Chapter 9:

Air Quality and Climate

9.0 AIR QUALITY AND CLIMATE

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts, if any, associated with the proposed development at Colp West, Drogheda, Co. Louth. The proposed development comprises a mix of residential units and a childcare facility along with associated infrastructure. The total gross site area comprises 13.44 hectares and is located adjacent to the Drogheda trainline to the west and Colpe Road to the south.

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9.2 STUDY METHODOLOGY

9.2.1 Criteria for Rating of Impacts

Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 and Appendix 9.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for NO_2, PM_{10}, $PM_{2.5}$, benzene and CO (see Table 9.1) which are relevant to this assessment. Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 9.1).

<table>
<tr><th>Pollutant</th><th>Regulation Note 1</th><th>Limit Type</th><th>Value</th></tr>
<tr><td rowspan="3">Nitrogen Dioxide</td><td rowspan="3">2008/50/EC</td><td>Hourly limit for protection of human health - not to be exceeded more than 18 times/year</td><td>200 μg/m³</td></tr>
<tr><td>Annual limit for protection of human health</td><td>40 μg/m³</td></tr>
<tr><td>Critical level for protection of vegetation</td><td>30 μg/m³ NO + NO_2</td></tr>
<tr><td rowspan="2">Particulate Matter (as PM_{10})</td><td rowspan="2">2008/50/EC</td><td>24-hour limit for protection of human health - not to be exceeded more than 35 times/year</td><td>50 μg/m³</td></tr>
<tr><td>Annual limit for protection of human health</td><td>40 μg/m³</td></tr>
<tr><td>Particulate Matter (as $PM_{2.5}$)</td><td>2008/50/EC</td><td>Annual limit for protection of human health</td><td>25 μg/m³</td></tr>
<tr><td>Benzene</td><td>2008/50/EC</td><td>Annual limit for protection of human health</td><td>5 μg/m³</td></tr>
<tr><td>Carbon Monoxide</td><td>2008/50/EC</td><td>8-hour limit (on a rolling basis) for protection of human health</td><td>10 mg/m³ (8.6 ppm)</td></tr>
</table>

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 9.1: Air Quality Standards Regulations

Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards 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 phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to 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 year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health & Local Government (DEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002 (UNFCC, 1997, 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Doha Amendment to the Kyoto Protocol, in December 2012, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 20% below the 2005 level over the period 2013 to 2020 (UNFCCC, 2012). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP24) took place in Katowice, Poland from the 4th to the 14th December 2018 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris in 2015 and is an important milestone in terms of international climate change agreements. The Paris Agreement was agreed by over 200 nations and has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

The EU, in October 2014, agreed the “2030 Climate and Energy Policy Framework” (EU, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under “Renewables and Energy Efficiency”, an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. The initial objective of the Protocol was to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$.

European Commission Directive 2001/81/EC, the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (DEHLG, 2004; 2007). The data available from the EPA in 2019 (EPA, 2019) indicated that Ireland complied with the emissions ceilings for SO_2 and NH_3 but failed to comply with the ceiling for NO_X and NMVOCs (non-methane volatile organic compounds). Directive (EU) 2016/2284 "*On the Reduction of National Emissions of Certain Atmospheric Pollutants and Amending Directive 2003/35/EC and Repealing Directive 2001/81/EC*" was published in December 2016. The Directive will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020 emission targets are 25.5 kt for SO_2 (65% on 2005 levels), 66.9 kt for NO_X (49% reduction on 2005 levels), 56.9 kt for NMVOCs (25% reduction on 2005 levels), 112 kt for NH_3 (1% reduction on 2005 levels) and 15.6 kt for $PM_{2.5}$ (18% reduction on 2005 levels). In relation to 2030, Ireland's emission targets are 10.9 kt (85% below 2005 levels) for SO_2, 40.7 kt (69% reduction) for NO_x, 51.6 kt (32% reduction) for NMVOCs, 107.5 kt (5% reduction) for NH_3 and 11.2 kt (41% reduction) for $PM_{2.5}$.

9.2.2 Construction Phase

The current assessment focuses on identifying the existing baseline levels of PM_{10} and $PM_{2.5}$ in the region of the proposed development by an assessment of EPA monitoring data. Thereafter, the impact of the construction phase of the development on air quality was determined by a qualitative assessment of the nature and scale of dust generating construction activities associated with the proposed development.

9.2.3 Operational Phase

Local Air Quality Assessment

The air quality assessment has been carried out following procedures described in the publications by the EPA (EPA, 2002; 2003; 2015; 2017) and using the methodology outlined in the guidance documents published by the UK DEFRA (UK DEFRA 2016, 2018) and UK DETR (1998). The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA (UK Highways Agency, 2007). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out and the likely location of air pollution "*hot-spots*" identified. An examination of recent EPA and Local Authority data in Ireland (EPA, 2018; 2019) has indicated that SO_2 and smoke are unlikely to be exceeded at the majority of locations within Ireland and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential issues in regards to nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ at busy junctions in urban centres (EPA, 2018; 2019). Benzene, although previously reported at quite high levels in urban centres, has recently been measured at several city centre locations to be well below the EU limit value (EPA, 2018; 2019). Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres (EPA, 2019). The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5}$, benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations will be predicted for nearby sensitive receptors for the following scenarios:

- The Existing Baseline scenario, for model verification;
- Opening Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place;
- Opening Year Do-Something scenario (DS), which assumes the proposed development in place;
- Design Year Do-Nothing scenario (DN), which assumes the retention of present site usage with no development in place; and
- Design Year Do-Something scenario (DS), which assumes the proposed development in place.

The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (UK Highways Agency, 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK DEFRA, 2017) (Version 6.1, 2017), and following guidance issued by the TII (2011), UK Highways Agency (2007), UK DEFRA (2016, 2018) and the EPA (2002, 2003, 2015, 2017).

The TII guidance (2011) 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).

The UK DMRB guidance (UK Highways Agency, 2007), on which the TII guidance was based, states that road links meeting one or more of the following criteria can be defined as being ‘affected’ by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres 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 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors that have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200 m of the chosen sensitive receptors inputs to the air dispersion model consist of: road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles, annual average traffic speeds and background concentrations. The UK DMRB guidance states that road links at a distance of greater than 200 m from a sensitive receptor will not influence pollutant concentrations at the receptor. Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The DMRB model uses conservative emission factors, the formulae for which are outlined in the DMRB Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case predicted ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the proposed development with these ambient air quality standards. The TII *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Scheme* (2011) detail a methodology for determining air quality impact significance criteria for road schemes and this can be applied to any project that causes a change in traffic flows. The degree of impact is determined based on both the absolute and relative impact of the proposed development. The TII significance criteria have been adopted for the proposed development and are detailed in Appendix 9.2 Table A1 to Table A3. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

Regional Air Quality & Climate Assessment

The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland (2011) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges (UK Highways Agency, 2007). The assessment focused on determining the resulting change in emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) and carbon dioxide (CO_2). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes and can be applied to any development that causes a change in traffic flows. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

Conversion of NO_X to NO_2

NO_x ($NO + NO_2$) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGVs the proportion of NOx emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO, have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NO_x to NO_2 in “*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*” (2011). The TII guidelines recommend the use of DEFRAs NO_x to NO_2 calculator (UK DEFRA, 2017) which was originally published in 2009 and is currently on version 6.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NO_x emitted as NO for each local authority across the UK. O_3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and the TII guidance recommends the use of 'Armagh, Banbridge and Craigavon' as the choice for local authority when using the calculator. The choice of Craigavon provides the most suitable relationship between NO_2 and NO_x for Ireland. The "*All Other Urban UK Traffic"* traffic mix option was used.

Ecological Sites

For routes that pass within 2 km of a designated area of conservation (either Irish or European designation) the TII requires consultation with an Ecologist (TII, 2011). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed development and when significant changes in AADT (>5%) occur.

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DOHLEG, 2010) provide details regarding the legal protection of designated conservation areas. If both of the following assessment criteria are met, an assessment of the potential for impact due to nitrogen deposition should be conducted:

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

The Boyne Estuary SPA (site code 004080), Boyne Coast and Estuary pNHA and SAC (site code 001957) and River Boyne and River Blackwater SAC (site code 002299) are located within 200m of a road link (Marsh Road) which will be directly impacted by the proposed development. As such an assessment of the impact with regards to nitrogen deposition was conducted. Dispersion modelling and prediction was carried out at typical traffic speeds at this location. Ambient NOx concentrations were predicted for the worst-case traffic year along a transect of up to 200 m within the pNHA, SPA and SAC. The road contribution to dry deposition along the transect was also calculated using the methodology outlined in Appendix 9 of the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (TII, 2011).

9.3 EXISTING RECEIVING ENVIRONMENT

9.3.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 30 km south of the site. Dublin Airport met data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 9.1). For data collated during five representative years (2014 - 2018), the predominant wind direction is westerly to south-westerly with a mean wind speed of 5.3 m/s over the period 2005 – 2018 (Met Eireann, 2019).

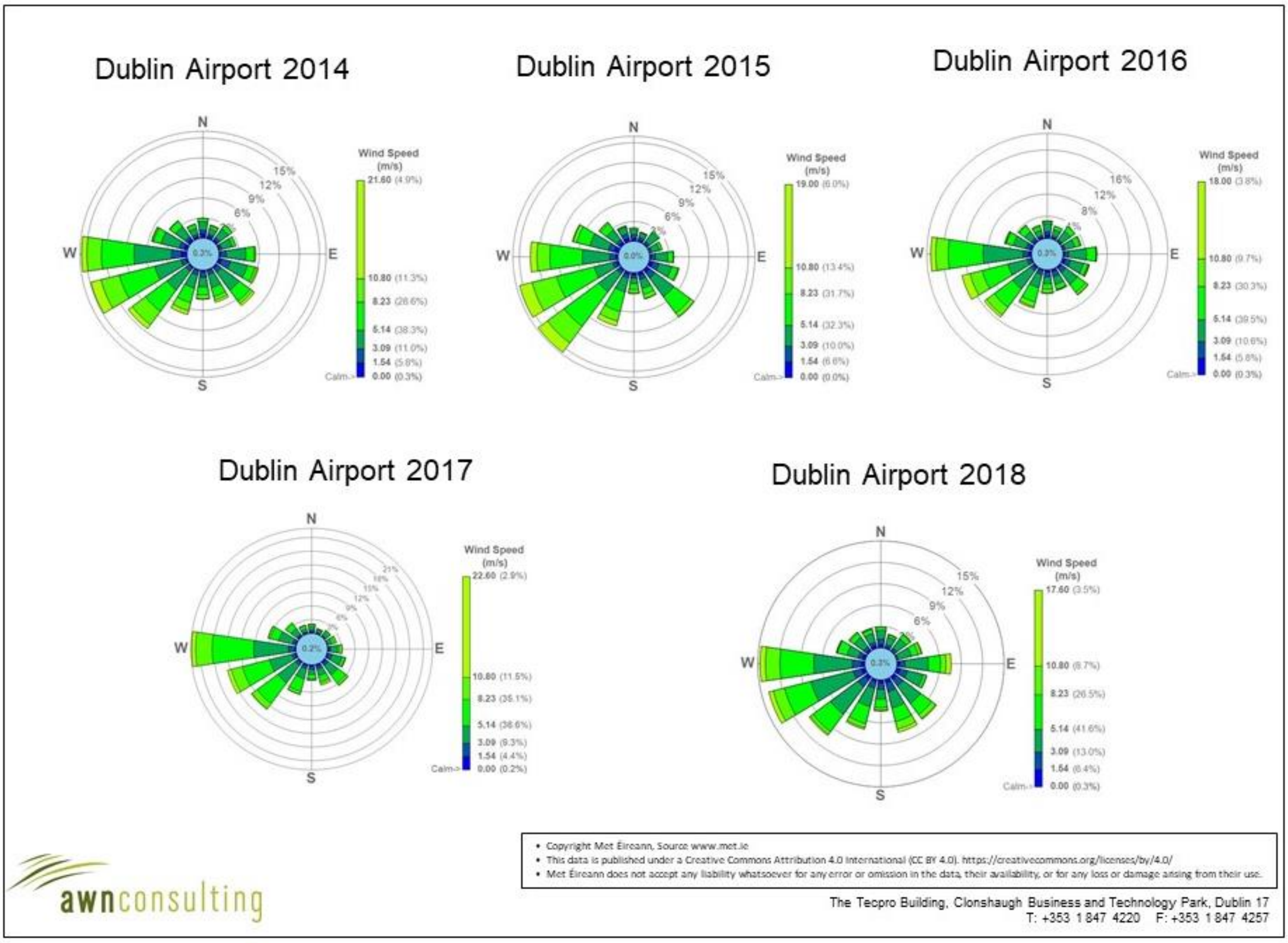

Figure 9.1: **Dublin Airport Windrose 2014 - 2018**

9.3.2 Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources (UK Highways Agency, 2007). Thus, residential exposure is determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In 2011 the UK DEFRA published research (Highways England, 2013) on the long term trends in NO_2 and NO_X for roadside monitoring sites in the UK. This study marked a decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this is that there now exists a gap between projected NO_2 concentrations which UK DEFRA previously published and monitored concentrations. The impact of this 'gap' is that the DMRB screening model can under-predict NO_2 concentrations for predicted future years. Subsequently, the UK Highways Agency (HA) published an Interim advice note (IAN 170/12) in order to correct the DMRB results for future years.

9.3.3 Baseline Air Quality

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality in Ireland is "*Air Quality In Ireland 2017 – Indicators of Air Quality*" (EPA, 2018). The EPA website details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments (EPA, 2019).

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2019). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development site is within Zone C (EPA, 2019). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

NO_2 monitoring was carried out at three Zone C locations in recent years, Kilkenny, Portlaoise and Mullingar (EPA, 2018). The NO_2 annual average in 2017 for Kilkenny and Portlaoise was 5 µg/m^3 and 11 µg/m^3 respectively. Long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m^3. The average results over the last five years at a range of Zone C locations suggests an upper average of no more than 12 µg/m^3 as a background concentration as shown in Table 9.2. Based on the above information, a conservative estimate of the current background NO_2 concentration for the region of the development in 2019 is 12 µg/m^3.

Long term NO_X monitoring has been carried out at a three Zone C locations in recent years: Mullingar, Kilkenny and Portlaoise. Annual mean concentrations of NO_X at the monitoring sites over the period 2013 – 2017 ranged from 6 - 27 µg/m^3, suggesting an upper average over the five year period of no more than 19 µg/m^3 as a background concentration. An appropriate estimate for the current background NO_X concentration in the region of the proposed development is 19 µg/m^3.

Station	**Averaging Period** Notes 1, 2	**Year**				
		2013	**2014**	**2015**	**2016**	**2017**
Kilkenny	Annual Mean NO_2 (µg/m^3)	4	5	5	7	5
	Max 1-hr NO_2 (µg/m^3)	90	57	70	51	58
Portlaoise	Annual Mean NO_2 (µg/m^3)	-	16	10	11	11
	Max 1-hr NO_2 (µg/m^3)	-	74	84	86	80
Mullingar	Annual Mean NO_2 (µg/m^3)	6	4	-	-	-
	Max 1-hr NO_2 (µg/m^3)	68	53	-	-	-

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 1-hour limit value - 200 µg/m^3 as a 99.8th%ile, i.e. not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Table 9.2: Trends In Zone C Air Quality - Nitrogen Dioxide (NO_2)

Long-term PM_{10} monitoring was carried out at the urban Zone C locations of Galway, Ennis and Portlaoise in recent years. The average annual mean concentrations measured at Ennis and Portlaoise in 2017 were 16 µg/m^3 and 10 µg/m^3 respectively (Table 9.3). In addition, there were at most 12 exceedances over the five year period (in Ennis) of the 24 hour limit value of 50 µg/m^3 measured as a 90.4th percentile (35 exceedances are permitted per year). The average results over the last five years at a range of Zone C locations suggest an upper average of no more than 19 µg/m^3 as a background concentration. Based on the above information a conservative estimate of the current background PM_{10} concentration for the region of the development in 2019 is 19 µg/m^3.

Station	Averaging Period Notes 1, 2	Year				
		2013	2014	2015	2016	2017
Galway	Annual Mean PM_{10} (µg/m^3)	21	15	15	15	-
	24-hr Mean > 50 µg/m^3 (days)	11	0	2	3	-
Ennis	Annual Mean PM_{10} (µg/m^3)	20	21	18	17	16
	24-hr Mean > 50 µg/m^3 (days)	8	8	10	12	9
Portlaoise	Annual Mean PM_{10} (µg/m^3)	-	-	12	12	10
	24-hr Mean > 50 µg/m^3 (days)	-	-	1	1	0

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).
Note 2 24-hour limit value - 50 µg/m^3 as a 90.4th%ile, i.e. not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

Table 9.3: Trends In Trends In Zone C Air Quality - PM_{10}

The results of $PM_{2.5}$ monitoring at Ennis for the period 2013 - 2017 indicated an average $PM_{2.5}/PM_{10}$ ratio ranging from 0.60 – 0.76. Based on this information, a conservative ratio of 0.8 was used to generate a current background $PM_{2.5}$ concentration of 15.2 µg/m^3.

In terms of benzene, monitoring data for the Zone C location of Kilkenny for the period 2014 – 2017 showed an upper average concentration of no more than 0.2 µg/m^3, which is significantly below the 5 µg/m^3 limit value. Based on this monitoring data a conservative estimate of the current background concentration in the region of the development is 0.2 µg/m^3.

With regard to CO, annual averages at the Zone C monitoring station in Portlaoise over the 2015 – 2017 period, gave an annual mean concentration of no more than 0.4 mg/m^3. Based on this EPA data, a conservative estimate of the current background CO concentration in the region of the development is 0.4 mg/m^3.

Background concentrations for the opening and design years have been calculated using the predicted current background concentrations and the year on year reduction factors provided by Transport Infrastructure Ireland in the *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (2011) and the UK Department for Environment, Food and Rural Affairs LAQM.TG(16) (2018).

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development comprises a mix of residential units and a childcare facility. The total gross site area comprises 13.44 hectares and is located adjacent to the Drogheda trainline to the west and Colpe Road to the south. A full description of the development can be found in Chapter 2.

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

A. construction phase, and;
B. operational phase.

During the construction stage the main source of air quality impacts will be as a result of fugitive dust emissions from site activities. Emissions from construction vehicles and machinery have the potential to impact climate. The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows on local road links which are affected by with the development.

The following describes the primary sources of potential air quality and climate impacts which have been assessed as part of this EIAR.

9.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

9.5.1 Construction Stage

Air Quality

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and PM_{10}/$PM_{2.5}$ emissions. The proposed development can be considered moderate in scale and therefore there is the potential for significant dust soiling 50 m from the source (TII, 2011) (Table 9.4). While construction dust tends to be deposited within 200 m of a construction site, the majority of the deposition occurs within the first 50 m. There are a number of sensitive receptors, predominantly residential properties in close proximity to the site. In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Provided the dust minimisation measures outlined in the plan (see Appendix 9.3) are adhered to, the air quality impacts during the construction phase will not be significant. These measures are summarised in Section 9.7.

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 limited use of haul roads	25m	10m	10m

Table 9.4: Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place (TII, 2011)

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. However, the impact on the climate is considered to be short-term and imperceptible.

Human Health

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

9.5.2 Operational Phase

Local Air Quality

There is the potential for a number of emissions to the atmosphere during the operational phase of the development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene, PM_{10} and $PM_{2.5}$.

Traffic flow information was obtained from DBFL, the consulting engineers on this project and has been used to model pollutant levels under various traffic scenarios and under sufficient spatial resolution to assess whether any significant air quality impact on sensitive receptors may occur.

Cumulative effects have been assessed, as recommended in the EU Directive on EIA (Council Directive 97/11/EC) and using the methodology of the UK DEFRA (2016, 2018). Firstly, background concentrations (EPA, 2018) have been included in the modelling study. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern. Appropriate background levels were selected based on the available monitoring data provided by the EPA (2018) (see Section 9.3.3). The modelling scenarios include for the cumulative impact of other developments in the vicinity of the proposed development, where such information is available.

The impact of the proposed development has been assessed by modelling emissions from the traffic generated as a result of the development. The impact of CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for the baseline, opening and design years was predicted at the nearest sensitive receptors to the development. This assessment allows the significance of the development, with respect to both relative and absolute impact, to be determined.

The receptors modelled represent the worst-case locations close to the proposed development and were chosen due to their close proximity (within 200 m) to the road links impacted by proposed development. The worst case traffic data is shown in Table 9.5. Four sensitive receptors (R1 – R4) in the vicinity of the proposed development have been assessed. Sensitive receptors have been chosen as they have the potential to be adversely impacted by the development, these receptors are detailed in Figure 9.2.

Road Name	Speed (kmph)	%HGV	Base	Do Nothing	Do Something	Do Nothing	Do Something
			2017	2021		2036	
Colpe Road	56	2.7%	11,286	11,932	13,013	13,790	16,347
Marsh Road	65	1.3%	6,646	7,026	8,190	8,121	7,615
Dublin Road	60	1.7%	17,333	18,324	19,226	21,178	21,095
Permitted Link Road	50	0.0%	0	1,293	2,311	4,160	5,056

Table 9.5: Traffic Data used in Modelling Assessment

Figure 9.2: Approximate Location of Sensitive Receptors Used in Air Modelling Assessment

Modelling Assessment

Transport Infrastructure Ireland *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (TII, 2011) detail a methodology for determining air quality impact significance criteria for road schemes and has been adopted for this assessment, as is best practice. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Results are compared against the 'Do-Nothing' scenario, which assumes that the proposed development is not in place in future years, in order to determine the degree of impact.

NO_2

The results of the assessment of the impact of the proposed development on NO_2 in the opening year 2021 and design year 2036 are shown Table 9.6 for the Highways Agency IAN 170/12 and Table 9.7 using the UK Department for Environment, Food and Rural Affairs technique respectively. The annual average concentration is in compliance with the limit value at all worst-case receptors using both techniques. Levels of NO_2 are 42% of the annual limit value in 2021 using the more conservative IAN technique, while concentrations are 39% of the annual limit value in 2021 using the UK Department for Environment, Food and Rural Affairs technique. Concentrations in the design year of 2036 are also low, with NO_2 levels reaching 39% of the annual limit value using the more conservative IAN technique. The hourly limit value for NO_2 is 200 μg/m^3 and is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The maximum 1-hour NO_2 concentration is not predicted to be exceeded using either technique in 2021 or 2036 (Table 9.8).

The impact of the proposed development on annual mean NO_2 levels can be assessed relative to "Do Nothing (DN)" levels in 2021 and 2036. Relative to baseline levels, some small increases in pollutant levels are predicted as a result of the proposed development. With regard to impacts at individual receptors, the greatest impact on NO_2 concentrations will be an increase of 1.4% of the annual limit value at receptor R1. Thus, using the assessment criteria outlined in Appendix 9.2 Tables A1 – A2, the impact of the proposed development in terms of NO_2 is negligible. Therefore, the overall impact of NO_2 concentrations as a result of the proposed development is long-term, negative and imperceptible at all of the receptors assessed.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} in the opening year 2021 and design year 2036 are shown in Table 9.9. Predicted annual average concentrations at the worst-case receptor in the region of the development are at most 49% of the limit value in 2021 and 50% in 2036. The 24-hour mean limit value of 50 μg/m^3 is expressed as a 90.4th percentile (i.e. it must not be exceeded more than 35 times per year). It is predicted that the worst case receptors will experience a maximum of 3 days of exceedance either with or without the proposed development.

Relative to baseline levels, some imperceptible increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on PM_{10} concentrations in the region of the proposed development will be an increase of 0.3% of the annual limit value at receptor R1. Thus, the magnitude of the changes in air quality are negligible at all receptors based on the criteria outlined in Appendix 9.2, Tables A1 – A3. Therefore, the overall impact of PM_{10} concentrations as a result of the proposed development is long-term, negative and imperceptible.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ are shown in Table 9.10. Predicted annual average concentrations in the region of the proposed development are 63% of the limit value in 2021 and 2036 at the worst-case receptor.

Relative to baseline levels, imperceptible increases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed development. None of the receptors assessed will experience an increase in concentrations of over 0.4% of the limit value. Therefore, using the assessment criteria outlined in Appendix 9.2, Tables A1 – A2, the impact of the proposed development with regard to $PM_{2.5}$ is negligible at all of the receptors assessed. Overall, the impact of increased $PM_{2.5}$ concentrations as a result of the proposed development is long-term, negative and imperceptible.

CO and Benzene

The results of the modelled impact of CO and benzene are shown in Table 9.11 and Table 9.12 respectively. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of CO are 23% of the limit value in 2021 and 2036 with levels of benzene reaching 6% of the limit value.

Relative to baseline levels, some imperceptible increases in pollutant levels at the worst-case receptors are predicted as a result of the proposed development. The greatest impact on CO and benzene concentrations will be an increase of 0.3% of the CO limit and 0.2% of the benzene limit value at receptor R1. Thus, using the assessment criteria for NO_2 and PM_{10} outlined in Appendix 9.2 and applying these criteria to CO and benzene, the impact of the proposed development in terms of CO and benzene is negligible, long-term, negative and imperceptible.

Summary of Local Air Quality Modelling Assessment

Levels of traffic-derived air pollutants from the proposed development will not exceed the ambient air quality standards either with or without the proposed development in place. Using the assessment criteria outlined in Appendix 9.2, Tables A1 – A3, the impact of the development in terms of PM_{10}, $PM_{2.5}$, CO, NO_2 and benzene is negligible, long-term, localised negative and imperceptible. The receptors modelled represent the worst-case locations impacted by additional traffic generated by the proposed development, all other locations, such as Julianstown or similar areas will have a lesser impact than the receptors modelled in this assessment.

Air Quality Impact on Sensitive Ecosystems

The impact of NO_X (i.e. NO and NO_2) emissions resulting from the traffic associated with the proposed development at the Boyne Coast and Estuary pNHA & SAC, Boyne Estuary SPA and River Boyne and River Blackwater SAC was assessed. The traffic data, which satisfied the assessment criteria outlined in Section 9.2.3 and used in the modelling assessment is detailed in Table 9.5. Ambient NO_X concentrations were predicted for the worst-case traffic year (2021) along a transect of up to 200m and are given in Table 9.13. The road contribution to dry deposition along the transect is also given and was calculated using the methodology of TII (2011).

The predicted annual average NO_X level in SAC/SPA/pNHA is below the limit value of 30 μg/m^3 for the "Do Something" scenario with the proposed development in place, with NO_X concentrations reaching at most 70% of the limit value, including background levels. The proposed development causes a 2% increase in NOx concentrations at this location.

The impact of the proposed development can be assessed relative to "Do Nothing" levels. The impact of the proposed development leads to an increase in NO_X concentrations of at most 0.65 μg/m^3 within the designated sites. Appendix 9 of the TII guidelines (2011) states that where the scheme or development is expected to cause an increase of more than 2 μg/m^3 and the predicted concentrations (including background) are close to, or exceed the standard, then the sensitivity of the habitat to NO_X should be assessed by the project ecologist. Neither of these criteria were met and so no further assessment was deemed necessary.

The contribution to the NO_2 dry deposition rate along the 200m transect within the designated sites is also detailed in Table 9.13. The maximum increase in the NO_2 dry deposition rate is 0.035 Kg(N)/ha/yr. This is well below the critical load for inland and surface water habitats of 5 - 10Kg(N)/ha/yr (TII, 2011).

It can be determined that the impact from air quality on the designated sites is long-term, negative but overall, not significant.

Regional Air Quality Impact

The regional impact of the proposed development on emissions of NO_X and VOCs has been assessed using the procedures of Transport Infrastructure Ireland (2011) and the UK Department for Environment, Food and Rural Affairs (2018). The results (see Table 9.14) show that the likely impact of the proposed development on Ireland's obligations under the Targets set out by Directive EU 2016/2284 "*On the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC*" are imperceptible and long-term. For the opening year 2021, the predicted impact of the changes in AADT is to increase NO_x levels by

0.00128% of the NO_x emissions ceiling and increase VOC levels by 0.00049% of the VOC emissions ceiling to be complied with from 2020. Impacts in the design year of 2036 are also predicted to be low, with NOx levels increasing by 0.0008% of the NOx emissions ceiling and VOC levels increasing by 0.00023% of the VOC emissions ceiling to be complied with from 2030.

Therefore, the likely overall magnitude of the changes in air quality from the operational stage of the proposed development is imperceptible, negative and long-term.

Climate

The impact of the proposed development on emissions of CO_2 impacting climate was also assessed using the Design Manual for Roads and Bridges screening model (see Table 9.14). The results show that the impact of the proposed development in the opening year 2021 will be to increase CO_2 emissions by 0.0014% of Ireland's EU 2020 Target. The impact in the design year of 2036 is equally low with CO_2 emissions increasing by 0.0005% of the EU 2020 Target. Thus, the impact of the proposed development on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the EU 2020 Target (EU, 2014).

Therefore, the likely overall magnitude of the changes on climate in the operational stage of the proposed development is imperceptible, negative and long-term.

Human Health

Air dispersion modelling of operational traffic emissions was undertaken to assess the impact of the development with reference to EU ambient air quality standards which are based on the protection of human health. As demonstrated by the modelling results, emissions as a result of the proposed development are compliant with all National and EU ambient air quality limit values and, therefore, will not result in a significant impact on human health. The receptors modelled represent the worst-case locations impacted by additional traffic generated by the proposed development, all other locations, such as Julianstown or similar areas will have a lesser impact than the receptors modelled in this assessment.

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	15.6	16.0	0.38	Imperceptible	Negligible Increase	15.1	15.7	0.56	Small	Small Increase
R2	16.6	16.7	0.10	Imperceptible	Negligible Increase	15.8	15.8	0.00	Imperceptible	Negligible Decrease
R3	11.7	11.7	0.01	Imperceptible	Negligible Increase	10.9	10.9	0.00	Imperceptible	Negligible Decrease
R4	12.9	13.1	0.23	Imperceptible	Negligible Increase	12.3	12.2	-0.09	Imperceptible	Negligible Decrease

Table 9.6 Annual Mean NO_2 Concentrations (µg/m^3) (using IAN 170/12 V3 Long Term NO_2 Trend Projections)

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	14.4	14.8	0.35	Imperceptible	Negligible Increase	14.9	15.4	0.55	Small	Small Increase
R2	15.5	15.6	0.09	Imperceptible	Negligible Increase	15.6	15.6	0.00	Imperceptible	Negligible Decrease
R3	10.5	10.5	0.01	Imperceptible	Negligible Increase	10.5	10.5	0.00	Imperceptible	Negligible Decrease
R4	11.7	11.9	0.21	Imperceptible	Negligible Increase	11.9	11.8	-0.09	Imperceptible	Negligible Decrease

Table 9.7 Annual Mean NO_2 Concentrations (µg/m^3) (using Defra's Technical Guidance)

Receptor	IAN 170/12 V3 Long Term NO_2 Trend Projections Technique				Defra's Technical Guidance Technique			
	Opening Year 2021		Design Year 2036		Opening Year 2021		Design Year 2036	
	DN	DS	DN	DS	DN	DS	DN	DS
R1	54.6	55.9	53	54.9	54.6	55.9	53	54.9
R2	58.1	58.5	55.2	55.2	58.1	58.5	55.2	55.2
R3	40.8	40.8	38.1	38.1	40.8	40.8	38.1	38.1
R4	45.2	46	42.9	42.6	45.2	46	42.9	42.6

Table 9.8 1 Hour 99.8th%ile NO_2 Concentrations (µg/m^3)

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	19.5	19.6	0.073	Imperceptible	Negligible Increase	19.6	19.7	0.120	Imperceptible	Negligible Increase
R2	19.7	19.8	0.021	Imperceptible	Negligible Increase	19.8	19.8	-0.002	Imperceptible	Negligible Decrease
R3	18.7	18.7	0.001	Imperceptible	Negligible Increase	18.7	18.7	0.001	Imperceptible	Negligible Increase
R4	18.9	19.0	0.045	Imperceptible	Negligible Increase	19.0	19.0	-0.020	Imperceptible	Negligible Decrease

Table 9.9: Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	15.6	15.6	0.059	Imperceptible	Negligible Increase	15.7	15.8	0.096	Imperceptible	Negligible Increase
R2	15.8	15.8	0.016	Imperceptible	Negligible Increase	15.9	15.9	-0.001	Imperceptible	Negligible Decrease
R3	14.9	14.9	0.001	Imperceptible	Negligible Increase	14.9	14.9	0.001	Imperceptible	Negligible Increase
R4	15.2	15.2	0.036	Imperceptible	Negligible Increase	15.2	15.2	-0.016	Imperceptible	Negligible Decrease

Table 9.10 Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	2.24	2.26	0.0213	Imperceptible	Negligible Increase	2.27	2.30	0.0340	Imperceptible	Negligible Increase
R2	2.31	2.32	0.0060	Imperceptible	Negligible Increase	2.33	2.33	-0.0005	Imperceptible	Negligible Decrease
R3	2.00	2.00	0.0005	Imperceptible	Negligible Increase	2.00	2.00	0.0004	Imperceptible	Negligible Increase
R4	2.08	2.09	0.0127	Imperceptible	Negligible Increase	2.09	2.08	-0.0055	Imperceptible	Negligible Decrease

Table 9.11 Maximum 8-hour CO Concentrations (mg/m^3)

Receptor	Impact Opening Year 2021					Impact Design Year 2036				
	DN	DS	DS-DN	Magnitude	Description	DN	DS	DS-DN	Magnitude	Description
R1	0.25	0.26	0.0049	Imperceptible	Negligible Increase	0.26	0.27	0.0115	Imperceptible	Negligible Increase
R2	0.28	0.28	0.0040	Imperceptible	Negligible Increase	0.29	0.29	-0.0004	Imperceptible	Negligible Decrease
R3	0.20	0.20	0.0001	Imperceptible	Negligible Increase	0.20	0.20	0.0001	Imperceptible	Negligible Increase
R4	0.22	0.22	0.0029	Imperceptible	Negligible Increase	0.22	0.22	-0.0013	Imperceptible	Negligible Decrease

Table 9.12: Annual Mean Benzene Concentrations (µg/m^3)

Distance to Road (m)	NO_X Conc. (µg/m^3)			NO_2 Dry Deposition Rate Impact
	Do Nothing	Do Something	Impact – Change in Conc.	Kg N ha^{-1} yr^{-1}
2	20.40	21.04	0.65	0.035
12	19.83	20.38	0.55	0.03
22	19.02	19.44	0.42	0.023
32	18.44	18.76	0.32	0.018
42	18.02	18.27	0.25	0.014
52	17.69	17.89	0.20	0.011
62	17.44	17.59	0.16	0.008
72	17.24	17.36	0.12	0.006
82	17.08	17.18	0.10	0.005
92	16.96	17.03	0.08	0.004
102	16.86	16.91	0.06	0.003
112	16.78	16.82	0.05	0.003
122	16.72	16.75	0.04	0.002
132	16.67	16.70	0.03	0.002
142	16.64	16.66	0.02	0.001
152	16.62	16.64	0.02	0.001
162	16.61	16.63	0.02	0.001
172	16.60	16.62	0.02	0.001
182	16.58	16.60	0.01	0
192	16.57	16.58	0.01	0
202	16.55	16.56	0.01	0

Table 9.13: Air Quality Impact on Designated Sites in 2021

Year	Scenario	VOC (kg/annum)	NO_X (kg/annum)	CO_2 (tonnes/annum)
2021	Do Nothing	2,501	8,044	4,680
	Do Something	2,782	8,902	5,199
2036	Do Nothing	3,086	9,809	5,776
	Do Something	3,206	10,135	5,978
Increment in 2021		281.4 kg	858.3 kg	518.7 Tonnes
Increment in 2036		119.9 kg	326 kg	201.9 Tonnes
Emission Ceiling (kilo Tonnes) 2020		**56.9**	**66.9**	**37,943**
Emission Ceiling (kilo Tonnes) 2030		**51.5**	**40.2**	**37,943**
Impact in 2021 (%)		0.00049 %	0.00128 %	0.0014 %
Impact in 2036 (%)		0.00023 %	0.0008 %	0.0005 %

Table 9.14: Regional Air Quality and Climate Impact Assessment

9.6 DO NOTHING IMPACT

The Do Nothing scenario includes retention of the current site without the proposed development in place. In this scenario, ambient air quality at the site will remain as per the baseline and will change in accordance with trends within the wider area (including influences from potential new developments in the surrounding area, changes in road traffic, etc).

The Do Nothing scenario for the operational phase has been assessed in Section 9.5.2.

9.7 AVOIDANCE, REMEDIAL AND MITIGATION MEASURES

9.7.1 Construction Phase

Air Quality

AIRCONST1: The pro-active control of fugitive dust will ensure the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released. The main contractor will be responsible for the coordination, implementation and ongoing monitoring of the dust management plan. The key aspects of controlling dust are listed below. Full details of the dust management plan can be found in Appendix 9.3.

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

Climate

AIRCONST2: Construction traffic and embodied energy of construction materials are expected to be the dominant source of greenhouse gas emissions as a result of the construction phase of the development. Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to short-term nature of these works, the impact on climate will not be significant.

Nevertheless, some site-specific mitigation measures can be implemented during the construction phase of the proposed development to ensure emissions are reduced further. In particular the prevention of on-site or delivery vehicles from leaving engines idling, even over short periods. Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site.

9.7.2 Operational Stage

The results of the air dispersion modelling study indicate that the impact of the proposed development on air quality and climate is predicted to be imperceptible with respect to the operational phase in the long term. Therefore, no additional site specific mitigation measures are required.

9.8 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

9.8.1 Construction Stage

Once the dust minimisation measures outlined in Section 9.7 and Appendix 9.3 are implemented, the impact of the proposed development in terms of dust soiling or PM_{10}/$PM_{2.5}$ emissions will be short-term and not significant at nearby receptors.

Impacts to climate are considered imperceptible during the construction stage of the proposed development.

9.8.2 Operational Stage

The results of the air dispersion modelling indicate that the impact of the proposed development on air quality and climate is considered long-term and imperceptible.

9.9 CUMULATIVE IMPACTS

Should the construction phase of the proposed development coincide with the construction of any other permitted developments within 350m of the site then there is the potential for cumulative dust impacts to the nearby sensitive receptors. There are currently three permitted developments within 350m of the proposed development, a commercial development (Meath County Council Reg. Ref. LB/180620) to the south east of the site on Colpe Road, a primary school (Meath County Council Reg. Ref. SA130927 & ABP Reference PL17.243331) to the northern boundary of the site and a temporary secondary school development to the eastern boundary of the site (Meath County Council Reg. Ref. LB190739). The dust mitigation measures outlined in Appendix 7.3 should be applied throughout the construction phase of the proposed development, with similar mitigation measures applied for other permitted developments which will avoid significant cumulative impacts on air quality. With appropriate mitigation measures in place, the predicted cumulative impacts on air quality and climate associated with the construction phase of the proposed development are deemed short-term and not significant.

Cumulative impacts have been incorporated into the traffic data supplied for the operational stage air and climate modelling assessments. The permitted primary school to the northern site boundary, commercial development to the south east of the site and temporary secondary school on the eastern site boundary have been included. The results of the modelling assessment (section 9.5.2) show that there is an imperceptible impact to air quality and climate during the operational stage.

If additional residential or commercial developments are proposed in the future, in the vicinity of the proposed development, this has the potential to add further additional vehicles to the local road network. However, as the traffic impact for the proposed development has an imperceptible impact on air quality, it is unlikely that other future developments of similar scale would give rise to a significant impact during the construction and operational stages of those projects. Future projects of a large scale would need to conduct an EIAR to ensure that no significant impacts on air quality will occur as a result of those developments.

9.10 MONITORING

9.10.1 Construction Stage

Monitoring of construction dust deposition at nearby sensitive receptors during the construction phase of the proposed development is recommended to ensure mitigation measures are working satisfactorily. This can be carried out using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28 - 32 days.

9.10.2 Operational Stage

There is no monitoring recommended for the operational phase of the development as impacts to air quality and climate are predicted to be imperceptible.

9.11 REINSTATEMENT

Not applicable to air quality and climate.

9.12 INTERACTIONS

Air quality does not have a significant number of interactions with other topics. The most significant interactions are between human beings and air quality. An adverse impact due to air quality in either the construction or operational phase has the potential to cause health and dust nuisance issues. The mitigation measures that will be put in place at the proposed development will ensure that the impact of the proposed development complies with all ambient air quality legislative limits and therefore the predicted impact is long term and neutral with respect to human beings.

Interactions between air quality and traffic can be significant. With increased traffic movements and reduced engine efficiency, i.e. due to congestion, the emissions of vehicles increase. The impacts of the proposed development on air quality are assessed by reviewing the change in annual average daily traffic on roads close to the site. In this assessment, the impact of the interactions between traffic and air quality are considered to be imperceptible.

Additional traffic as a result of the proposed development is predicted to cause an increase in NOx concentrations within a portion of the Boyne Coast and Estuary SAC & pNHA, River Boyne and River Blackwater SAC and Boyne Estuary SPA. However, this increase is below the assessment criteria stipulated by the TII (2011) and therefore is not considered significant.

With the appropriate mitigation measures to prevent fugitive dust emissions, it is predicted that there will be no significant interactions between air quality and land and soils. No other significant interactions with air quality have been identified.

9.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered when compiling this assessment.

9.14 REFERENCES

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World Health Organisation (2006) Air Quality Guidelines - Global Update 2005 (and previous Air Quality Guideline Reports 1999 & 2000)

APPENDIX 9.1 - AMBIENT AIR QUALITY STANDARDS

AMBIENT AIR QUALITY STANDARDS

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time which was the issue of acid rain. As a result of this sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these 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, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002), and has set limit values which came into operation on 17th June 2002. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead, to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and started to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

The most recent EU Council Directive on ambient air quality was published on the 11/06/08 which has been transposed into Irish Law as S.I. 180 of 2011. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. The margins of tolerance specific to each pollutant were also slightly adjusted from previous directives. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, new ambient standards for $PM_{2.5}$ are included in Directive 2008/50/EC. The approach for $PM_{2.5}$ was to establish a target value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2010) and a limit value of 25 $\mu g/m^3$, as an annual average (to be attained everywhere by 2015), coupled with a target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target will range from 0% (for $PM_{2.5}$ concentrations of less than 8.5 $\mu g/m^3$ to 20% of the average exposure indicator (AEI) for concentrations of between 18 - 22 $\mu g/m^3$). Where the AEI is currently greater than 22 $\mu g/m^3$ all appropriate measures should be employed to reduce this level to 18 $\mu g/m^3$ by 2020. The AEI is based on measurements taken in urban background locations averaged over a three year period from 2008 - 2010 and again from 2018-2020. Additionally, an exposure concentration obligation of 20 $\mu g/m^3$ was set to be complied with by 2015 again based on the AEI.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modelling.

An annual average limit for both NO_X (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_X such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NO_X limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation
- As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

Under the terms of EU Framework Directive on Ambient Air Quality (96/62/EC), geographical areas within member states have been classified in terms of zones. The zones have been defined in order to meet the criteria for air quality monitoring, assessment and management as described in the Framework Directive and Daughter Directives. Zone A is defined as Dublin and its environs, Zone B is defined as Cork City, Zone C is defined as 23 urban areas with a population greater than 15,000 and Zone D is defined as the remainder of the country. The Zones were defined based on among other things, population and existing ambient air quality.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Air Dispersion Modelling

The inputs to the DMRB model consist of information on road layouts, receptor locations, annual average daily traffic movements, annual average traffic speeds and background concentrations (UK DEFRA, 2018). Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB has recently undergone an extensive validation exercise (UK DEFRA, 2016) as part of the UK's Review and Assessment Process to designate areas as Air Quality Management Areas (AQMAs). The validation exercise was carried out at 12 monitoring sites within the UK DEFRAs national air quality monitoring network. The validation exercise was carried out for NO_X, NO_2 and PM_{10}, and included urban background and kerbside/roadside locations, "open" and "confined" settings and a variety of geographical locations (UK DEFRA, 2016).

In relation to NO_2, the model generally over-predicts concentrations, with a greater degree of over-prediction at "open" site locations. The performance of the model with respect to NO_2 mirrors that of NO_X showing that the over-prediction is due to NO_X calculations rather than the NO_X:NO_2 conversion. Within most urban situations, the model overestimates annual mean NO_2 concentrations by between 0 to 40% at confined locations and by 20% to 60% at open locations. The performance is considered comparable with that of sophisticated dispersion models when applied to situations where specific local validation corrections have not been carried out.

The model also tends to over-predict PM_{10}. Within most urban situations, the model will over-estimate annual mean PM_{10} concentrations by between 20% to 40%. The performance is comparable to more sophisticated models, which, if not validated locally, can be expected to predict concentrations within the range of $\pm$50%.

Thus, the validation exercise has confirmed that the model is a useful screening tool for the Second Stage Review and Assessment, for which a conservative approach is applicable (UK DEFRA, 2016).

APPENDIX 9.2 - TRANSPORT INFRASTRUCTURE IRELAND SIGNIFICANCE CRITERIA

TRANSPORT INFRASTRUCTURE IRELAND SIGNIFICANCE CRITERIA

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 50 µg/m³	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥4 µg/m³	Increase / decrease >4 days	Increase / decrease ≥2.5 µg/m³
Medium	Increase / decrease 2 - <4 µg/m³	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m³
Small	Increase / decrease 0.4 - <2 µg/m³	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase / decrease <0.4 µg/m³	Increase / decrease <1 day	Increase / decrease <0.25 µg/m³

Table A1: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration Note 1		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Note 1 Well Below Standard = <75% of limit value.

Table A2: Air Quality Impact Significance Criteria For Annual Mean NO_2 and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration Note 1		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Table A3: Air Quality Impact Significance Criteria For Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor

APPENDIX 9.3 – DUST MINIMISATION PLAN

DUST MINIMISATION PLAN

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within two hundred metres of the construction area.

In order to ensure mitigation of the effects of dust nuisance, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate, dry sweeping of large areas should be avoided. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while 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 must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speeds restricted where there is a potential for dust generation. Vehicles delivering material with dust potential to an off-site location shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust. Access gates to be located at least 10m from receptors where possible.

Vehicles exiting the site shall make use of a wheel wash facility where appropriate, 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. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record should be kept of all inspections of the haul routes and any subsequent action in a site log book.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods, activities such as scabbling should be avoided. Bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

At all times, the procedures put in place will be strictly monitored and assessed by the contractor. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented to rectify the problem. Dust monitoring should be put in place to ensure dust mitigation measures are controlling emissions. Dust monitoring should be conducted using the Bergerhoff method in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel and a stand with a protecting gauge. The collecting vessel is secured to the stand with the opening of the collecting vessel located approximately 2m above ground level. The TA Luft limit value is 350 mg/(m^2*day) during the monitoring period between 28-32 days.

The Dust Minimisation Plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures. The name and contact details of a person to contact regarding air quality and dust issues should be displayed on the site boundary, this notice board should also include head/regional office contact details. Community engagement before works commence on site should be put in place, including a communications plan. All dust and air quality complaints should be recorded and causes identified, along with the measures taken to reduce emissions. This complaints log should be available for viewing by the local authority, if requested. Daily on and off site inspections should occur for nuisance dust and compliance with the dust management plan. This should include regular dust soiling checks of surfaces such as street furniture, windows, and cars within 100m of the site boundary. Cleaning should be provided if necessary.