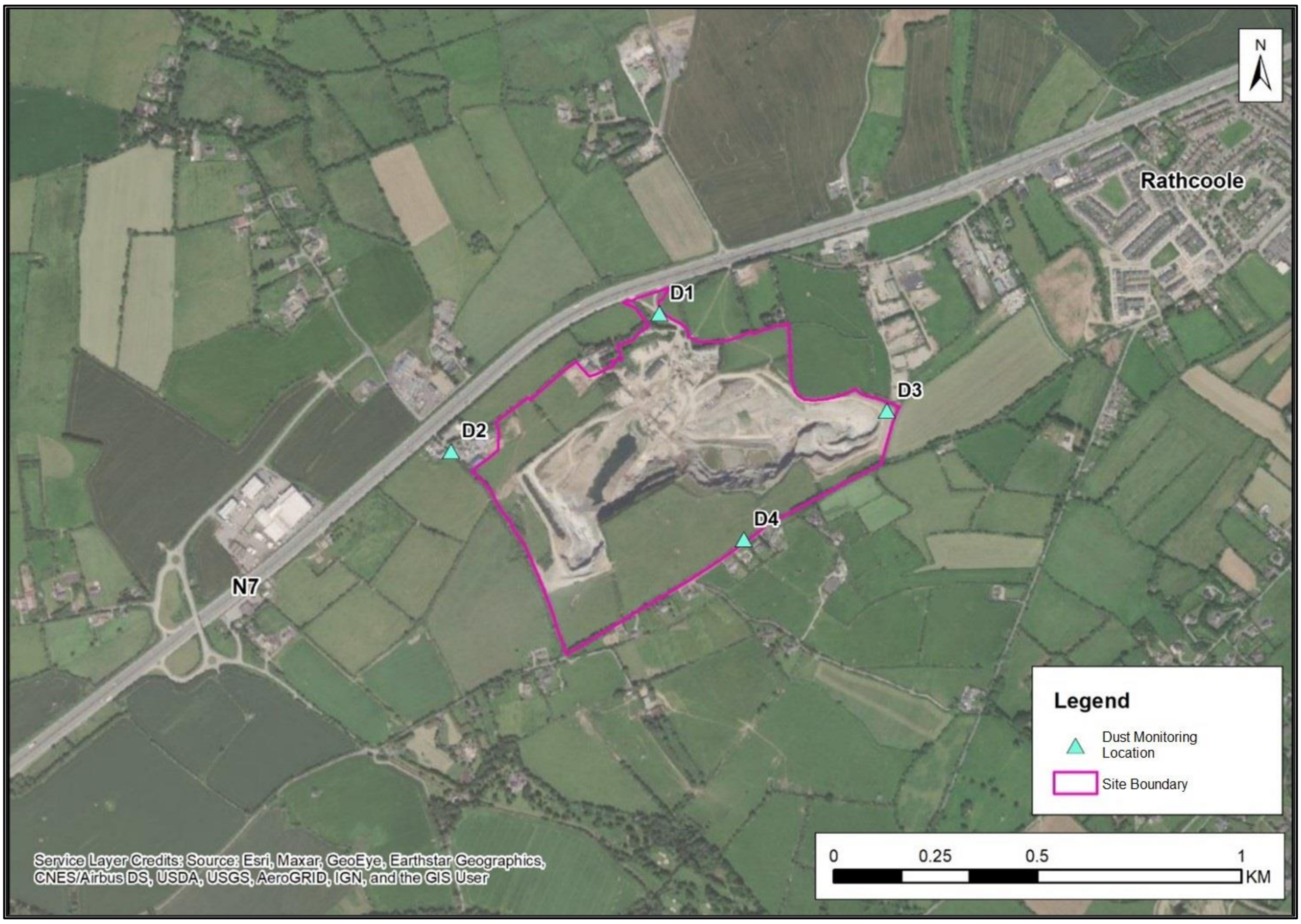

Figure 7.4: Plan Showing Dust Monitoring Locations

The method employed for measuring dust deposition at the Site is the Bergerhoff method. 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 also recommended by the EPA in their guidance - Environmental Management in the Extractive Industries (April 2006). Monitoring was undertaken in 2020 and 2021 by independent laboratories, using standard Bergerhoff gauges. The results of this monitoring are shown in Table 7.6 and are also included in Figure 7.5.

Table 7.6: Recorded Deposited Dust (mg/m2/day) at Monitoring Locations during 2020/2021

Monitoring Period	Monitoring Location			
	D1	D2	D3	D4
04/03/2020 – 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.

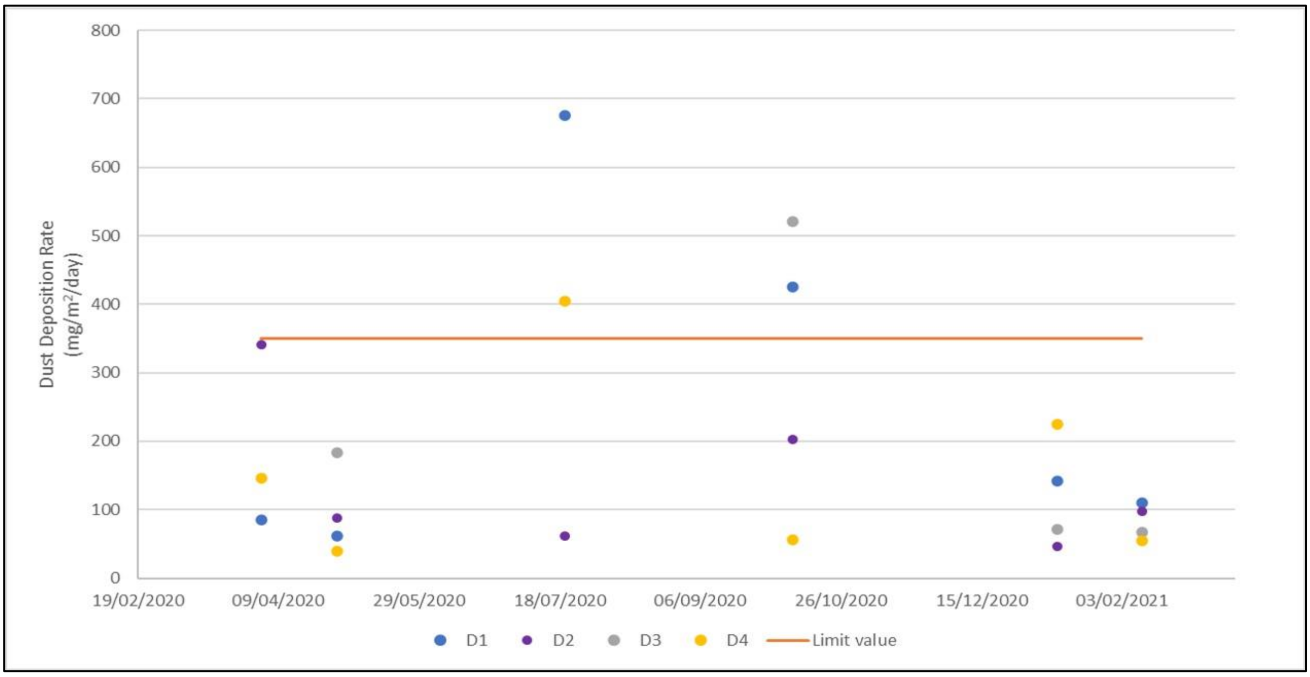

Figure 7.5: 2020/2021 dust deposition monitoring results

7.3.5.1.1 Commentary on Concentrations greater than the Limit Value

During the recent sampling shown in Table 7.6 above, there were four samples that were greater than the limit value of 350 mg/m^2/day occurring during the sampling periods 19/06/2020 - 20/07/2020 and 10/09/2020 – 09/10/2020. The first was at site D1 (675.7 mg/m^2/day), and the second at site D4 (404.3 mg/m^2/day). Then the remaining 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. 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 areas; 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 7.7 below. No $PM_{2.5}$ monitoring was undertaken at this location.

Table 7.7: 2010/ 2011 Background Monitoring Data for PM10 at Celbridge

	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 7.8 below. 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 7.8: Annual Mean Monitoring Data for Suburban Dublin Zone C Stations

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

Pollutant	Year	Monitoring Location	Concentration (µg/m³)
	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 7.11 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.

7.5 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 continued operation of the Site 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 and used these to assign a magnitude to the dust effects likely to be experienced at identified receptors. Consideration was given to mitigation measures which are currently in place, and will remain in place with the continuation of Site activities. 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 was defined as 'moderate' without mitigation, and 'slight' with mitigation.

Coarse particulate residual impacts of the continuation of existing Site activities on air quality, microclimate and climate change are considered to be slight. During long spells of dry weather, dust emissions can potentially be more elevated, however dust nuisance from the operation is expected to be unlikely if the mitigation measures defined in Appendix 7.1 are implemented during production and restoration. The overall impact from the continued operation of the Site, in terms of dust emissions, is considered 'slight' to the air environment.

In the longer term, on completion of the site restoration, the concentration of airborne dust would be expected to be reduced from operational levels as the result of covering and seeding of exposed, un-vegetated soil surfaces. This will most likely constitute a minor positive impact for the local environment.

With the continued application of the site-specific mitigation measures, it is therefore considered that the residual effects associated with the continued operation of the Site will be 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 by the Site.

7.6 Climate Factors

This section considers climate change resilience and adaptation, i.e. how the continued operation of the Site may interact with a changing climate and whether this interaction could result in significant environmental effects.

The contribution of the continued operation of the Site to climate change is also a requirement of the assessment of climate change resilience and adaptation of a development. The assessment will consider the potential climate impacts during the operational phase.

7.6.1 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.

7.6.2 Climate Change Impacts for Ireland

The EPA has identified a number of potential impacts for Ireland from climate change. Such changes are expected to include:

- Storm surges and waves. Storm surge events are expected to increase in frequency, with significant increases to be observed on the western coast of the country during the winter months. Average wave heights are expected to increase on the north-west coast of the country by approximately 10%.
- Weather extremes. The prediction of such weather extremes is difficult to predict however, additional energy trapped in the atmosphere by greenhouse gases is likely to continue to stimulate greater atmospheric volatility in Ireland.
- Fluvial flooding. Although it is difficult to predict it is expected that increases in the seasonality extremes will occur with increasing run-off to catchments in winter and decreasing flows in summer. This will result in significant consequences for the management of flood defences, water supplies, waste treatment and biodiversity conservation.
- Sea level rise. The EPA has noted that satellite altimetry has identified a rise of around 3.5 cm per decade in the seas around Ireland, which is in line with the IPCC's global projections. Further increases in sea levels would present as a substantial increase in sea levels globally. This would have significant implications for low lying coastal regions throughout the world and in Ireland.
- Precipitation. Similar to other climate variables precipitation is expected to become heavier during autumn and winter months by the end of the century, while summers are likely to become substantially drier over the same period. The EPA has noted that the accuracy of model projection can be difficult to verify however rainfall in winter/autumn is projected to increase by up to 25% and decline by up to 18% in the summer period.
- Sea temperatures. Sea temperatures around Ireland have been shown to increase by 0.3 to 0.4ºC per decade. Changes of this magnitude will have a significant effect on maritime ecosystems and economies through effects on commercial fish species.

The most applicable climate variable and hazards for the Site, as identified by the EPA, include weather extremes, fluvial flooding and precipitation. Climate change factors such as ocean acidification, sea-level rise and storm surges and waves have been scoped out of this climate assessment, due to the location of the Site.

Factors in relation to the EIAR study areas have also been incorporated into the evaluation below, these include, air quality, noise, landscape and visual, water and flood risk, geology and ecology and biodiversity.

The assessment considers aspects of the Site that are potentially vulnerable to the effects of climate change. Where relevant aspects have been identified, these can be mitigated through embedded mitigation, monitoring or other measures. The impact of the Site on environmental receptors sensitive to climate change has also been considered.

7.6.3 Effect of Climate Change on the Continued Operation of the Site

7.6.3.1 Air Quality

An increase in summer and winter rainfall volume and periods of higher intensity rainfall (storms) could lead to increased dust dampening and suppression. This would result in less dispersion of dust as the increased rainfall would result in particles being less available to be entrained by the air.

In the summer, higher air temperatures could result in changes to chemical reactions which occur in the atmosphere. If temperatures increase, there could be an increase in photochemical reactions in the atmosphere. This could lead to an increase in ozone concentrations in the atmosphere.

Increases in wind speed could change the dispersion patterns of pollutants.

7.6.3.2 Noise

The projected windier, wetter and warmer environment is not anticipated to result in any significant change to future noise or vibration levels arising from the continued operation of the Site.

7.6.3.3 Landscape and Visual

The predicted seasonal variations in rainfall i.e. wetter winters and drier summers could create unfavourable conditions for the establishment of trees and shrubs, particularly during prolonged periods of drought, or where waterlogging of the ground persists. This could increase plant mortality and reduce the effectiveness of screening around the periphery of the Site, along with potential increased on-going maintenance costs.

7.6.3.4 Water and Flood Risk

In the future, increases in winter rainfall volume and periods of higher intensity rainfall (storms) could lead to increased runoff, greater surface water flows and more incidents of flooding. In summary, current predictions suggest that flashier floods in summer and bigger floods in winter could be expected.

In the summer, higher air temperatures could lead to higher surface water temperatures leading to greater evaporation and reduced flows. Rainfall could be less and more intense leading to potential increases in erosion and suspended solid concentrations during sudden high intensity rainfall events on dry ground. Less overall summer rainfall could also lead to lower flows in watercourses and possibly poorer quality (i.e. caused by changes in land use and the quality of runoff). Changes in surface water flow regime through the year caused by changes in rainfall distribution could alter the mobility and dilution of nutrients and contaminants (i.e. lower dilution in summer due to lower flow rates would result in higher concentrations, and lower flow rates could lead to algal blooms and lower oxygen). Lower summer flows and water levels also have the potential to result in reduced surface water resource availability.

The susceptibility of the Site to fluvial flooding has been considered in Chapter 8 Water. Although the Site is currently not mapped as at risk of flooding and is categorised as in low risk Flood Zone C, climate change could alter the risk of flooding and flood damage, due to changes in surface water flows and flood plain storage and also due to flood risk from groundwater flooding. The potential for future change in flood risk is already incorporated into the embedded design mitigation, so no further consideration is required in this climate change assessment.

7.6.3.5 Geology, Ground Conditions and Groundwater

There are no geological heritage sites within the geology study area, and no other mineral sites identified since the Site has been operational. Changes in rainfall, temperature and wind are not anticipated to result in any change to geological conditions that could affect the Site.

In terms of ground conditions and groundwater, higher air temperatures and windier conditions could result in higher evaporation and reduced soil saturation. Reduced soil saturation in drier and warmer summers could lead to reduced groundwater recharge in the summer, and the winter groundwater recharge period could be shortened due to autumn and winter rainfall balancing the soil moisture deficit before recharging groundwater. This may be compensated to some extent by increased winter rainfall. However, aquifers are recharged more effectively by prolonged steady rain, so changes in rainfall regimes could lead to more runoff to surface water rather than recharge to ground during higher intensity summer and winter rainfall events.

If recharge and groundwater levels were to decrease, there could be increased frequency and severity of groundwater droughts. Conversely, if groundwater recharge increases at certain times of the year there could be an increase in the frequency and severity of groundwater-related floods. If groundwater levels in contaminated ground rise due to climate change, this could lead to the mobilisation of historical contamination that was previously above groundwater level highs, which could impact baseline groundwater quality and ground quality.

Higher future temperatures and the potential reduction in the availability of surface water resources could also lead to a greater demand on groundwater resources for urban/industrial supplies and agricultural irrigation. However, improvements in water use efficiency may also take place in parallel with climate change.

7.6.3.6 Ecology and Biodiversity

Climate change presents a risk to native wildlife and to the ecosystem services provided by natural capital, for example clean water.

At a local level (i.e. the spatial extent of the assessment defined for the Site), the projected windier, wetter and warmer environment is not expected to result in any measurable positive or negative change to the baseline biodiversity features of the Site.

7.6.4 Climate Mitigation and Monitoring

7.6.4.1 Air Quality

No additional air quality mitigation or monitoring is required as a result of potential climate change effects.

7.6.4.2 Noise

No additional noise mitigation or monitoring is required as a result of potential climate change effects.

7.6.4.3 Landscape and Visual

Consideration should be given to the inclusion of drought and water tolerant species in the perimeter planting mixes. This would minimise plant losses and maintain landscape and visual amenity.

Any dead or defective plants should be replaced annually as part of the ongoing site maintenance. No additional mitigation or monitoring is required as a result of climate change effects.

7.6.4.4 Water and Flood Risk

No additional water resources or flood risk mitigation or monitoring is required as a result of potential climate change effects.

7.6.4.5 Geology, Ground Conditions and Groundwater

No additional ground conditions or groundwater mitigation or monitoring is required as a result of potential climate change effects.

7.6.4.6 Ecology and Biodiversity

No additional ecology or biodiversity mitigation or monitoring is required as a result of potential climate change effects.

8.1.1 Residual Climate Effects

7.6.4.7 Air Quality

There will be no change to the identified residual air quality effects as a result of potential climate change effects.

7.6.4.8 Noise

There will be no change to the identified residual noise effects as a result of potential climate change effects.

7.6.4.9 Landscape and Visual

The potential changes to the landscape or to views experienced by nearby receptors, as a result of climate change, would be fully mitigated by the mitigation measures proposed. There would be no change to the residual landscape or visual effects identified.

7.6.4.10 Water and Flood Risk

There will be no change to the identified residual water resources and flood risk effects as a result of potential climate change effects.

7.6.4.11 Geology, Ground Conditions and Groundwater

There will be no change to the identified geology, ground conditions or groundwater effects as a result of potential climate change effects.

7.6.4.12 Ecology and Biodiversity

There will be no change to the identified residual ecology and biodiversity effects as a result of potential climate change effects.

7.6.5 Greenhouse Gas

There is the potential for greenhouse gases to be generated from the ongoing operation of the Site.

Primary sources of direct GHGs will likely include vehicle movements, asphalt manufacturing plant operation, waste disposal, and water and energy use. There may also be indirect sources of GHG emissions related to energy purchase.

Estimated ongoing vehicle movements associated with the Site are estimated to generate approximately 11.39 Kilo tonnes carbon dioxide equivalent (Kt CO_{2e}) per annum based on an assumption of 880 AADT with 70% HDV. This assumes diesel HDVs with an average one-way trip length of 50 km one way 100% laden and one way unladen. For LDVs the average trip length is assumed to be 30 km for an average car. The figures are expressed as annual amounts.

The assessment of GHG emissions has required assumptions to be made as some values are currently projected as they cannot be known with complete certainty at this stage. The emission factors used have been sourced from the DEFRA (2019) Greenhouse Gas Reporting Conversion Factors which are designed for emissions reporting. The most appropriate conversion factor has been selected for each activity to represent the resulting emissions as best as possible. However, there will be some discrepancies in the results – such as for car traffic data, as 'average' car conversion factors have been used. Where available, data has been sourced directly such as the projected AADT data for the operational phase. Where data was not available assumptions have been made regarding traffic travel distances.

Ireland's Greenhouse Gas Emissions Projections (EPA, 2020) estimate that annual emissions for 2021 for the road transport sector will be 12,246.5 Kt CO_{2e}.. The estimated emissions relating to the Proposed Development traffic are less than 0.09% of the EPA projections for road transport. It should be noted that this data relates to Irish emissions pre COVID-19 and does not include the findings of the 2021 EPA report on the Impact on 2020 greenhouse gas emissions of COVID-19 restrictions, which has seen a decrease in transport emissions and an increase in residential emissions during restrictions. These findings have not been incorporated due to the likely extended length of the ongoing operational period. Based on the quantum of Greenhouse Gas emissions estimated to be generated by the Proposed Development, the impacts are deemed to be negligible and therefore Not Significant.

7.7 Residual Impacts

Residual impacts of the continuation of existing Site activities on air quality, microclimate and climate change are considered to be no more than slight and the effects Not Significant.

In terms of coarse particulates (dust), during long spells of dry weather, dust emissions can potentially be more elevated, however dust nuisance from the operation is expected to be unlikely if mitigation measures defined in Appendix 7.1 are implemented during production and restoration. The overall impact from the continued operation of the Site, in terms of dust emissions, is considered 'slight' to the air environment. In the longer term, on completion of the site restoration, the concentration of airborne dust would expect to be reduced from operational levels as the result of covering and seeding of exposed, un-vegetated soil surfaces. This will most likely constitute a minor positive impact for the local environment. Following the continued application of the site-specific mitigation measures set out in Appendix 7.1, it is therefore considered that the residual effects associated with the continued operation of the Site relating to dust will be Not Significant.

7.8 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 planned operations in close proximity to the Site which may generate significant emissions to air. Therefore, there is no opportunity for significant cumulative impacts to arise as a result of the continuation of activities at the Site.

7.9 Summary & Conclusion

This EIAR chapter has assessed the potential impacts of the ongoing operation of the Site on Air Quality and Climate. The possible sources of emissions to air were identified as particulates resulting from the operation of the Site.

The impact of coarse particulates (dust) on the surrounding area as a result of the ongoing activities at the Site is considered to be 'slight' and therefore Not Significant. The assessment considered the ongoing mitigation measures which will continue to be in place. With regards to fine particulates, it is considered that there may be the potential for an increase in PM_{10} and $PM_{2.5}$ concentrations at the residential receptors downwind in the vicinity of the Site, 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.

When considering all of the emissions to air associated with the ongoing operation of the Site, the impacts to air and climate 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 EIAR and considers the potential effects of the activities relating to the continued operation at Windmillhill, Rathcoole, Co. Dublin (the "Site") 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 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 Air Quality Assessment (EIAR Chapter 7.0) dated May 2021 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 continued 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.

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 (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 proposed development that are the most likely dust generating sources are listed below:

- 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/restoration is classified as a large magnitude source due to the size of the working area. The land subject to this EIAR extends approximately 26.87 ha. The actual size of the working area may be 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 (based on the total combined extraction area being ca. 40 ha), 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 is conservatively assumed that there will continue to be <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 will continue to be >250 (616) on-site HDV trips per day. A 7 m wide haulage road with a bitumen tarmac finish is constructed from the Site entrance to the yard area and Conveyer belt systems are also used to transport material on site, however, there are also 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 on the pit floor and surface aggregate processing area.

Off-site transportation is classified as a large magnitude source as the proposed movements in this Application are consistent with the current AADT, (this will be approximately 308 outward HDV movements per day), and the fact that the existing wheel wash will be used by 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 07, 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 5 - 8 m/s and some higher wind speeds of >8 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.

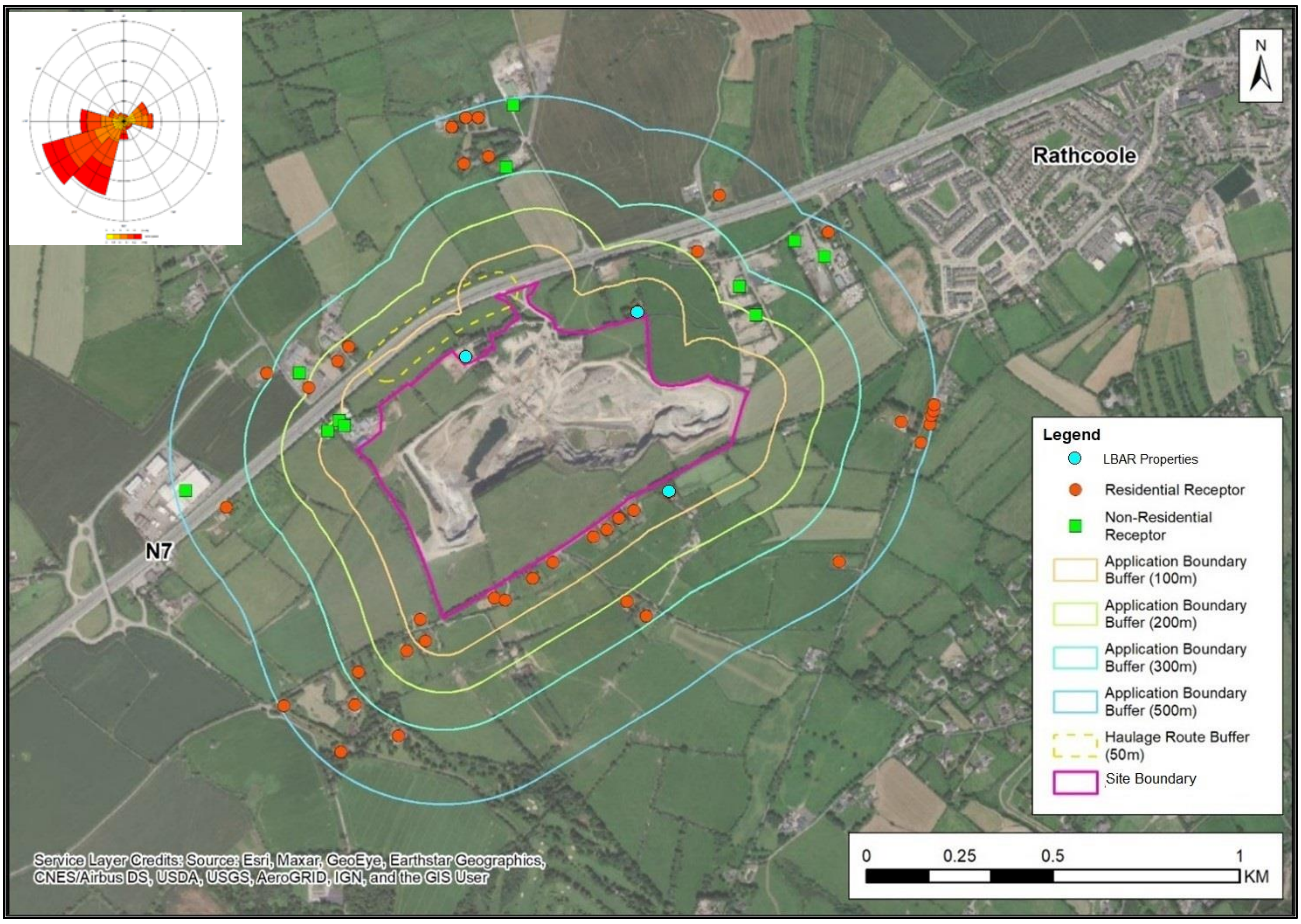

Figure 1: Location of receptors within 500 m of the Site (including Site Boundary) and within 50 m of the Haulage Route (extending 350 m from the point of exit of the Site Boundary).

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
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 proposed development 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 EIAR 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	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

1.Property is owned by the applicant.

5.0 MITIGATION

Currently, the Site has a number of mitigation measures in place which aim to reduce the impact of dust emissions on the surrounding area and identified sensitive receptors. These mitigation measures will continue to be in place and are as follows:

- Dust monitoring will continue to be carried out monthly at the designated monitoring locations;
- The timing of operations will be optimised in relation to meteorological conditions;
- Safety/screening berms are in place along Site boundaries – 2m high and 2 m wide at the crest;
- A water bowser is available on Site for dust suppression/dampening to minimise dust blow during working hours;
- Crushing and screening equipment are fitted with dust suppression systems;
- Conveyors are partially enclosed where possible;
- Stockpiles are located within the quarry floor to take advantage of shelter from the wind.
- Plant will be regularly maintained;
- On site speed restrictions (<15 kph) will be 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 proposed development 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 occur in the medium term during the quarry's phased operations (i.e. during stripping, extraction and restoration). 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 affect the character of an environment but would have noticeable changes. Through the implementation of the environmental management programme it is likely that the dust from various activities will have 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 continuation of existing Site activities on air quality are considered to be slight. During long spells of dry weather, dust emissions can potentially be elevated, however dust nuisance from the operation is expected to be unlikely if the above mitigation measures are implemented during production and restoration. The overall impact from the continued operation of the Site, in terms of dust emissions and particulates, is considered 'slight' to the air environment and Not Significant

In the longer term, on completion of the site restoration, the concentration of airborne dust would expect to be reduced from operational levels as the result of covering and seeding of exposed, un-vegetated soil surfaces. This will most likely constitute a minor positive impact for the local environment.

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 generate significant emissions to air. Therefore, there is no opportunity for significant cumulative impacts to arise as a result of the continuation of activities at the Site.

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.