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AIR QUALITY CHAPTER FOR THE PROPOSED EIS FOR BOHERKILL QUARRY REMEDIATION, BOHERKILL, RATHANGAN, CO. KILDARE.

PREPARED BY ODOUR MONITORING IRELAND ON BEHALF OF RAPHAEL MCEVOY ENVIRONMENTAL

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1. Air quality environmental assessment

1.1 Introduction and Summary

Odour Monitoring Ireland was commissioned by Raphael McEvoy of RME Environmental to perform an air quality survey and to develop an air quality chapter in order to assess the potential impact to air quality from the proposed remediation of the operational Boherkill Quarry located in Boherkill, Rathangan, Co. Kildare. This study will identify, describe and assess the impact of the development in terms of its impact on air quality.

The Air Quality and Climate assessment has been carried out in line with all relevant guidelines. The proposed remediation plan has been designed to ensure that there are no significant adverse effects on air quality. This is demonstrated through the air assessment study, which establishes that no International or Irish air quality standards or guidelines are forecast to be exceeded.

A Construction Environmental Management Plan (CEMP) will incorporate best practice measures in order to minimise dust at the construction / remediation phase. During the operational phase emissions to air from the facility will be regulated in accordance with specific conditions set out in planning issued by Kildare County Council. Boherkill Quarry will be required to regularly monitor emissions in accordance with the provisions of the planning and these results will be made available to the public.

An air quality assessment has been carried out in the area utilising existing monitoring data collected by Boherkill Quarry and baseline air quality data collected and generated by synoptic EPA monitoring stations in the area. The purpose of this study was to identify existing pollutant trends in the vicinity of the existing 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.

This assessment was prepared in accordance with the Guidelines on the information to be contained in Environmental Impact Statements. The proposed development covers the existing Boherkill Quarry facility. This section should be read in conjunction with the site layout plans for the facility.

1.2 Study methodology-Assessment Criteria

1.2.1 Facility Design Review

A full review of the design of the proposed remediation plan was undertaken in order to establish emission levels of classical air pollutants such as Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, Benzene and Dust.

1.2.2 Assessment Criteria

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, PM_{10}, $PM_{2.5}$ and nitrogen dioxide set by the CAFÉ Directive are detailed in **Table 1.1**.

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 $PM_{2.5}$. With regard to $PM_{2.5}$, the proposed approach is to establish a limit value of 25 μg/m^3, as an annual average (to be attained by 2015), coupled with a non-binding target to reduce human exposure generally to $PM_{2.5}$ 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 limit values for each species / compound is reported in **Table 1.1.**

Table 1.1. EU, Irish and EPA Ambient Air Quality Standards and Proposed EPA limit values

Parameter	Directive / Regulation	Limit Type	VALUE
Nitrogen Dioxide	2008/50/EC and SI 180 of 2011	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
Sulphur Dioxide	2008/50/EC and SI 180 of 2011	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 as PM_{10}	2008/50/EC and SI 180 of 2011	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 as $PM_{2.5}$	2008/50/EC and SI 180 of 2011	Annual limit for protection of human health-Annual	25μg/m^3 $PM_{2.5}$
Benzene	2008/50/EC and SI 180 of 2011	Annual limit for protection of human health	5 μg/m^3
Carbon Monoxide	2008/50/EC SI180 of 2011	8-hour limit (on a rolling basis) for protection of human health	10 mg/m^3
Total depositional dust	VDI2118	Nuisance prevention	350mg/m^2/day

1.2.3 Consultation

Preplanning consultation was undertaken with both statutory and non-statutory consultees. Full details of the consultation process and feedback received are presented in Section 1.5 of the EIS.

None of the responses received from either statutory or non-statutory consultees were relevant to the air quality and climate assessment.

2. Receiving environment-Air

2.1 General

This proposal provides for the importation, placement and capping of approximately 1,500,000m^3 of inert soil and rock and inert construction materials (concrete, block, brick, paving stones, granular fill, ceramics etc). The inert materials will be imported by permitted waste contractors.

The site is located entirely within the townland of Boherkill, Rathangan, Co. Kildare, approximately 3km south-east of Rathangan Co Kildare on the R401 National Secondary routeway and 5.5km north-west of Kildare Town. Irish National Grid Coordinates (E269919, N217476). The total land ownership boundary encompasses an area of 24.5Ha. The lands surrounding the site are generally agricultural in nature with a small number of dwellings located along local R401 road. The nearest town is Rathangan (3km south-west) and Edenderry (9km west). The site is located at the foot of Dunmurray Hill, on lands sloping gently towards the west. The gravel pit is screened from the R401 road by a substantial and well established hedge line. The total site encompasses an area of 20.42hectares and is owned by the applicant Mr. Michael Ennis. The site is set on a saddle of land slightly elevated above Rathangan and the flat lands to the west, and at the foothills of higher ground in Dunmurray Hill and Red Hill. The character of the landscape is that of a rich pastoral landscape, up to a line high on Dunmurray Hill, above which there is a mixture of established deciduous woodland and semi-mature coniferous planting. Land within the holding of the applicant (east of the R401), and adjoining this holding, has had many of the traditional field boundaries removed over the years to facilitate intensive tillage farming, however many traditional field boundaries remain and mature hedgerows are dominant in the overall landscape, notably as perceived in views from the public road. Access to the site is to/from the main Rathangan - Kildare Newbridge road Regional Route R401. Although the road is generally characterised by its meandering, undulating nature, it is a regional route with a typical width of 5.5 metres and site visibility lines at the site entrance are acceptable. The application site and existing sand and gravel quarry is located largely in an agricultural area. There are a number of isolated residences in the area immediately surrounding the existing facility. The surrounding land use activities are largely agricultural with a mix of tillage and grazing activities predominant.

2.2 Baseline air quality assessment

The EU Air Framework Directive deals with each EU Member State in terms of 'Zones' and 'Agglomerations' for air quality. For Ireland, four zones, A, B, C and D have been defined and are included in the *Air Quality Standards (AQS) Regulations* (SI No 180 of 2011).

- Zone A – Dublin conurbation
- Zone B – Cork conurbation
- Zone C – 21 towns in Ireland with population > 15,000
- Zone D – remaining area of Ireland

Boherkill and its environs are classified for the purposes of this assessment as falling within Zone D. While there is some availability of recent and historic data for air quality in major urban and rural areas, there is no data available from the national air quality monitoring database for air quality specific to Boherkill. As such, available data from the EPA Monitoring Site located in a Zone D area has been referenced for Carbon Monoxide, Nitrogen Oxides, Sulphur Dioxide and PM_{10} and $PM_{2.5}$ levels (see **Table 2.1**) and is considered representative of background air quality in the study area.

In addition and for completeness, a baseline air quality survey was performed between November 2015 and December 2015 at four locations in the vicinity of the application area (see **Figure 8.1**). This survey was undertaken in order to assess the baseline air quality concentrations of specific key pollutants including Nitrogen dioxide, Sulphur dioxide, Benzene and Total particulate matter. This monitoring also allowed for the assessment of cumulative baseline emissions in the vicinity of the proposed operations. The results of monitoring undertaken are presented on **Table 2.2**.

2.2.1 Carbon Monoxide (CO)

Carbon monoxide is produced as a result of the 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 exhausts, etc.

A number of the EPA air quality monitoring locations include analysis of carbon monoxide over a 1 year period. Results from this monitoring are presented in **Table 8.4**.

As can be observed in **Table 2.1**, the baseline annual average 8 hr concentration of Carbon monoxide expected in this region is in the range of 300 µg/m^3 which is well within the limit value of 10 mg/m^3 presented in **Table 1.1**.

2.2.2 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. In the transportation sector, 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.

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 source of primary NO_2 for the proposed development will be from vehicle exhausts.

At the onsite baseline monitoring locations (see **Figure 8.1**) the air quality data was analysed for Nitrogen dioxide over a 1 month period, while at the EPA monitoring locations, monitoring was undertaken for a 1 year period. The results are presented in **Table 2.1** and **2.2**.

As can be observed in **Table 2.1** and **2.2**, the baseline annual average concentration of Nitrogen dioxide expected in this region is in the range of 13 µg/m^3 which is below the annual limit value of 30 µg/m^3 for protection of vegetation and well within the annual limit value of 40 µg/m^3 for protection of human health, as presented in **Table 1.1**.

The baseline value recorded on the site ranged from 13.20 to 18.90 µg/m^3 with an average of 16.80 µg/m^3 which is within the limit values for both the protection of vegetation and human health.

2.2.3 Sulphur Dioxide (SO_2)

Sulphur dioxide is a colourless gas, about 2.5 times as heavy as air, with a suffocating faint sweet odour. It occurs in volcanic gases and thus traces of sulphur dioxide are present in the atmosphere. Other sources of SO_2 include smelters and utilities, electricity generation, iron and steel mills, petroleum refineries, pulp and paper mills, metallurgical processes, chemical processes and the combustion of iron pyrites, which is often present in coal. Small sources include residential, commercial and industrial space heating.

At the onsite baseline monitoring stations (see **Figure 8.1**) and EPA monitoring location, the air quality data was analysed for Sulphur dioxide over a 1 month and 1 year period, respectively. The results are presented in **Table 2.1** and **2.2**.

The baseline value recorded on the site ranged from 2.12 to 5.42 µg/m^3 with an average of 4.10 µg/m^3 which is within the limit values for both the protection of vegetation and human health.

As can be observed in **Table 2.1** and **2.2**, the baseline annual average concentration of Sulphur dioxide expected in this region is between the range 2.12 to4.10 µg/m^3 which is well within the limit value of 20 µg/m^3 for protection of ecosystems and well within the limit value of 125 µg/m^3 for protection of human health, as presented in **Table 1.1**.

2.2.4 Particulate Matter (as PM_{10} and $PM_{2.5}$)

PM_{10} and $PM_{2.5}$ refer to particulate matter with an aerodynamic diameter of 10 and 2.5 µm, respectively. Generally, such particulate matter remains in the air due to low deposition rates. Particulate matter is of concern in Europe and as a result air quality limits have been established for both parameters.

At the onsite baseline monitoring stations (see **Figure 8.1**) and EPA monitoring location, the air quality data was analysed for particulate matter (PM_{10} and $PM_{2.5}$) over a 2 day and 1 year period, respectively. The results are presented in **Table 2.1** and **2.2**.

The average baseline value recorded on the site for PM_{10} was 20 µg/m^3, while for $PM_{2.5}$ the average was 11 µg/m^3 which is well within the limit value for the protection of human health.

As can be observed in **Table 2.1 and 2.2**, the baseline annual average concentrations of Particulate matter as PM_{10} and $PM_{2.5}$ expected in this region is between the range 20 to 22 and 11 to 13 µg/m^3 respectively, which is well within the limit values for protection of human health of 40 and 25 µg/m^3 respectively, as presented in **Table 1.1**.

2.2.5 Benzene

The sources associated with individual volatile organic compounds (VOCs) tend to be dependent on the nature of industries in a region. Methane is a naturally occurring VOC derived from plants and animals; it is also generated as a by-product of certain industries. Benzene and other aromatic/alkanes are most often derived from petrol driven vehicle exhausts. Heavier semi-volatile organic compounds are frequently derived from diesel-powered engines.

At the onsite baseline monitoring stations (see **Figure 8.1**) and EPA monitoring locations, the air quality data was analysed for Benzene over a 1 month and 1 year period, respectively. The results are presented in **Table 2.1** and **2.2**.

The average baseline value recorded on the site for Benzene was 0.94 µg/m^3, which is well within the limit values for the protection of human health.

As can be observed in **Table 2.1** and **2.2**, the baseline annual average concentration of Benzene expected in this region is between the range 0.62 and 0.94 µg/m^3 which is well within the limit value of 5 µg/m^3 for protection of human health, as presented in **Table 8.1**.

2.2.6 Total depositional dust

The results of Total dust deposition monitoring at four locations in the vicinity of the existing facility over the time period 2014 are presented in *Table 2.2*. 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 site. The glass jars containing the dust were submitted to an accredited test house for analyses.

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 operational 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". These value was not exceeded at any of the sample locations with all measured values at least 74% lower than the maximum recommended limit value.

Table 2.1 - EPA Baseline air quality monitoring data for Zone D sites throughout Ireland

Compound	Zone D worst case data EPA, 2014 2014 (µg/m^3)[1]
	Zone D
Carbon monoxide 8 hr (Annual mean)	500
Oxides of nitrogen (Annual mean)	13
Sulphur dioxide (Annual mean)	4
Particulate matter as PM10 (Annual mean)	22
Particulate matter as PM2.5 (Annual mean)	13
Benzene (mg/m3) (Annual mean)	0.94 (Zone A)

Notes: [1] see EPA Air Quality in Ireland 2014 Report – Key indicators in Ambient Air Quality, www.epa.ie

Table 2.2 - Baseline air quality monitoring data in the vicinity of proposed facility operations

Compound	Site specific baseline monitoring Nov 2015 to Dec 2015 (μg/m³)[1]
Carbon monoxide 8 hr (Annual mean)	-
Oxides of nitrogen (Annual mean) (5 locations)	Avg. 16.80
Sulphur dioxide (Annual mean) (5 locations)	Avg. 4.10
Particulate matter as PM10 (Annual mean) (2 locations)	Avg. 20
Particulate matter as PM2.5 (Annual mean) (2 locations)	Avg. 11
Benzene (mg/m3) (Annual mean) (5 locations)	Avg. 0.62
Total depositional dust (June 2014 to July 2014) Loc DM-01 Loc DM-02 Loc DM-03 Loc DM-04	 80 49 86 43

[1] denotes that the average from 4 individual monitoring locations are presented to represent annual average baseline data for the location of the proposed facility. Monitoring was performed between the period of Nov 2015 to Dec 2015. Monitoring locations A1 to A4 are presented in Figure 8.1. All analysis was performed in a UKAS certified laboratory for such analytes.

2.3 Climate

The assessment methodology of the existing climatic environment involved a desk-based review of literature including the National Climate Change Strategy 2007-2012 (Department of Environment Heritage and Local Government, 2007).

Please refer to Chapter 2 of the EIS for description of the surrounding environment.

The prevailing wind direction at the application area is from the southwest. Northerly and easterly winds tend to be very infrequent. Wind characteristics vary between a moderate breeze to gales (average 2.2 days with gales per annum). Monthly average wind speeds range between 6.30 and 9.40 knots 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 typical wind roses for Casement Aerodrome identifies that such wind conditions are very infrequent (0.50% of hours in the years 2002 to 2010 inclusive).

The nearest WMO synoptic meteorological station to the application area with long term averages is the Met Éireann Station at Casement which lies approximately 40km east 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 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 Casement are presented in **Table 2.3**.

Table 2.3 - 30-year Average Meteorological Data from Casement Aerodrome (1981-2010)

Parameter	30 yr Average (1981 to 2010)
Mean temperature (^{0}C)	13.40
Mean relative humidity at 0900UTC (%)	83.60
Mean daily sunshine hours (Hrs)	3.70
Mean Annual total rainfall (mm)	754
Mean monthly wind speed (Knots)	10.70

Source: www.met.ie

2.3.1 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 National Climate Change Strategy 2007-2012 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 states that Ireland must meet its responsibilities with regard to reducing CO_2 emissions in partnership with the EU and the global community.

3. Characteristics of the proposal

The proposed restoration scheme at Boherkill, Rathangan, Co. Kildare provides for:

(i) Use of imported inert natural materials, principally excess soil, stones and/or broken rock excavated on construction sites, to backfill and restore a large existing void created by previous extraction of sand and gravel

(ii) Recovery of imported inert construction materials, including stones, granular fill, concrete, blocks, bricks and ceramic tile.
The target materials for recovery are as follows:

EWC Code	Description
170504	Soil and Stone
170101	Concrete
170102	Bricks
170103	Tiles and Ceramics
170107	Mixture of concrete Bricks, tiles and Ceramics other than those mentioned in 170601

Proposed Waste Materials for import

(iii) Separation and Quarantine of any non-inert construction and demolition waste (principally metal, timber, PVC pipes and plastic) unintentionally imported to site prior to removal off-site to appropriately licensed waste disposal or recovery facilities

(v) Continued excavation on a limited basis of the residual resource of sand and gravel remaining in the quarry. Export of sand and gravel off-site for use by others.

(vi) Phased restoration of the backfilled void (including placement of cover soils and seeding) and return to former use as agricultural grassland

(vii) Temporary stockpiling of topsoil and subsoil pending re-use as cover material for phased restoration of the site

(viii) Environmental monitoring of noise, dust, surface water and groundwater for the duration of the site restoration works.

The existing void will only be infilled using inert materials imported from pre-approved external construction sites and secondary aggregate generated on site. No peat, contaminated soils intermixed construction and demolition waste or non-hazardous waste will be accepted at the application site. Non-inert quarantined construction and demolition wastes will be removed off-site.

4. Potential Impacts of the Proposal

4.1 'Do Nothing'

The baseline survey undertaken as part of this assessment suggests that air quality in the vicinity of the application area is expected to be average/good with typical levels of pollutants for a rural area. All pollutant levels are within the relevant Irish and EU limits (for similar sized population centres).

4.2 Construction Phase Impact – Air Quality

The following sections describe the potential impacts to air quality resulting from the construction phase of the proposed facility. The impacts have been assessed on a local scale to determine impacts on human health and ecological receptors. The aspects considered include:
Potential sources of dust from construction and operation include the following:

- The working of the borrow area,
- The transport of material including vehicles carrying dust on their wheels,
- Un-vegetated stockpiles of construction materials,
- The handling of construction materials for the construction phase of the facility,
- Construction of the raise.
- Construction dust and its potential to impact on sensitive receptors and to cause an environmental nuisance,
- Construction traffic emissions and their potential for impacts on sensitive receptors.

The impacts are assessed in the following sections with respect to the relevant assessment criteria where appropriate.

4.2.1 Construction Dust

Construction activities such as 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 4.1 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 4.1- 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 minor to moderate scale. Using this screening assessment tool, at a minor to moderate construction site there is a risk that dust may cause an impact at sensitive receptors within 50m of the source of the dust generated. The nearest sensitive receptors to the centre of the subject site is located at a distance of greater than 50m from the activities, therefore, the impact from construction activities can be considered to be imperceptible.

All sensitive habitats are located at a distance greater than 25m from the emission source as a result the impact on habitats will be imperceptible.

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.

4.2.2 Construction Traffic Emissions

Emissions associated with construction traffic can impact on local air quality. In particular, the proposed routes used for deliveries and any sensitive receptors that line these routes may experience impacts to local 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 200 (which is well in excess of the expected peak AADT so as to assume worst case potential impact – see Section 11 EIS) with a mean traffic speed of 20km/hr (which again is worst case scenario). The detailed results of the modelling exercise are presented in **Table 4.2**.

Table 4.2 - Predicted contribution of air pollutants to baseline air quality as a result of construction traffic.

Link location	Carbon monoxide Annual mean (μg/m³)	Benzene Annual mean (μg/m³)	Oxides of nitrogen Annual mean (μg/m³)	Particulate matter 10um	
				Annual mean (μg/m³)	Days > 50 (μg/m³)
Worst case receptor 5m from road centreline on any roadway	<0.04	<0.04	<0.50	<0.10	0

4.3 Operational Phase Impacts – Air Quality

Air quality impacts may arise from process based emissions and traffic movements associated with the operational phase of the proposed plant. Traffic based air quality emissions will result from traffic making deliveries and collections to and from the proposed plant and employee traffic movements.

4.3.1 Traffic

The detailed information provided in the Traffic and Transport assessment (see **Section 11** of the EIS) has been used to identify whether any significant impact on sensitive receptors will occur. The traffic information has been inputted into the Design Manual for Roads and Bridges (DMRB), Volume 11 (ver. 1.03c) model. This model was prepared by the United Kingdom Department of Transport, the Scottish Office of Industrial Development, the Welsh Office and the Department of Environment for Northern Ireland as a screening tool to assess worst-case air quality impact associated with traffic movements.

The screening model uses a worst-case scenario in calculating emissions. The emission factors used for each pollutant are intentionally set to bias and to overestimate the actual emission rate. In addition, wind speeds are assumed to be 2 ms^{-1} (approximately 3.90 knots compared to a mean wind speed of between 4 to 6 ms^{-1} at the nearest Met station (Clones Met Station)). Emission rates predicted as a result of traffic are added to the cumulative emissions generated by the proposed plant's scheduled emission points and baseline data. This is considered a worst case assessment of likely impact. It can therefore be assumed with confidence that traffic related air pollution will not arise if the model does not identify any issues.

Traffic figures have been assessed using Annual Average Daily Traffic (AADT) figures. The Heavy Goods Vehicle (HGV) percentage was taken from the traffic assessment. As the average speed of vehicles has a significant effect on the generation of pollutants, calculations are carried out at a worst case traffic speed scenarios. The speed used is 20 km hr^{-1}, to represent gridlock conditions so as to assess the worst case scenario. In addition, it was assumed within the model that the sensitive receptor was located within 5m of the road centreline, again to represent worst case conditions.

4.3.2 Traffic: Output Data from Traffic Air Quality Model

Tables 4.3 to **4.5** presents the results of the worst case conservative traffic air quality modelling data, performed in order to ascertain the likely increase in air quality impact as a result of additional traffic generated during the operational phase of the proposed operation and remediation.

As can be observed, there is no significant increase in the air quality impact of named pollutants as a result of increased baseline traffic numbers in 2017, 2022 and 2027 with only a slight increase occurring in pollutant concentration predicted 5m from the road centreline.

In terms of the 'do nothing' versus 'do something' for 2017, 2022 and 2027, there is a slight increase in pollutant concentration in the order of 1 to 2% which is considered to be imperceptible. When this increase is added to baseline data presented in **Table 2.1** and **2.2** for each named pollutant, emissions will remain well within the air quality limits presented in **Table 1.1** for the protection of human health.

Table 4.3 - Predicted contribution of air pollutants as a result of traffic 2017, do-nothing and do-something scenario

Year	Worst case Assessment location (as per Traffic Assessment Section 11)	
	(Road next Entrance)	
Baseline emissions as a result of traffic **2017 – Do nothing**	Carbon monoxide Annual mean (µg/m³)	0.060
	Benzene Annual mean (µg/m³)	0.060
	Oxides of nitrogen Annual mean (µg/m³)	2.74
	Particulate matter 10um – Annual mean (µg/m³)	0.79
	Particulate matter 10um – Days > 50 (µg/m³)	0
Baseline emissions as a result of traffic **2017 – Do something**	Carbon monoxide Annual mean (µg/m³)	0.060
	Benzene Annual mean (µg/m³)	0.060
	Oxides of nitrogen Annual mean (µg/m³)	2.87
	Particulate matter 10um – Annual mean (µg/m³)	0.81
	Particulate matter 10um – Days > 50 (µg/m³)	0

Table 4.4 - Predicted contribution of air pollutants as a result of traffic 2022, do-nothing and do-something scenario

Year	Worst case Assessment location (as per Traffic Assessment Section 11)	
	(Road next Entrance)	
Baseline emissions as a result of traffic **2022 – Do nothing**	Carbon monoxide Annual mean (µg/m³)	0.060
	Benzene Annual mean (µg/m³)	0.060
	Oxides of nitrogen Annual mean (µg/m³)	2.70
	Particulate matter 10um – Annual mean (µg/m³)	0.80
	Particulate matter 10um – Days > 50 (µg/m³)	0
Baseline emissions as a result of traffic **2022 – Do something**	Carbon monoxide Annual mean (µg/m³)	0.060
	Benzene Annual mean (µg/m³)	0.060
	Oxides of nitrogen Annual mean (µg/m³)	2.83
	Particulate matter 10um – Annual mean (µg/m³)	0.82
	Particulate matter 10um – Days > 50 (µg/m³)	0

Table 4.5 - Predicted contribution of air pollutants as a result of traffic 2032, do-nothing and do-something scenario

Year	Worst case Assessment location (as per Traffic Assessment Section 11) (Road next Entrance)	
Baseline emissions as a result of traffic **2032 - Do nothing**	Carbon monoxide Annual mean (µg/m³)	0.070
	Benzene Annual mean (µg/m³)	0.070
	Oxides of nitrogen Annual mean (µg/m³)	2.82
	Particulate matter 10um - Annual mean (µg/m³)	0.88
	Particulate matter 10um - Days > 50 (µg/m³)	0
Baseline emissions as a result of traffic **2032 - Do something**	Carbon monoxide Annual mean (µg/m³)	0.070
	Benzene Annual mean (µg/m³)	0.070
	Oxides of nitrogen Annual mean (µg/m³)	2.85
	Particulate matter 10um - Annual mean (µg/m³)	0.88
	Particulate matter 10um - Days > 50 (µg/m³)	0

4.4 "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 a rural 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/sands and no construction activity and therefore no dust creation as a result of construction works.

In addition "Do nothing" scenario would in no remediation of the quarry pit. Whilst some of the potential local environmental impacts, associated primarily with construction activity, would be reduced under a "do-nothing" option.

4.5 Remedial or Reductive Measures

4.5.1 Construction Phase

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

1. Site roads shall be regularly cleaned and maintained as appropriate.

2. Hard surface roads shall be swept to remove mud and aggregate materials from their surface as a result of the facility development. 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.

3. Vehicles using site roads shall have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road and on hard surfaced roads that site management dictates speed shall be restricted to 20 km per hour.

4. 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.

5. Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary. Aggregates, fine sized material with dust potential will be delivered in covered trucks.

6. 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.

7. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods. Temporary stockpiles of filter sand will be covered.

8. 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.

9. 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.

10. 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.

4.5.2 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 implementation of dust management and mitigation techniques where required.

The principal factors that influence the potential for dust generation include:
1. The particle size distribution within the deposited material,
2. The moisture content of the material,
3. Exposure to wind,
4. The presence of a vegetation cover once material deposition has ceased.

Dust control on surfaces is achieved by a combination of techniques including:

1. Controlled material deposition and maintenance of adequate moisture content in the deposited material. The maintenance of adequate moisture content by the use of water sprays and crusting agents is of utmost importance to prevent dust blow in dry weather.
2. The use of agricultural spray irrigation on exposed areas of quarry as required within the operational part of the facility.
3. The rapid establishment of vegetation on the surface of non-operational parts of the facility.

Potential impacts during operation and post-closure are confined to the emission of dust from surfaces.

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.

4.5.3 Climate

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.

5. Predicted Residual Impacts of the development

5.1 Construction Phase

The effect of construction of the facility on air quality will not be significant following the implementation of the proposed mitigation measures (as is the case with the existing development). The main environmental nuisance associated with construction and operation activities is dust.

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 chapter.

5.1.2 Operation Phase

The impact will be insignificant due to the implemented mitigation measures.

Current good quarry management practice as adopted by Boherkill Quarry will be continued.

This will include:

1. The maintenance of adequate moisture content on exposed surface beaches using water sprays where necessary.
2. The rapid establishment of vegetation cover on the facility after the cessation of operations.

5.1.3 "Worst Case" Scenario

For traffic-derived pollutants, the "worst-case" scenario consists of gridlock conditions with large volumes of traffic on the road simultaneously.

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.

5.2 Monitoring

5.2.1 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. Moreover, 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 350mg/m^{2}day in the vicinity of the site, further mitigation measures will be incorporated into the construction of the proposed site.

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

5.2.2 Operational phase

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

5.3 Reinstatement

Not Applicable

6. Non-Technical Summary

A baseline ambient air quality survey was carried out in the vicinity of the proposed Boherkill Quarry facility development located in Boherkill, Rathangan, Co. Kildare. Currently, the air quality is average to good with levels of criteria pollutants for traffic, industrial and residential derived pollution (BTEX, NO_2, CO, and PM_{10}) below the relevant Irish and European Union limits. The main source of air pollution in the area is from motor vehicle exhausts, construction and industrial activities, heating and associated urban and farming emissions. There is the risk that emissions from dust from the facility could result in air quality impacts and nuisance in the vicinity of the existing and proposed facility development during the construction and operation phase. A series of mitigation measures will be maintained and applied to minimise any impact associated with dust. It is anticipated that no long-term associated impacts on air quality will occur in the area as a result of the proposed facility development.

7. *Appendix I*-Monitoring locations

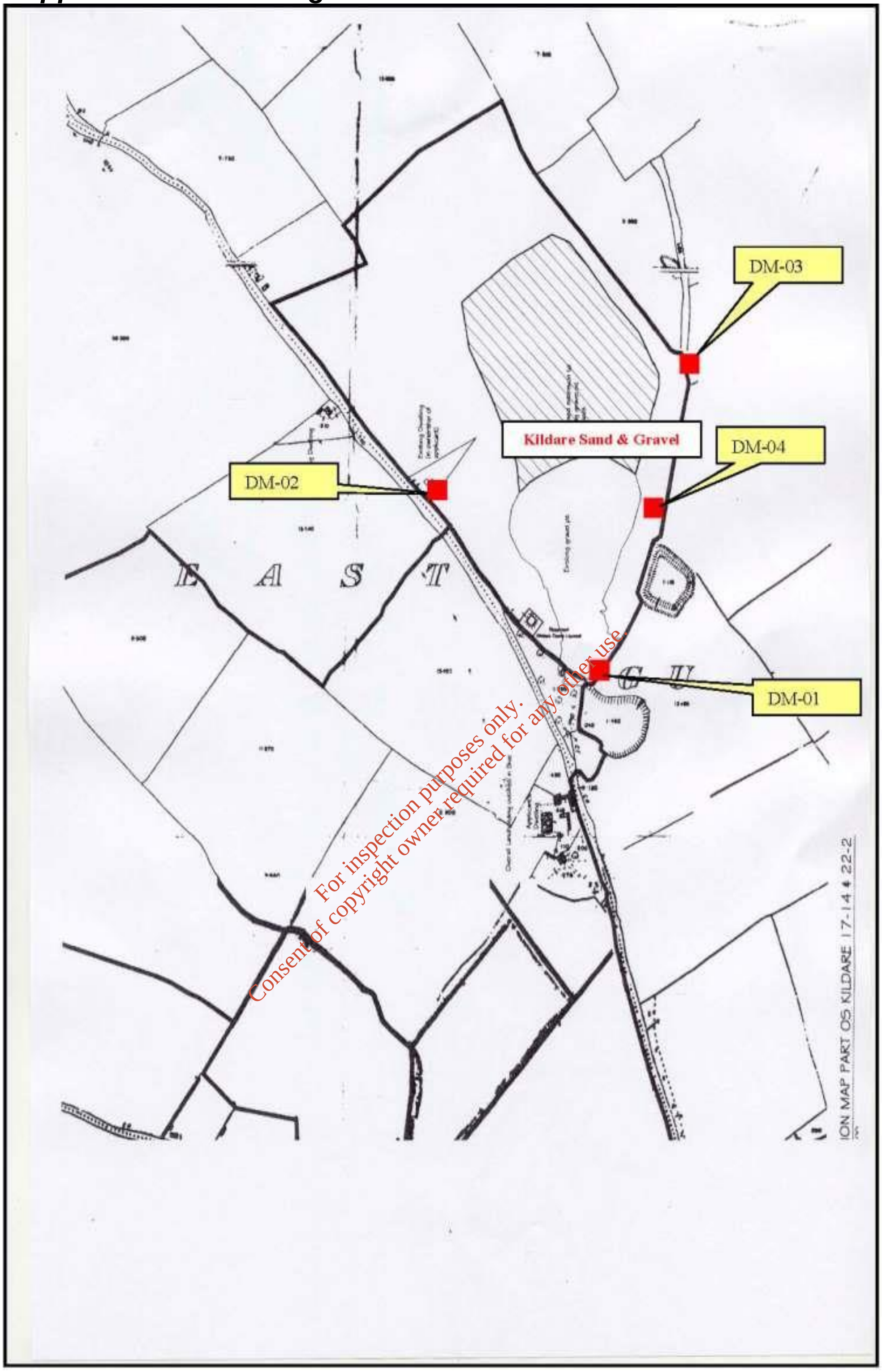

Figure 7.1. Overview of existing monitoring locations in the vicinity of Boherkill Quarry facility.

Table 7.1. Monitoring locations.

Monitoring location identity	Location description
DM-01	Southern side boundary at entrance
DM-02	North-western corner of site
DM-03	North-eastern corner of site
DM-04	Eastern site boundary