CHAPTER 8 AIR QUALITY

8.1 Introduction

Odour Monitoring Ireland was commissioned by Boliden Tara Mines DAC (BTM) to undertake the Air Quality Chapter of Environmental Impact Assessment Report for proposed buttressing works to be undertaken on sections of embankment dam walls of the Randallstown Tailings Storage Facility (TSF). These works are proposed to be undertaken with a view to increasing the Factor of Safety (FoS) associated with the dam walls. This chapter of the EIAR will identify, describe and assess the impact of the proposed development in terms of its impact on air quality.

This chapter evaluates the impact which the Proposed Development may have on Air Quality as defined in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

A desktop air quality assessment has been carried out in the area utilising existing monitoring data collected by BTM and baseline air quality data generated by synoptic EPA monitoring stations in the area. The purpose of this desktop study was to identify existing pollutant trends in the vicinity of the proposed development, and to assess the potential impact of the proposed development. This will establish sufficient spatial information in order to determine compliance with relevant ambient air quality legislation. Additionally, comparison with longer period limit values can be used to establish trends and are important in defining baseline air quality.

8.1.1 Company Background

Odour Monitoring Ireland Ltd. was established in 2001 and specialises in air quality measurement and consultancy. The company has been involved in over 700 air quality studies. The company is operated by Dr. John Casey and Dr. Brian Sheridan. Both directors are educated to Postdoctoral level in Agriculture and Chemical Engineering. In 2012, Odour Monitoring Ireland Ltd. established an INAB accredited stack testing company for the assessment of industrial emissions from EPA and non-EPA licensed facilities.

8.1.2 Aim of Report

The main aims of the study included:

- review of background ambient air quality in the vicinity of the application area using available collected baseline and reference data generated by the facility, EPA and other referenced sources;

- identification of the significant substances likely to be released from the proposed development during construction and when operational;

- identification of predicted ground level concentrations (GLC's) of released substances at the site boundary and at identified sensitive receptors in the local environment;

- a full cumulative assessment of significant releases from the proposed development taking into account the releases from all other significant sources to be operated within the facility;

- evaluation of the significance of these predicted concentrations, including consideration of whether these GLC's are likely to exceed the ambient air quality standards and guidelines;

- assessment of other potential air quality impacts such as construction dust and emissions from construction, operational phase traffic and operational emissions associated with the proposed development.

8.2 Study Methodology-Assessment Criteria

This report has been prepared in accordance with the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022). Potential impacts have been described with regard to Table 3.4 of the guidelines.

The European Union (EU) has introduced several measures to address the issue of air quality management. In 1996, Environmental Ministers agreed a Framework Directive on ambient air quality assessment and management (Council Directive 96/62/EC). As part of the measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC.

The first of these directives to be enacted, 1999/30/EC, set limit values in April 2001 that replaced previous limit values that were set by Directives 80/779/EEC, 82/884/EEC and 85/203/EEC. This was again updated through the implementation of the Ambient Air Quality and Cleaner Air for Europe (I) Directive 2008/50/EC. New limit values for sulphur dioxide, PM10, PM2.5 and nitrogen dioxide set by the CAFÉ Directive are detailed in Table 8.1.

The National Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002) transpose those parts of the “Framework” Directive 96/62/EC on ambient air quality assessment and management not transposed by the EPA Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (S.I. No. 33 of 1999). The 2002 Regulations also transpose, in full, the 1st two “Daughter” Directives 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, and 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air.

Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe has revised and combined several existing Ambient Air Quality Standards including Council Directives 96/62/EC, 1999/30/EC and 00/69/EC. With regard to existing ambient air quality standards, it will not modify the standards but will strengthen existing provisions to ensure that non-compliances are removed. It does however set a new ambient standard for PM2.5. With regard to PM2.5, the proposed approach is to establish a limit value of 25 μg/m3, as an annual average (to be attained by 2015), coupled with a non-binding target to reduce human exposure generally to PM2.5 between 2010 and 2020. This exposure reduction target is currently proposed at 20% of the average exposure indicator (AEI). The AEI is based on measurements taken in urban background locations averaged over a three-year period.

In 2011, SI 271 of 2002, Air Quality Standards Regulations 2002 was replaced with SI 180 of 2011, Air Quality Standards Regulations 2011 which transposes 2008/50/EC into Irish law. The Air Quality Framework Directive (96/62/EC) sets out the principles of ambient air quality monitoring, assessment and management and was followed by four daughter directives which detailed the limit values for specific pollutants. This is the fourth daughter directive (2004/107/EC) and covers polyaromatic hydrocarbons, arsenic, nickel, cadmium, and mercury in ambient air. SI 58 of 2009 transposed the 4^{th} Daughter Directive into Irish law.

In 2022, SI 739 of 2022, Air Quality Standards Regulations 2022 replaced with SI 180 of 2011, Air Quality Standards Regulations 2011.

These Regulations provide for the implementation of Directive 2008/50/EC on ambient air quality and cleaner air for Europe (as amended). The regulations set the limit values and alert thresholds for air pollution for particular pollutants and also specific the requirements for monitoring and reporting air quality data. The Environmental Protection Agency is the competent authority for the purpose of Directive 2008/50/EC and these Regulations. These Regulations replace S.I. No. 180 of 2011, as amended by SI 659 of 2016, which is revoked.

The concern from a health perspective is focused on particles of dust which are less than 10µm in size and the EU ambient air quality standards outlined in Table 8.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5.}$

With regard to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction and operation phase of a development in Ireland.

However, guideline for dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/m^2/day) averaged over a one-month monitoring period at any receptor outside the site boundary. Recommendations from the Department of the Environment, Health and Local Government (DOEHLG, 2004) apply the Bergerhoff limit of 350 mg/m^2/day to the site boundary for quarries. This limit value can be implemented with regard to dust impacts from construction and operation phase of the Proposed Development.

This limit value of 350 mg/m^2/day has also been incorporated into Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006) and the Irish Concrete Federation Environment Code (ICF, 2005).

The limit values applicable species / compound for the study area is reported in Table 8.1.

Table 8.1. Irish and EU Ambient Air Standard (SI739 of 2022) and Guideline limit values.

Pollutant	Regulation	Limit Type	VALUE
Nitrogen Dioxide	SI 739 of 2022	Hourly limit for protection of human health - not to be exceeded more than 18 times/year-1 hour average	200 μg/m^3 NO_2
		Annual limit for protection of human health-Annual	40 μg/m^3 NO_2
		Annual limit for protection of vegetation-Annual	30 μg/m^3 $NO + NO_2$
Lead	SI 739 of 2022	Annual limit for protection of human health-Annual average	0.5 μg/m^3
Sulphur Dioxide	SI 739 of 2022	Hourly limit for protection of human health – not to be exceeded more than 24 times/year-1 hour average	350 μg/m^3
		Daily limit for protection of human health – not to be exceeded more than 3 times/year-24hr average	125 μg/m^3
		Annual & Winter limit for the protection of ecosystems-Annual	20 μg/m^3
Particulate Matter (PM_{10})	SI 739 of 2022	24-hour limit for protection of human health - not to be exceeded more than 35 times/year-24-hour average	50 μg/m^3 PM_{10}
		Annual limit for protection of human health-Annual	40 μg/m^3 PM_{10}
Particulate Matter ($PM_{2.5}$)	SI 739 of 2022	Stage 1 - Annual limit for protection of human health-Annual	25 μg/m^3 $PM_{2.5}$
		Stage 2 - Annual limit for protection of human health-Annual	20 μg/m^3 $PM_{2.5}$
Benzene	SI 739 of 2022	Annual limit for protection of human health	5 μg/m^3
Carbon Monoxide	SI 739 of 2022	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3
Arsenic	SI 58 of 2009	Annual limit for the protection of human health	6.0 ng/m^3
Cadmium	SI 58 of 2009	Annual limit for the protection of human health	5.0 ng/m^3
Nickel	SI 58 of 2009	Annual limit for the protection of human health	20.0
Zinc	EPA License PO516-04	Annual limit for the protection of human health	1 μg/m^3
Total depositional dust	TaLuft / EPA Guidelines / EPA IEL P0515-04	Daily limit for the prevention of nuisance	350

8.3 RECEIVING ENVITONMENT - AIR

8.3.1 General

The Tara mine site is situated at Knockumber, 2 km west of Navan, County Meath. The Tailings Storage Facility (TFS) is located approximately 2.8 km to the north of the mine and currently covers a footprint area of about 250 ha. The Tailings Facility is situated within a temperate climatic zone of 941.3mm mean annual rainfall. The region can generally be described as rural-agricultural. The surrounding area is comprised of farmland and farm dwellings and residential dwellings. Population density is low with ribbon development along the road network in the area. Immediately adjacent to the west of the Tailings Facility is the Yellow River, which flows into the River Blackwater, the Blakes stream to the northeast and the Simonstown stream to the east and southeast. The new Boyne Valley to Lakelands (BVL) Greenway is located to the east on the old *Navan-Kingscourt* railway line. Navan racecourse is located to the east of the facility.

8.4 Baseline Air Quality

A number of baseline monitoring stations and a review of available EPA air quality data were chosen to represent the baseline air quality in the vicinity of the existing facility. These locations are listed in *Tables 8.2* and *8.3* and presented in *Figure 8.1 and Figure 8.2.*

The following monitoring technique was utilised for dust monitoring in the vicinity of the facility. These include:

- A network of total depositional dust gauges as describes in VDI 2119 – Bergerhoff total depositional dust gauges[1].
- A network of continuous air samplers performed in accordance with the requirements of SI 739 of 2022, SI58 of 2009 and in accordance with the requirements of the Directive (99/30/EC) (MCERTS certified equipment for

[1] EPA Industrial Emissions license P0516-04 Condition 6.27.7

the continuous monitoring of PM_{10}, $PM_{2.5}$, Arsenic, Cadmium, Lead and Zinc)[2].

The baseline EPA monitoring stations were chosen as they represent the typical pollutants trends that would be experienced in the rural Navan area (i.e. classified as Zone D). In addition, it is likely that the concentration values of air quality would tend to be worst case as these monitoring stations were located in towns while the existing facility is located in rural area. As a result of the existing site conditions and the potential for construction, traffic, residential and amenity-derived pollution, the following parameters are reported:

- Benzene
- Nitrogen dioxides (NO_2)
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Particulate matter (PM_{10} and $PM_{2.5}$)
- Total depositional Dust monitoring and Metals.

[2] EPA Industrial Emissions license P0516-04 Condition 6.27.6

Figure 8.1. Site location and sensitive receptor locations in the vicinity of the facility.

Figure 8.2. Air monitoring locations in the vicinity of the facility.

Table 8.2. Description of Air Monitoring Locations

Reference	Monitoring Parameters	Description and monitoring location
A1 - Baseline EPA station Rural max and average values (Air Quality in Ireland 2021 and 2022)	Oxides of Nitrogen, Sulphur dioxide, $PM_{10,\ 2.5}$, Benzene, Carbon monoxide	Monitored by EPA using synoptic stations located in Zone D locations throughout Ireland.
DB4, DB5, DB6, DB7, DB28, DB37 and DB42	Total depositional dust	Monitored using Bergerhoff gauges– see Table 6.5 for 7 grid location
DA1 and DA2	PM_{10} and $PM_{2.5}$	Monitored using high volume continuous air sampler– *see Table 6.5* for 2 grid location
DA1 and DA2	Ambient Arsenic, Lead, Cadmium, and Zinc concentrations	Monitored using high volume continuous air sampler– *see Table 6.5* for 2 grid location

Table 8.3. Location of Air Monitoring Locations

Monitoring location	**X grid reference (m)**	**Y grid reference (m)**
DA1	285786	271826
DA2	284140	271435
DB4	286466	270734
DB5	286038	270667
DB6	285844	272862
DB7	284170	270710
DB28	285283	270817
DB37	285631	272230
DB42	284376	272125

8.4.1 Benzene

The sources associated with individual volatile organic compounds (VOCs) tend to be dependent on the nature of industries in the sample region. Methane is a naturally occurring volatile organic carbon (VOC) from plants and animals but is also generated as a by-product of certain industries. Benzene, Toluene, Ethyl benzene, p/o xylene (BTEX) and other aromatics/alkanes are most likely derived from petrol driven vehicle exhausts. Heavier semi-volatile organic compounds are frequently derived from diesel-powered engines. Benzene is a known carcinogen, poisonous by inhalation and a severe eye and moderate skin irritant.

With reference to the EPA monitoring locations for Zone D locations within the 2021 and 2022 report (A1), the air quality was monitored for Benzene. The desktop baseline results are presented in *Table 6.4* for Location A1. The results illustrated in

Table 6.4 that Benzene is compliant with Irish and EU limit values contained in Table 6.1 for both year 2021 and year 2022. Average Benzene concentrations were up to 90% lower than the Irish and EU directive limit values.

8.4.2 Nitrogen Dioxides (NO_2)

Nitrogen is a constituent of both the natural atmosphere and of the biosphere. When industrial metabolism releases nitrogen to the environment it is considered a "pollutant" because of its chemical form: NO, NO_2, and N_2O. These oxides of nitrogen can be toxic to humans, to biota, and they also perturb the chemistry of the global atmosphere. In the transportation sector, the NOx emissions result from internal combustion engines. In power plants and industrial sources, NOx is produced in boilers. The overwhelming fraction of nitrogen oxide emissions arises from the high temperature combustion of fossil fuels; emissions from metal-processing plants and open-air burning of biomass are insignificant.

Nitrogen dioxide is classed as both a primary pollutant and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). Potentially, the main sources of primary NO_2 for the proposed development will be from vehicle exhausts.

As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources (e.g. volatile organic compounds). Secondary pollution is usually derived from regional sources and may be used as an indicator of general air quality in the region. Nitrogen dioxide has been shown to reduce the pulmonary function of the lungs. Long-term exposure to high concentrations of NO_2 can cause a range of effects, primarily in the lungs, but also in the liver and blood.

With reference to the EPA monitoring locations for Zone D within the 2021 and 2022 report (A1), the air quality was monitored for Nitrogen dioxide. The desktop baseline results are presented in Table 6.4 for each year.

The dominant source of NO_2 in Ireland appears to be from motor vehicle exhausts and the burners/boiler of space heating of light industry and business units. The measured concentrations of NO_2 at all baseline monitoring stations are within the Irish and EU Ambient Air Standards. The baseline monitoring data indicated that NO_2 is an average

81% lower than currently established Irish and European ambient air regulatory levels for annual averages.

8.4.3 Sulphur Dioxide (SO_2)

Sulphur dioxide is a colourless gas, about 2.50 times as heavy as air, with a suffocating faint sweet odour. Sulphur dioxide occurs in volcanic gases and thus traces of sulphur dioxide are present in the atmosphere. Other sources of sulphur dioxide include smelters and utilities, electrical generation, iron and steel mills, petroleum refineries, pulp and paper mills, metallurgical processes, chemical processes and the combustion of the iron pyrites, which are contained in coal. Small sources include residential, commercial and industrial space heating.

SO_2 can be oxidised to sulphur trioxide, which in the presence of water vapour is readily transformed to sulphuric acid mist. SO_2 is a precursor to sulphates, which are one of the main components of respirable particles in the atmosphere. Health effects caused by exposure to high levels of SO_2 include breathing problems, respiratory illness, changes in the lung's defences, and worsening respiratory and cardiovascular disease. People with asthma or chronic lung or heart disease are the most sensitive to SO_2. It also damages trees and crops. SO_2, along with nitrogen oxides, are the main precursors of acid rain. This contributes to the acidification of lakes and streams, accelerated corrosion of buildings and reduced visibility. SO_2 also causes formation of microscopic acid aerosols, which have serious health implications as well as contributing to climate change.

With reference to the EPA monitoring locations for Zone D within the 2021 and 2022 reports (A1), the air quality was monitored for Sulphur dioxide. The desktop baseline results are presented in Table 8.4 for each year. The dominant source of SO_2 in Ireland appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating single residences and industrial units. The measured concentrations of SO_2 for each year is within the Irish and EU Ambient Air Standards. EPA monitoring locations are an average 75% lower than currently established Irish and European ambient air regulatory levels for annual averages.

8.4.4 Carbon Monoxide (CO)

Carbon monoxide is produced as a result of incomplete burning of carbon-containing fuels including coal, wood, charcoal, natural gas, and fuel oil. It can be emitted by combustion sources such as un-vented kerosene and gas heaters, furnaces, woodstoves, gas stoves, fireplaces and water heaters, automobile exhaust from attached garages, and tobacco smoke. Carbon monoxide interferes with the distribution of oxygen in the blood to the rest of the body. Depending on the amount inhaled, this gas can impede coordination, worsen cardiovascular conditions, and produce fatigue, headache, weakness, confusion, disorientation, nausea, and dizziness. Very high levels can cause death. The symptoms are sometimes confused with the flu or food poisoning. Foetuses, infants, elderly, and people with heart and respiratory illnesses are particularly at high risk for the adverse health effects of carbon monoxide.

With reference to the EPA monitoring locations for Zone D within the 2021 and 2022 report (A1), the air quality was monitored for carbon monoxide. The desktop baseline results are presented in Table 8.4for each year. The dominant source of CO in Ireland appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating single residences and industrial units. The measured concentrations of CO at all monitoring locations are within the Irish and EU Ambient Air Standards. EPA monitoring locations are an average 97% lower than currently established Irish and European ambient air regulatory levels for annual 8-hour averages.

8.4.5 Particulate Matter (PM_{10} & $PM_{2.5}$)

Major sources of particulates include industrial/residential combustion and processing, energy generation, vehicular emissions and construction projects. The particulate matter created by these processes is responsible for many adverse environmental conditions including reduced visibility, contamination and soiling, but also recognised as a contributory factor to many respiratory medical conditions such as asthma, bronchitis and lung cancer. $PM_{10, 2.5}$ (Particulate Matter 10 and 2.5) refers to particulate matter with an aerodynamically diameter of 10 and 2.50 μm. Generally, such particulate matter remains in the air due to low deposition rates. It is the main particulate matter of concern in Europe and has existing air quality limits.

In order to obtain a baseline PM_{10} for the proposed work area, a PM_{10} analyser was used to monitor the PM_{10} ambient concentration levels at two locations (PM_{10} and $PM_{2.5}$) within the vicinity of the existing tailings pond (i.e. DA1 and DA2). Continuous monitoring data is presented from June 2022 to Jan 2024. The monitoring location is presented in Figure 8.2 and Tables 8.2 and 8.3. In addition to the onsite monitoring data, EPA baseline data was also used for comparison to compare pollutant trends in general with the sample area. Results are presented in Table 8.4.

The dominant source of PM_{10} in Ireland appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating single residences, industrial and farming activities. The measured concentrations of PM_{10} at all baseline EPA monitoring locations are within the Irish and EU Ambient Air Standards. EPA monitoring locations are an average 68% lower than currently established Irish and European ambient air regulatory levels for 24-hour annual mean values of PM_{10} (see Table 8.4).

The dominant source of $PM_{2.5}$ in Ireland appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating single residences, industrial and farming activities. The measured concentrations of $PM_{2.5}$ at all baseline EPA monitoring locations are within the Irish and EU Ambient Air Standards. EPA monitoring locations are an average 65% lower than currently established Irish and European ambient air regulatory levels for 24-hour annual mean values of $PM_{2.5}$ (see Table 8.4).

For onsite monitoring at location DA1 and DA2 which is due west and east of the existing facility and located within the facility boundary, PM_{10} and $PM_{2.5}$ values have been in and around normal background levels. Measured average concentrations over the time period June 2022 and Jan 2024 ranged from 14.6 to 29.1 µg/m^3. This is no more than 73% of the annual PM_{10} limit value of 40 µg/m^3. There have been no exceedances above 50 µg/m^3 over the measurement period.

With regards to $PM_{2.5}$, at location DA1 and DA2, $PM_{2.5}$ values have been in and around normal background levels. Measured average concentrations over the time period June 2022 and Jan 2024 ranged from 4.9 to 15.7 µg/m^3. This is no more than 63% of the annual $PM_{2.5}$ limit value of 25 µg/m^3. There has been no exceedance above 25 µg/m^3 over the measurement period.

Table 8.4. Ambient air monitoring results for EPA monitoring station A1 and onsite monitoring stations DA1 and DA2.

Monitoring location	Parameter - Zone D unless otherwise stated for NO2, SO2, PM_{10} & $PM_{2.5}$, Benzene & CO	Annual average 2021 ($\mu g/m^3$)	Annual average Year 2022 ($\mu g/m^3$)	Notes
A1	Oxides of nitrogen (NO2) - Zone D	7.5	7.3	EPA Baseline reports - Air quality in Ireland 2021 and 2022
A1	Sulphur dioxide (SO2) - Zone D	4.2	5	EPA Baseline reports - Air quality in Ireland 2021 and 2022
A1	Particulate matter PM10 - Zone D	11.9	12.7	EPA Baseline reports - Air quality in Ireland 2021 and 2022
A1	Particulate matter PM2.5 - Zone D	8.7	8.4	EPA Baseline reports - Air quality in Ireland 2021 and 2022
A1	Benzene - Zone C	0.35	0.5	EPA Baseline reports - Air quality in Ireland 2021 and 2022
A!	Carbon monoxide (CO) - Zone C	300	200	EPA Baseline reports - Air quality in Ireland 2021 and 2022
Onsite stations	**Detail**	**PM_{10} ($\mu g/m^3$)**	**$PM_{2.5}$ conc. ($\mu g/m^3$)**	
DA1	Average Particulate matter - Onsite	20.3	9.9	June 2022 to Jan 2024
DA1	Min Particulate matter - Onsite	14.6	4.9	June 2022 to Jan 2024
DA1	Max Particulate matter - Onsite	26.2	15.7	June 2022 to Jan 2024
DA2	Average Particulate matter - Onsite	19.8	8.2	June 2022 to Jan 2024
DA2	Min Particulate matter - Onsite	15.2	6.6	June 2022 to Jan 2024
DA2	Max Particulate matter - Onsite	29.1	11.2	June 2022 to Jan 2024

8.4.6 Dust Monitoring - *Total Depositional Dust*

The results of Total dust deposition monitoring at seven locations in the vicinity of the existing facility over the time period Jan 2021 to Dec 2023 are presented in Table 8.5. Monitoring was performed using Bergerhoff gauges specified in the German Engineering Institute VDI 2119 entitled “Measurement of Dustfall Using the Bergerhoff Instrument (Standard Method).” The purpose of these monitors is to assess the total depositional dust impact in the vicinity of the existing facility.

Dust emitted from near-surface sources (as opposed to that emitted from stacks) rarely extends beyond 250 to 500 m from the point of release. The monitoring gauges are mostly located within or close to the perimeter fence of the Tailings Facility and total deposition rates would be expected to decline dramatically with distance away from the facility.

Currently in Ireland, there are no statutory limits for dust deposition, however, EPA guidance suggest, "a soiling of 350mg/m^2/day is generally considered to pose a soiling nuisance". This value was not exceeded at any of the sample locations lower than the maximum recommended limit value for nuisance dust.

Total particulate deposition at the tailings facility, recorded using the Bergerhoff gauges (refer to Table 8.5), is highly variable, as expected, ranging from between 59 and 328 mg/m^2/day expressed as an average based on monthly monitoring over the period Jan 2021 to Dec 2023. These deposition rates are typical of rural areas in Ireland, and compare well with a monitoring exercise undertaken at greenfield locations for the proposed Lisheen zinc/lead mine in Co. Tipperary (average daily total deposition 45 - 607 mg/m^2/day, recorded using "Frisbee gauges") and with the range of monthly values recorded for rural environments in the U.K. (average daily total deposition 8 - 201 mg/m^2/day) (quoted in N.J. Coppin & Montgomery, Dust - Understanding the Solutions. Quarry Management, March 1996).

Table 8.5. Total depositional dust levels at each monitoring location in the vicinity of the existing tailings facility

Sample location	Average Dust deposition ($mg/m^2/day$)	Max Dust deposition ($mg/m^2/day$)	Time period
DB4	101	316	Jan 2021 to Dec 2023
DB5	99	192	Feb 2021 to Dec 2023
DB6	146	226	Jan 2021 to Dec 2023
DB7	59	177	Feb 2021 to Dec 2023
DB28	130	219	Jan 2021 to Dec 2023
DB37	69	318	Jan 2021 to Dec 2023
DB42	136	328	Feb 2021 to Dec 2023

8.4.7 Continuous Particle Sampling for Metals

The results of the continuous sampling performed at two locations DA1 and DA2 in the vicinity of the existing facility over the time period June 2022 to Jan 2024 are presented in Table 8.6. continuous sampling was performed in accordance with the requirements of the Air Quality Standards Regulations SI 244 of 1987 and in accordance with the requirements of the Directive (99/30/EC).

SI58 of 2009 limit values and IPPC Licence limit values as specified in IE Licence PO516-04 for specified metals are listed in *Table 8.1*.

The data also indicates that, between June 2022 and Jan 2024 concentrations of Zinc, Cadmium, Arsenic and Nickel were within the guideline limit values published in the Industrial Emissions License (IEL) PO516-04, SI58 of 2009, World Health Organisation (WHO), the Danish EPA and NAOSH documents (see Table 8.6). The recorded lead concentrations also demonstrate compliance with the WHO guideline level of 0.50 to 1.0 $\mu g/m^3$ for lead in air and the limit of 2 $\mu g/m^3$ lead in air imposed in IE Licence P0516-04.

Table 8.6. Ambient air metals concentration at each monitoring location in the vicinity of the existing facility.

	Monitoring location DA1				**Monitoring location DA2**			
Monitoring period	**Lead (µg/m³)**	**Cadmium (µg/m³)**	**Zinc (µg/m³)**	**Arsenic (µg/m³)**	**Lead (µg/m³)**	**Cadmium (µg/m³)**	**Zinc (µg/m³)**	**Arsenic (µg/m³)**
Event 1 - 01/06/2022 - 01/07/2022	<0.0024	<0.0024	0.0104	<0.0024	<0.0024	<0.0024	0.0072	<0.0024
Event 2 - 01/07/2022 - 02/08/2022	<0.002	<0.0024	0.01	<0.0024	<0.002	<0.0024	0.01	<0.0024
Event 3 - 02/08/2022 - 02/09/2022	<0.002	<0.0022	<0.00	<0.0022	<0.002	<0.0022	<0.00	<0.0022
Event 4 - 02/09/2022 - 03/10/2022	<0.0022	<0.0022	0.0037	<0.0022	<0.0022	<0.0022	0.0096	<0.0022
Event 5 - 03/10/2022 - 01/11/2022	<0.0024	<0.0024	0.008	<0.0024	<0.0024	<0.0024	0.0167	<0.0024
Event 6 - 01/11/2022 - 01/12/2022	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023	<0.0023
Event 7 - 01/12/2022 - 09/01/2022	<0.0017	<0.0017	0.0035	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Event 8 - 09/01/2023 - 03/02/2023	<0.0030	<0.0028	0.004	<0.0028	<0.0030	<0.0028	0.003	<0.0028
Event 9 - 03/02/2023 - 06/03/2023	0.0127	<0.0022	0.01	<0.0022	<0.0023	<0.0023	0.012	<0.0023
Event 10 - 06/03/2023 - 04/04/2023	<0.0025	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024
Event 11 - 04/04/2023 - 04/05/2023	<0.0023	<0.0023	0.0031	<0.0023	<0.0023	<0.0023	0.0093	<0.0023
Event 12 - 04/05/2023 - 06/06/2023	<0.0021	<0.0021	0.0028	<0.0021	Power issues	Power issues	Power issues	Power issues
Event 13 - 06/06/2023 - 04/07/2023	<0.0025	<0.0025	0.005	<0.0025	Power issues	Power issues	Power issues	Power issues
Event 14 - 04/07/2023 - 02/08/2023	<0.0024	<0.0024	0.0063	<0.0024	Power issues	Power issues	Power issues	Power issues
Event 15 - 02/08/2023 - 01/09/2023	<0.0023	<0.0023	0.0031	<0.0023	Power issues	Power issues	Power issues	Power issues
Event 16 - 01/09/2023 - 03/10/2023	<0.0022	<0.0022	0.0022	<0.0022	Power issues	Power issues	Power issues	Power issues
Event 17 - 03/10/2023 - 01/11/2023	<0.0024	<0.0024	0.0049	<0.0024	<0.0024	<0.0024	<0.0024	<0.0024
Event 18 - 01/11/2023 - 04/12/2023	0.0028	<0.0021	0.0035	<0.0021	<0.0021	<0.0021	<0.0021	<0.0021
Event 19 - 04/12/2023 - 15/01/2024	<0.0017	<0.0017	0.0051	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Average conc. (µg/m³)	0.003791	0.002188	0.00535	0.002188	0.002084	0.002084	0.007405	0.002084
Max conc. (µg/m³)	**0.0127**	**0.002435**	**0.0104**	**0.002435**	**0.002427**	**0.002427**	**0.0167**	**0.002427**
Limits values (µg/m³)	<0.50	<0.005	<1.0	<0.006	<0.50	<0.005	<1.0	<0.006

8.4.8 Sensitivity of the Receiving Environment

In line with the UK Institute of Air Quality Management (IAQM) guidance document “Guidance on the Assessment of Mineral Dust Impact for Planning” (2016) prior to assessing the impacts of dust from a Proposed Development, the sensitivity of the area must first be assessed as outlined below. Both receptors sensitivity and proximity to proposed works area are taken into consideration. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Adverse dust impacts from sand and gravel sites are uncommon beyond 100 m from the source. In terms of receptor sensitivity to dust spoiling, sensitive receptors are located greater than 100 m from the proposed facility (see Figure 8.1). Based on the IAQM criteria outlined in Table 8.5, the worst-case sensitivity of the area to dust spoiling is considered to be **Low**.

Table 8.7. Sensitivity of the Area to Dust Soiling Effects on People and Property**.**

Receptor sensitivity	**Number of receptors**	**Distance from source (m)**			
		<20	**<50**	**<100**	**<350**
High	>100	High	High	Medium	**Low**
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

In addition to sensitivity to dust spoiling, the IAQM guidelines also outline the assessment criteria for determining the sensitivity of the area to human health impacts. The criteria take into consideration the current annual mean PM_{10} concentration, receptors sensitivity based on type (residential receptor are classified as sensitive) and the number of receptors affected within various distance bands from the works. A conservative estimate of the current annual mean PM_{10} concentration in the vicinity of the Proposed Development is estimated to be no greater than 20.3 μg/m^3 and there are between 1-100 sensitive receptors located less than 350 m from the proposed development works. Based on the IAQM criteria outlined in Table 8.8, the worst-case sensitivity of the area to human health is considered **Low**.

Table 8.8. Sensitivity of the Area to Human Health Impacts

Receptor sensitivity	**Annual Mean PM_{10} Concentration**	**Number of receptors**	**Distance from source (m)**			
			<20	**<50**	**<100**	**<200**
High	<24 μg/m^3	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	**Low**
		1-10	Low	Low	Low	Low
Medium	<24 μg/m^3	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	<24 μg/m^3	>1	Low	Low	Low	Low

8.5 CHARACTERISTICS OF THE PROPOSAL

Boliden Tara Mines DAC (BTM) is proposing the following engineering works at the Randalstown Tailings Storage Facility (TSF): The construction of a reinforcement buttress to the extant embankment walls of the TSF.

BTM has recently become a member of the International Council for Mining and Metals (ICMM) and is in the process of adopting the Global Industry Standard on Tailings Management (GISTM).

A key objective of GISTM is to address the risk of tailings embankment failure through conservative design criteria, independent of trigger mechanisms, in order to minimise potential impacts. In order to increase the factor of safety of the extant embankment walls of the tailings facility a rockfill and earthen buttress will be constructed against the extant embankment walls of the TSF.

8.5.1 Project Description

The construction of the buttress will require the movement of materials to the Tailings Storage Facility from a number of source locations, including mine rock from the Main Mine site, Navan, Co. Meath and Greenfield soil from third-party development sites. The lands surrounding the subject site can be characterised as rural, with land uses in the area comprising agriculture, and single house residential. The construction traffic will utilise an existing access from the L74141 Local Road approximately 0.3km west of its junction with the R163 Regional Road. Trucks entering the site must approach from the R163 and therefore turn left when entering the site. Similarly, trucks exiting the site are permitted to turn right only. Signage is provided at the site access advising drivers of the permitted movements.

8.6 POTENTIAL IMPACTS OF THE PROPOSAL

8.6.1 Construction Phase

There is the potential for a number of emissions to atmosphere during the construction of the proposed buttress with wind-blown dust being most significant. With regards to material quantities, it is estimated that approximately 265,700 m^3 of rock fill and 295,690 m^3 of greenfield soil will be handled during the project term.

Wind blown dust emissions may arise during the construction phase of the proposed buttress wall, which may impact upon the surrounding environment. The deposition of dust and mud on the local roads is both unsightly and dangerous. Dust may be a particular problem during periods of dry windy weather. There is no anticipated impact from dust emissions when the development has been constructed.

Potential sources of dust from construction and operation include the following:

- The importation of greenfield soil from third-part development sites;
- The importation of mine rock from Tara mine site;
- The transport of materials including vehicles carrying dust on their wheels;
- Un-vegetated stockpiles of construction materials;
- The handling of construction materials for the construction phase of development; and
- Construction of the buttress wall.

The construction vehicles, generators, etc., will also give rise to petrol and diesel exhaust emissions, although this is of minor significance compared to dust.

Construction activities such as demolition, excavation, earth moving and backfilling can generate dust, particularly in dry weather conditions. The extent of dust generation is dependent on the nature of the material (soils, peat, sands, gravels, silts etc.) and the location of the construction activity. In addition, the potential for dust dispersion depends on the local meteorological factors such as rainfall, wind speed and wind direction. Vehicles transporting material to and from the site also have the potential to cause dust generation along the selected haul routes.

Table 8.9 presents the distances within which dust could be expected to result in a nuisance from construction sites for impacts such as soiling (dust nuisance), PM_{10} deposition and vegetation effects. This data has been taken from the National Roads Authority (NRA) *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* and is considered a worst-case assessment. These distances present the potential for dust impact with standard mitigation in place.

Detail of proposed mitigation measures to be implemented as part of the construction phase of the project are presented under the Construction Phase Mitigation section of this report.

Table 8.9. Assessment criteria for the impact of dust from construction, with standard mitigation in place.

Source		**Potential distance for significant effects (distance from source)**		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation effects**
Major	Large construction sites with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites with minor use of haul roads	25m	10m	10m

Source: National Roads Authority, 2006.

The construction phase of this proposal is deemed for the purposes of this assessment to be of a Major scale. Using this screening assessment tool, at a major construction site there is a risk that dust may cause an impact at sensitive receptors within 100m of the source of the dust generated. The nearest residential sensitive receptors are located at a distance of c. 240m in a southeast direction from the application boundary works, therefore, the impact from construction activities can be considered to be **imperceptible.**

Where any sensitive habitats are located at a distance of less than 25m from the emission source mitigation measures will be implemented to reduce risks associated with dust.

A Construction Environmental Management Plan (CEMP) incorporating dust mitigation measures will further reduce any impacts significantly and this will be implemented as part of the proposed development.

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the previously established sensitivity of the area (see Section 8.4.8).

The major dust generating activities are divided into four types within the IAQM guidance to reflect their different potential impacts. These are:

- Site preparation / restoration (including soil and overburden handling);
- On-site transportation (haul roads);
- Stockpiling / exposed surface; and
- Off-site transportation (e.g. leading to track out onto external road network).

8.6.2 Site preparation, Stockpiling and Mineral extraction

Site preparation and extraction primarily involve excavating materials, loading and unloading of materials, tipping and stockpiling activities. Activities such as levelling the site and landscaping works are also considered under this category. The dust emission magnitude can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: Total site area>10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved > 100,000 tonnes;

Medium: Total site area 2,500 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4-8 m high, total material moved 20,000 – 100,000 tonnes;

Small: Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m high, total material moved <20,000 tonnes, earthworks during the wetter months.

The dust emission magnitude for the proposed activities can be classified as Medium and this is considered a conservative estimate given the works to be completed on the site and the site will not involve any blasting of materials.

The sensitivity of the area, as determined in Section 8.4.8 is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 8.10, this results in an overall **High sensitivity** of temporary dust soiling impacts and an overall **medium risk** of temporary human health impacts as results of the proposed works.

Table 8.10. Risk of Dust Impacts - Earthworks

Sensitivity of area	**Dust emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Low Risk

8.6.3 Onsite and Offsite transportation

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, number of vehicles, road surface materials and duration of movement. Dust emission magnitude from track-out can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

Large: > 50 HGV (>3.5t) outward movement in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m;

Medium: 10-50 HGV (>3.5 t) outwards movement in any one day, moderately dusty surface materials (e.g. high clay content), unpaved road length 50 – 100m;

Low: <10 HGV (>3.5 t) outwards movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

The dust emission magnitude for the proposed track out can be classified as Large, as there is expected to be 270 HGV trips (assuming Option A worse-case scenario in relation to traffic) per day along an unpaved surface (stone with dust suppression) of >100 m.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 8.11, this results in an overall **Medium Risk** of dust soiling impacts and an overall **Medium Risk** of human health impacts as a result of the proposed site transportation activities.

Table 8.11. Risk of Dust Impacts – Onsite / Off site transportation

Sensitivity of area	**Dust emission Magnitude**		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	**Medium Risk**	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

8.6.4 Summary of Dust Emission Risk

The risk of dust impacts as a result of the Proposed Development are summarised in Table 8.12 for each activity. The magnitude of risk determined is used to prescribe the level of site-specific mitigation required for each activity in order to prevent significant impacts occurring.

Overall, in order to ensure that no dust nuisance occurs during the various activities, a range of dust mitigation will be implemented to ensure the dust risk matrix is considered Low risk. When the dust mitigation measures detailed in the mitigation section of this chapter (Section 8.7) are implemented, fugitive emissions of dust from the site will be **insignificant** and pose no nuisance at nearby receptors.

Table 8.12. Summary of Dust Impact Risk used to Define Site Specific Mitigation

Potential Impact	Dust Emission Magnitude		
	Site preparation	**Stockpiling**	**Onsite / Offsite transportation**
Dust Soiling	Low Risk	Low Risk	Low Risk
Human health	Low Risk	Low Risk	Low Risk

8.6.5 Traffic Emissions

Emissions associated with construction traffic can impact on local air quality. In particular, the proposed routes used for haulage and deliveries and any sensitive receptors that line these routes may experience impacts to local air quality.

The assessment methodology as a result of impacts associated with traffic involves air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (UK Highways Agency, DEFRA, 2007) (Version 1.03c, July 2007), the NO_X to NO_2 Conversion Spreadsheet (UK DEFRA, 2016) (Version 6.1), and following guidance issued by Transport Infrastructure Ireland (TII, 2011), UK Highways Agency (2007), UK Department for Environment, Food and Rural Affairs (2018) and the EPA (2017 Draft; 2015 Draft).

Transport Infrastructure Ireland guidance states that the assessment must progress to detailed modelling if:

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

In order to determine which road links need inclusion in the local air quality assessment, they must meet one or more of the following criteria. This criterion is stipulated in the UK Design Manual for Roads and Bridges guidance (UK Highways

Agency, 2007), on which Transport Infrastructure Ireland guidance (2011) was based on Proposed Development.

- Road alignment change of 5 m or more,
- Daily traffic flow changes by 1,000 AADT or more,
- HGV flows change by 200 vehicles per day or more,
- Daily average speed changes by 10 kg/h or more, or
- Peak hour speed changes by 20 km/h or more.

None of the road links impacted by the Proposed Development satisfy any of the criteria outlined above; therefore no assessment using the DMRB model was required for the Proposed Development. For completeness, this was completed and included in the overall impact assessment on Air quality.

The potential impact of construction traffic associated with this proposal was estimated as a worst case Annual Average Daily Traffic (AADT) scenario of 400 (which is approximately 2 times the expected peak AADT so as to assume worst case potential impact) with a mean traffic speed of 25km/hr. The detailed results of the modelling exercise are presented in Table 8.13.

Table 8.13. Predicted contribution of air pollutants to baseline air quality as a result of construction traffic.

Link location	**Carbon monoxide Annual mean (µg/m^3)**	**Benzene Annual mean (µg/m^3)**	**Oxides of nitrogen Annual mean (µg/m^3)**	**Particulate matter 10µm**	
				Annual mean (µg/m^3)	**Days > 50 (µg/m^3)**
Worst case receptor 5m from road centreline on any roadway	0.10	0.10	3.88	0.20	0

The IAQM (2009) provided a generic basis of definition of impact magnitude for changes in ambient pollutant concentrations as a percentage of Objective/Limit value. Within this table (see Table 8.14) they defined the magnitude of change versus the increase/decrease in annual mean percentage.

Table 8.14. Generic basis of definition of impact magnitude for change in Ambient Pollutant concentrations as percentage of Objective/Limit value/Environmental assessment level.

Magnitude of change	**Annual mean**
Large	Increase/decrease > 10%
Medium	Increase/decrease 5 – 10%
Small	Increase/decrease 1 – 5%
Imperceptible	Increase/decrease <1%

When considering the increase in the annual mean and comparison of the % contribution to the ambient air quality limit value for each classical air pollutant, the magnitude of change can be considered **Imperceptible** and **Negligible**.

8.7 Operation Phase

8.7.1 Scheduled Emissions

Regarding operations at the proposed development, the only potential emissions will be from dust emissions from the exposed surface of tailings which already exists and is considered within the baseline assessments contained in Section 8.4. The following mitigation measures are in place and will continue to minimise associated impacts with the operation of the tailings facility.

- An irrigation system;
- Spigotting of water over tailings surface from perimeter deposition lines;
- A CCTV system in operation which allows continuous 24-hour manned surveillance from the Mill Central Control Room;
- Availability of a trained mine rescue team on a 24 hour call out basis;
- Rehabilitation trials to vegetate areas more susceptible to dust blow; and
- Application where necessary with suitable dust binding additives to minimise dust blow.

8.7.2 Climate

The assessment methodology of the existing climatic environment involved a desk-based review of literature including the EU ‘Energy and Climate’ Package, Energy Policy Framework 2007-2020 (and Review) and Climate Action & Low Carbon Development Bill 2015.

Please refer to Chapter 3 for Description of the surrounding environment.

The prevailing wind direction at the application area is from the west and southwest as presented in the wind rose for Dublin Airport (2018-2022) in Figure 8.3. Northerly and easterly winds tend to be very infrequent. Wind characteristics vary between a moderate breeze to gales. Predominant wind speeds range between 5 and 8 m/s (i.e. 71%) with highest wind speeds occurring during winter and spring months (January, February and March). Lowest wind speeds were recorded in the June to August period.

Poor dispersion can occur under certain weather characteristics known as inversions that form in very light or calm wind and stable atmospheric conditions. The wind roses presented in Figure 8.3 identifies that such wind conditions are very infrequent (less than 0.50% of hours in the years 2018 to 2022 inclusive).

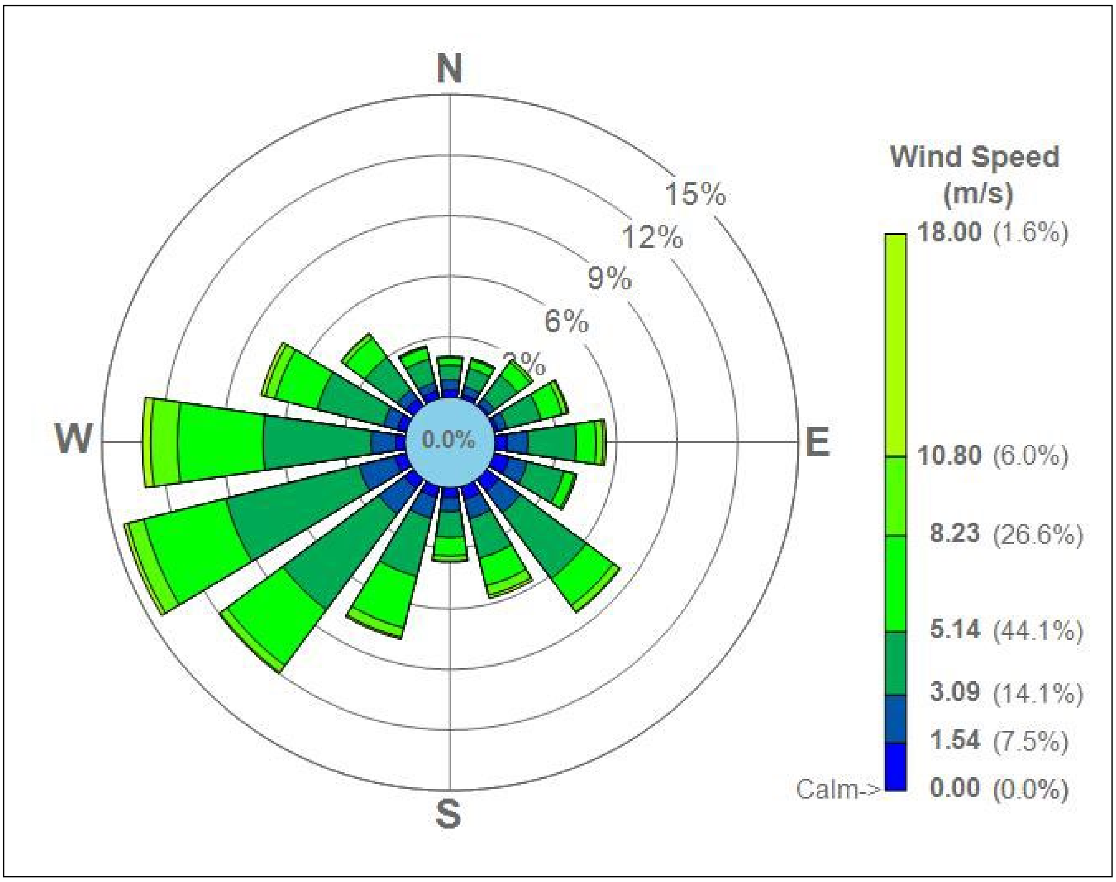

Figure 8.3. Dublin Airport Windrose 2018 to 2022 inclusive[3]

The nearest meteorological station to the application area with long term averages is the Met Éireann Station at Dublin Airport which lies approximately 50 km southeast of the subject site. The weather in the area is influenced by the Irish Sea, resulting in mild, moist weather dominated by cool temperate oceanic air masses. The prevailing wind direction in Ireland is from a quadrant centred on the southwest. These are relatively warm winds and frequently bring rain. Easterly winds are weaker and less

[3] Source: www.met.ie

frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer. The 30-year averages from the station at Dublin Airport are presented in Table 8.9.

Table 8.9. 30-year Average Meteorological Data from Dublin Airport (1981-2010)

Parameter	**30 yr Average (1981 to 2010)**
Mean temperature (^{0}C)	13.30
Mean relative humidity at 0900UTC (%)	83
Mean daily sunshine hours (Hrs)	3.90
Mean Annual total rainfall (mm)	758
Mean wind speed (Knots)	10.30

Source: www.met.ie

8.7.3 Effects of Climate Change in Ireland

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPCC). The resulting impacts in Ireland are outlined in the EU 'Energy and Climate' Package, Energy Policy Framework 2007-2020 (and Review) and Climate Action & Low Carbon Development Bill 2015 and include the following:

- Significant increases in winter rainfall, in the order of 10% in the southeast, with a corresponding increase in the water levels in rivers, lakes and soils. Flooding will be more frequent than experienced at present.
- Lower summer rainfall, in the order of 10% in the southern half of the country. Less recharge of reservoirs in the summer leading to more regular and prolonged water shortages than at present.

- An overall annual decrease in rainfall in the east of the country and a resultant decrease in baseline river flows.

- Increased agricultural production, with new crops becoming more viable and potentially reduced agricultural costs. Grass growth could enjoy beneficial effects with an increase of 20% possible with higher temperatures and changes in rainfall patterns.

A paper entitled *Establishing Reference Climate Change Scenarios for Ireland* (Sweeney & Fealy, 2003) identified future climate change scenarios for Ireland. This paper predicts that the average annual temperature in Ireland will increase by 1.5°C by the 2050's with an average increase in summer temperature of 2°C. These temperature increases are predicted to be accompanied by alterations in precipitation levels. The authors estimate an 11% increase in precipitation levels during the winter periods, whilst a more significant increase in precipitation levels during the summer periods were predicted i.e. 25% by the 2070's.

It is important to note that considerable uncertainty is encountered when attempting to predict future climate scenarios. This uncertainty arises due to the difficulties associated with determining future demographic changes, economic development, technological advancement, and future emissions of greenhouse gases to the atmosphere. Further difficulty is associated with the complexity of the climatic system and uncertainty surrounding these processes.

It is recognised that Ireland cannot, on its own, prevent or ameliorate the impacts of climate change. However, the National Climate Change Strategy 2007-2012 stated that Ireland must meet its responsibilities with regard to reducing CO_2 emissions in partnership with the EU and the global community.

There is a potential for impacts to climate as a result of any development that requires fuel and energy. These impacts are the generation of greenhouse gas emissions (principally carbon dioxide and oxides of nitrogen) from traffic and electrical supply.

Please refer to Chapter 10 Climate.

8.7.4 "Do-nothing" Scenario

The baseline survey results suggest that air quality in the vicinity of the existing facility and proposed development is good and shows typical levels for an urban area with all pollutants within the relevant Irish and EU limits. If the proposed development were not to take place, the current air pollutant concentrations will remain unchanged. In relation to dust, non-development of the site would result in no movement of soils/rock and no construction activity and therefore no dust creation as a result of construction works.

In addition "Do nothing" scenario would entail not constructing the reinforced buttress wall and improving the safety factors associated with operating the tailing facility.

8.8 Remedial or Reductive/ Mitigation Measures

8.8.1 Construction Phase

Activities associated with the movement of materials and construction of the buttress wall are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. In order to ensure that no dust nuisance occurs, a series of measures will be implemented.

- Site roads shall be regularly cleaned (water bowser) and maintained as appropriate.
- Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust may be regularly watered, as appropriate, during extended dry and/or windy conditions.
- Vehicles using site roads shall have their speed restricted, and this speed restriction must be enforced rigidly. Site management dictates speed shall be restricted to 25 km per hour.

- Any vehicles exiting the site shall make use of a wheel wash facility, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads.
- Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary. Aggregates, mine rock, fine sized material with dust potential will be delivered in covered trucks.
- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. The double handling of material will be avoided where possible and drop heights will be minimised during material loading and unloading.
- Diesel engines or plant machinery and trucks shall be properly maintained so that they do not discharge excessive quantities of visible smoke likely to result in a local nuisance.
- A full traffic and dust management plan will be implemented into the Construction Environmental Management Plan (CEMP) in order to minimise such emission as a result of the construction phase of the facility development. This will be generated specifically for the development when detailed design is completed. The UK British Research Establishment (BRE) document "Control of Dust from Construction and Demolition Activities" (Feb 2003) is a best practice guidance document for such plans. This document will be used as the basis for any construction dust minimisation plan.
- The dust management plan will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures to minimise dust emissions. This will include internal haul roads.
- Where any sensitive habitats are located at a distance of less than 25m from the emission source mitigation measures will be implemented to reduce risks with dust potential. A risk assessment along the route of buttressing works will be conducted and a risk matrix created in order to define the extent of mitigation measures.
- A dry tailings surface is vulnerable to dust blow when disturbed. An irrigation system will be used as required if particularly dusty activities are necessary during dry or windy periods. Temporary stockpiles of filter sand will be

covered. In addition, where deemed necessary, binding agents will be applied to the surface of material to prevent wind dust blow.

8.8.2 Operation Phase

It is not anticipated that dust will be a significant problem during the operation (as is the current situation) of the facility as a result of the absence of scheduled emission points and through the continued implementation of dust management and mitigation techniques being maintained.

The principal factors that influence the potential for dust generation include:

- The particle size distribution within the deposited tailings;
- The moisture content of the tailings;
- Exposure to wind; and
- The presence of a vegetation cover once tailings deposition has ceased.

The proportion of clay (particles less than 2 µm in diameter) is critical because as little as 5% clay in a homogenous mixture can have a significant effect on the cohesiveness of the tailings as they begin to dry. The clay fraction in tailings at Tara is variable but generally lies in the range of 9 to 17%. It therefore has a significant influence in binding coarser material to the surface and, at the same time, enhances the water holding capacity of the tailings. Tailings that are wet (kept saturated) will not give rise to dust blow but as the tailings surface dries a threshold is reached at which wind erosion begins. Experiments have shown that for a sand/silt mixture exposed to a strong breeze (Force 6 or 32 mph) the threshold water content to prevent erosion lies between 4 and 13% depending on the actual proportion of sand and silt in the material. Experience at BTM is that it can take 2 to 6 months for the water content of the deposited tailings to fall to 25% and therefore the potential for excessive dust blow is limited (Ricks & Moynan, 1992).

The average height of the TSF is 25 m above ground level. It is known that wind speed increases with increasing height above the land or sea due to a reduction in frictional forces exerted by the surface. The zone of frictional influence extends to an altitude of approximately 1 kilometer although variations in wind speed are most marked near to the surface. Furthermore, the surface of the tailings dam is large enough to exert frictional forces in its own right and this will further diminish the wind gradient effect.

Stage 5 TSF is partially vegetated and rehabilitated with the remaining tailings surface area periodically saturated through mechanical means when necessary. Stage 6 TSF is active with a large pond area and the remaining exposed tailings surface elevation is 16m below cell crest level.

Under current operational practice, dust control on the tailings surface is achieved by a combination of techniques including:

- Controlled tailings deposition and maintenance of adequate moisture content in the deposited tailings;
- The use of irrigation system on exposed areas of tailings as required within Stage 5;
- The rapid establishment of temporary vegetation cover on the surface of non-operational parts of the Tailings Facility; and
- The controlled dewatering of the tailings to ensure that a minimum area of tailings beaches is exposed.

Potential impacts during operation and post-closure are confined to the emission of dust from tailings surfaces. Monitoring data obtained during the operation of Stages 1,2,3, 4, 5 and 6 together with experience gained elsewhere, indicates that a well-managed tailings storage facility does not normally generate significant amounts of dust. When constructed the embankment walls of the buttress will be seeded and vegetated as is current practice.

It is envisaged that the proposed facility development will not have a significant impact on the surrounding air quality. However, as discussed previously a number of mitigation measures have been suggested. Moreover, specific dust monitoring could be carried out during the construction phase of the development if deemed necessary by the planning authority. If the level of dust is found to exceed regulatory guidelines in the vicinity of the site, further mitigation measures will be incorporated into the construction and operation of the proposed development.

8.8.3 Climate

Road traffic and power usage would be expected to be the dominant sources of greenhouse gas emissions as a result of the proposed facility development. Vehicles during construction and power used during operation of the facility will give rise to CO_2 and N_2O emissions as a result of the proposed development.

Emissions of Oxides of nitrogen, Sulphur dioxide, Carbon monoxide and Carbon dioxide will be mitigated by using efficient construction vehicles, appropriate scheduling of construction activities to minimise duration, the shutting off of equipment during periods of inactivity if they do occur, and a transport management plan as part of the CEMP as described above. No additional mitigation measures are considered necessary.

8.9 PREDICTED RESIDUAL IMPACTS OF THE DEVELOPMENT

8.9.1 Construction Phase

The effect of construction of the facility on air quality will not be significant following the implementation of the proposed mitigation measures. The main environmental nuisance associated with construction and operation activities is dust. Nevertheless, the trace metal content of the tailings is such that without adequate control of the moisture content, a minor impact may be experienced.

However, it is proposed to adhere to good working practices and dust mitigation measures to ensure that the levels of dust generated will be minimal and are unlikely to cause an environmental nuisance. A series of such good working practices and mitigation measures are outlined earlier in this section.

8.9.2 Operation Phase

When dust mitigation measures detailed in the mitigation section of this report are implemented, fugitive emissions of dust and particulate matter from the site will be **minor** and **not significant** in nature posing no nuisance at nearby receptors.

The current good tailings management practice as adopted by Tara Mines will be continued. This will include:

- The maintenance of adequate moisture content on exposed tailings beaches using irrigation system;
- The rapid establishment of a temporary vegetation cover on tailings after the cessation of operations; and
- The application of suitable binding agents to the tailings surface to minimise the effects of wind erosion on the surface.

8.2.9.1 Climate

Climate is discussed in Chapter 10 of the EIAR.

8.2.9.2 Human Health

Best practice mitigation measures are proposed for the construction and operation phase of the Proposed Development which will focus on the pro-active control of dust and air pollutants to minimise generation of emissions at source. The mitigation measures that will be put in place during the construction and operation of the Proposed Development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values and EPA guideline limit values which are based on the protection of human health and prevention of nuisance. Therefore, the impact of operation of the Proposed Development is likely to be **imperceptible** with result to human health.

8.10 Interactions

Interactions with human health and population are likely to arise during the construction and operation phase, however the mitigation measures that will be put in place during the construction and operation phase of the Proposed Development will ensure that the impact of the development complies with all EU ambient air quality legislative limit values and EPA Guideline limit values which are based on the protection of human health and prevention of nuisance. Therefore, the impact of construction and operation of the Proposed Development is likely to be **Minor** and

imperceptible with respect to human health and significant impairment to amenity. This is further discussed within Chapter 11 - Human and Population Health.

8.11 "Worst Case" Scenario

For dust emissions, the "worst case" scenario consists of the failure to implement dust management and mitigation measures resulting in nuisance conditions downwind of the facility. This will not occur and the currently implemented high level dust management and mitigation procedures will be maintained at the existing and proposed facility operations.

8.12 Monitoring

8.12.1 Construction Phase

It is envisaged that the proposed facility development will not have a significant impact on the surrounding air quality. However, as discussed previously a number of dust mitigation measures have been suggested. If the level of dust is found to exceed 350mg/m^2day in the vicinity of the site, further mitigation measures will be incorporated into the activities.

The current programme of dust monitoring around the tailings facility will be continued.

8.12.2 Operational Phase

The current programme of dust monitoring around the tailings dam will be continued.

8.13 Bibliography

1. BRE (2003), Controlling Particles, Vapours and Noise Pollution from Construction Sites.
2. DEHLG (2004), National Program for Ireland under Article 6 of Directive 2001/81/EC for the Progressive Reduction of National Emissions of Transboundary Pollutants by 2010
3. DEHLG (2007) Update and Revision of the National Programme for Ireland under Article 6 of the Directive 2001/81/EC for the Progressive Reduction of National Emissions of Transboundary Pollutants by 2010.
4. Design Manual for Roads and Bridges, Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, May 2007.
5. EPA (2006)., Environmental Management Guidelines, Environmental management in the Extractive industry (non-scheduled minerals). Yr 2006.
6. EPA (2015), Advice Notes for Preparing Environmental Impact Statements – Draft September 2015
7. EPA (2022), Guidelines on the information to be contained in Environmental Impact Statements – 2022
8. EPA (2022), Air quality in Ireland Monitoring Report 2022
9. EPA (2021), Air quality in Ireland Monitoring Report 2021
10. EPA (2019), Ireland's Final Greenhouse Gas emissions 1990-2017.
11. EPA (2019), Irelands Transboundary Gas Emissions 1990-2030
12. German VDI (2002, 2006), Technical Guidelines on Air Quality Control – TA Luft
13. IAQM (2009), Significance in Air Quality.
14. IAQM (2014), Guidance on the Assessment of Dust from Demolition and Construction.
15. IAQM (2016), Guidance on the Assessment of Mineral Dust Impacts for Planning.
16. ICF (2005)., Environmental Code. Oct 2005, 2nd Ed.
17. Met Eireann (2019) www.met.ie
18. The Scottish Office (1996), Planning Advice Note PAN50 Annex B: Controlling the Environmental Effects of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings.
19. UK Office of Deputy Prime Minister (2002), Controlling the Environmental Effects of Recycled and Secondary Aggregates Production Good Practice Guidance.

20. UN Framework Convention on Climate Change (1999), Ireland – Report on the in-depth review of the second national communication of Ireland
21. USEPA (1997), Fugitive Dust Technical Information Document for the Best Available Control Measures
22. S.I. No. 739 of 2022 – Ambient Air Quality Standards Regulations 2022.