Chapter 16 Air Quality and Climate

16.1 Introduction and Methodology

This chapter of the EIS assesses the impacts on air quality and climate associated with both the construction and operational phases of the proposed M7 Naas to Newbridge By-Pass Upgrade Scheme.

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 16.1** and **Appendix 16.1**).

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 SO_2, NO_2, PM_{10}, $PM_{2.5}$, benzene and CO (see **Table 16.1**). 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 16.1**).

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 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the *Kyoto Protocol*, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the *Kyoto Protocol* to 13% above the 1990 level over the period 2008 to 2012 (ERM, 1998). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as emissions trading and burden sharing.

Gothenburg Protocol

In 1999, Ireland signed the *Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution*. The objective of the Protocol is 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 targets Ireland will, by 2010, have to meet national emission ceilings of 42kt for SO_2 (67% below 2001 levels), 65kt for NO_X (52% reduction), 55kt for VOCs (37% reduction) and 116kt for NH_3 (6% reduction). *European Commission Directive 2001/81/EC*, the National Emissions Ceiling Directive, prescribes the same emission limits. Emissions of SO_2 and NH_3 from the road traffic sector are insignificant accounting for less than 1.5% of total emissions in Ireland in 2001. Road traffic emissions of Nitrogen Oxides (NO_X) and Volatile Organic Compounds (VOCs) are important accounting for 37% and 38% respectively of total emissions of these pollutants in Ireland in 2001 (DoEHLG, 2003). A National Programme for the progressive reduction of emissions of the four transboundary pollutants is in place since April 2005 (DoEHLG, 2004). A review of the National Programme in 2011 (EPA, 2013A) showed that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3, but failed to comply with the emission ceiling for NO_X. Although emissions from road traffic decreased by 47% over the period 1990 – 2011, NO_X levels in 2011 were 2.6 kt above the emission ceiling of 65kt (EPA, 2013A).

Table 16.1 Air Quality Standards Regulations 2011 (based on *European Commission Directive 2008/50/EC*)

Pollutant	Regulation Note1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 µg/m^3 NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 µg/m^3 NO_2
		Annual limit for protection of vegetation	None	30 µg/m^3 NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	100%	0.5 µg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 µg/m^3	350 µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 µg/m^3
		Annual & Winter limit for the protection of ecosystems	None	20 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m^3 PM_{10}
		Annual limit for protection of human health	20%	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2) Note 2	-	Annual limit for protection of human health	None	20 µg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 µg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

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

Note 2 EU 2008/50/EC states - *'Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'.*

Local Air Quality Assessment

The air quality assessment has been carried out following procedures described in the publications by the EPA (EPA 2002, 2003) and using the methodology outlined in the guidance documents published by the UK DEFRA (UK DEFRA 2001, 2007, 2009a, 2009b; UK DETR 1998). The assessment of air quality was carried out using a phased approach as recommended by the UK DEFRA (UK DEFRA 2009a). 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 2012, 2013), has indicated that SO_2, smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres (EPA 2012, 2013). Benzene, although previously reported at quite high levels in urban centres (EPA 2012), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2012, 2013). 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 2012, 2013).

The current assessment thus focused firstly on identifying the existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, benzene and CO and in the region of the Proposed Scheme, both currently (by carrying out a baseline survey and by analysis of suitable EPA monitoring data), and when the Proposed Scheme is opened (through modelling). Thereafter, the impact of the Proposed Scheme on air quality at the neighbouring sensitive receptors was determined relative to "Do Nothing" levels for the opening and design years (2015 and 2030). The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (UK DEFRA 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK DEFRA, 2012) (Version 3.2) and following guidance issued by the NRA (NRA 2011), UK DEFRA (UK DEFRA 2007, 2009a) and the EPA (EPA 2002, 2003). The inputs to the air dispersion model consist of information on road layouts, receptor locations, annual average daily traffic movements (AADT), annual average traffic speeds and background concentrations. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. This worst-case concentration is then added to the existing background concentration to give the worst-case predicted ambient concentration. The worst-case predicted ambient concentration is then compared with the relevant ambient air quality standard to assess the compliance of the Proposed Scheme with these ambient air quality standards.

Although no relative impact, as a percentage of the limit value, is enshrined in EU or Irish Legislation, the NRA guidelines (NRA 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. The NRA significance criteria have been adopted for the Proposed Scheme and are detailed in **Tables 16.2 – 16.4**. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the limit values. 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.

Table 16.2 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

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

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

Table 16.3 Air Quality Impact Significance Criteria For Annual Mean Nitrogen Dioxide and PM10 and PM2.5 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 (≥40 $\mu g/m^3$ of NO_2 or PM_{10}) (≥25 $\mu g/m^3$ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36 - <40 $\mu g/m^3$ of NO_2 or PM_{10}) (22.5 - <25 $\mu g/m^3$ of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30 - <36 $\mu g/m^3$ of NO_2 or PM_{10}) (18.75 - <22.5 $\mu g/m^3$ of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 $\mu g/m^3$ of NO_2 or PM_{10}) (<18.75 $\mu g/m^3$ of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 $\mu g/m^3$ of NO_2 or PM_{10}) (≥25 $\mu g/m^3$ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 $\mu g/m^3$ of NO_2 or PM_{10}) (22.5 - <25 $\mu g/m^3$ of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (30 - <36 $\mu g/m^3$ of NO_2 or PM_{10}) (18.75 - <22.5 $\mu g/m^3$ of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<30 $\mu g/m^3$ of NO_2 or PM_{10}) (<18.75 $\mu g/m^3$ of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

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

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

Table 16.4 Air Quality Impact Significance Criteria For Changes to Number of Days with PM10 Concentration Greater than 50 μg/m^3 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

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - National Roads Authority (2011)

Regional Impact Assessment Including Climate

The impact of the Proposed Scheme at a national / international level has been determined using the procedures given by the NRA (NRA 2011) and the methodology provided in Annex 2 in the UK DMRB (UK DEFRA 2007). The assessment focused on determining the resulting change in emissions of CO, particulates (PM_{10}), 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. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

16.2 Description of Existing Conditions

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 Casement Aerodrome meteorological station, which is located approximately 12 km northeast of the Proposed Scheme. For data collated during five representative years (2006 - 2010), the predominant wind ranges from southerly to westerly in direction with an average wind speed of approximately 5-7 m/s.

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 DEFRA 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.

Background Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2011" (EPA 2012, 2013A), details the range and scope of monitoring undertaken throughout Ireland.

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 2012). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 21 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, the region of the Proposed Scheme is categorised as Zone C (EPA 2012).

Long-term NO_2 monitoring is carried out at the three Zone C locations, Limerick Park Road, Newbridge and Celbridge in 2010 and at one Zone C location in 2011, Limerick Park Road (EPA 2012). The NO_2 annual average in 2011 and 2010 for these sites ranged from 12 - 17 $\mu g/m^3$ with no exceedences of the 1-hour limit value. Hence long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40 $\mu g/m^3$. Based on the above information, a conservative estimate of the 2013 background NO_2 concentration for the region of the Proposed Scheme is 17 $\mu g/m^3$.

The results of CO monitoring carried out at the Zone C stations of Newbridge and Celbridge in 2010 indicated long-term averages of 0.5 mg/m^3 and 0.3 mg/m^3 respectively (EPA 2012). Based on the above information, a conservative estimate of the background CO concentration for the region of the Proposed Scheme in 2013 is 0.50 mg/m^3 as an annual mean.

With regard to benzene, continuous monitoring was carried out at Zone D locations, Shannon Town in 2011 and at Emo Court in 2010 with a long-term average of 0.4 $\mu g/m^3$ for both locations (EPA 2011). Continuous monitoring was carried out at Newbridge and Letterkenny (Zone C) in 2009, with long-term averages of 1.4 $\mu g/m^3$ and 1.0 $\mu g/m^3$ respectively (EPA 2010). Based on the above information a conservative estimate of the background benzene concentration for the region of the Proposed Scheme in 2013 is 1.40 $\mu g/m^3$.

Long-term PM_{10} monitoring is carried out at the four Zone C locations of Galway, Celbridge, Ennis and Bray (EPA 2012). The average concentrations measured in 2011 ranged from 13 $\mu g/m^3$ in Bray to 24 $\mu g/m^3$ in Celbridge. Data from the Phoenix Park in Dublin also provides a good indication of urban background levels, with an annual average in 2011 of 12 $\mu g/m^3$ (EPA 2012). Based on the above information a conservative estimate of the 2013 background PM_{10} concentration for the region of the Proposed Scheme which is defined as Zone C is 18 $\mu g/m^3$.

The results of $PM_{2.5}$ monitoring at the Zone C location of Ennis (EPA 2012) indicated an average $PM_{2.5}/PM_{10}$ ratio of 0.64. Based on this information, a ratio of 0.64 was used to generate a rural background $PM_{2.5}$ concentration in 2012 of 11.5 $\mu g/m^3$.

Background concentrations for 2015 and 2030 were calculated from the 2013 background concentrations using the Netcen background calculator, which uses year on year reduction factors provided by UK DEFRA (UK DEFRA 2009a). A summary of the background concentrations used for the air dispersion model is detailed in **Table 16.5**.

Table 16.5 Summary of background concentrations used in the air dispersion model

Background Values	Nitrogen Oxides ($\mu g/m^3$)	Nitrogen Dioxide ($\mu g/m^3$)	Benzene ($\mu g/m^3$)	Particulates (PM_{10}) ($\mu g/m^3$)	Particulates ($PM_{2.5}$) ($\mu g/m^3$) Note 2	Carbon Monoxide (mg/m^3)
Year 2013	30.82	17.0	1.40	18.0	11.50	0.50
Year 2015 Note 1	27.45	15.45	1.40	17.83	11.41	0.49
Year 2030 Note 1	13.18	8.55	1.47	17.45	11.17	0.52

Note 1 Reduction in future years using the Netcen background calculator (November 2002) and Netcen background calculator 3.2 (2012).

Note 2 A ratio of 0.64 has been used for the ratio of PM2.5 / PM10.

16.3 Characteristics of the Proposed Scheme

Road traffic is expected to be the dominant source of emissions resulting from the Proposed Scheme and thus is the focus of the current assessment. Road traffic would also be expected to be the dominant source of greenhouse gas emissions resulting from the Proposed Scheme.

16.4 Predicted Impacts of the Proposed Scheme

Construction Phase – Local Air Quality

The greatest potential impact on air quality during the construction phase of the Proposed Scheme is from construction dust emissions and the potential for nuisance dust. Construction dust emissions can come from a variety of sources including construction traffic.

While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. Most importantly, if the dust minimisation measures specified in **Section 16.14** and **Appendix 16.2** of this chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

Construction Phase – Climate

The impact of construction on climate has been estimated using the UK Environment Agency's Carbon Calculator (Version 3.4, 2012). The carbon calculator measures the greenhouse gas impacts of construction activities (in terms of CO_{2eq}) by calculating the embodied CO_{2eq} of material plus the CO2eq associated with their transportation. The model can also consider personnel travel, site energy use and waste management.

Information on the material quantities, waste product and construction traffic was obtained from Table 4.8 of the EIS. This information was input into the Carbon Calculator to determine an estimate of the greenhouse gas emissions associated with the project. The estimated greenhouse gas emissions associated with the project is outlined in **Table 16.6**.

Table 16.6 Greenhouse Gas Emissions Associated With The Construction Phase Of The Scheme

Sub-totals	CO_2eq (Tonnes)	%
Quarried Material	6652.8	16%
Timber	93.0	0%
Concrete, Mortars & Cement	7604.3	19%
Metals	289.1	1%
Plastics	438.5	1%
Glass	0.0	0%
Miscellaneous	0.0	0%
Finishings, coatings & adhesives	2933.3	7%
Plant and equipment emissions	321.2	1%
Waste Removal	20983.7	52%
Portable site accommodation	52.1	11.4.1 0%

Sub-totals	CO_2eq (Tonnes)	%
Material transport	890.8	2%
Personnel travel	161.6	0%
Total	**40,420**	**100%**

As shown in **Table 16.6**, the major source of greenhouse gas emissions associated with the project is waste removal with approximately 52% of total emissions. Other sources include concrete, mortars and cement emissions and quarried material emissions. In terms of Ireland's Kyoto target over the period 2008-2012, the construction phase of the project will account for 0.06% of the annual Kyoto Target over the two year construction period.

Operational Phase – Local Air Quality

Detailed traffic flow information was obtained from the traffic consultant for the 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. Annual Average Daily Traffic (AADT) data was inputted into the UK DMRB Screening Model (version 1.03c) (UK DEFRA 2007). The emission factors used are embedded into the DMRB Screening Model and are based on the UK fleet for each specific year. The traffic data corresponded to the design years of 2015 and 2030. The traffic data used represented capacity figures for the "Do Nothing" (i.e. without the Proposed Scheme in place) and "Do something" (i.e. with the Proposed Scheme in place) scenarios.

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 (UK DEFRA 2009a, UK DETR 1998). Firstly, background concentrations (UK DEFRA 2009a) have been included in the modelling study, for both "Do Nothing" and "Do something" scenarios. These background concentrations are year-specific and account for non-localised sources of the pollutants of concern (UK DEFRA 2009a). Appropriate background levels were selected based on the available monitoring data provided by the EPA and Local Authorities (EPA 2011, 2012) (**see section 16.2**).

Once appropriate background concentrations were established, the existing situation, including background levels, was assessed in the absence of the Proposed Scheme for the opening and design years. The assessment methodology involved air dispersion modelling using the UK DMRB Screening Model (Version 1.03c) (UK DEFRA 2007), the NO_x to NO_2 Conversion Spreadsheet (UK DEFRA, 2012) (Version 3.2) and the following guidance issued by the UK DEFRA (UK DETR 1998; UK DEFRA 2007, 2009a, 2009b). Ambient concentrations of CO, benzene, NO_2, PM_{10} and $PM_{2.5}$ for 2015 and 2030 were predicted at the nearest sensitive receptors to the Proposed Scheme. "Do Nothing" and "Do something" modelling was carried out at the building façade of the worst-case receptors for both 2015 and 2030. This assessment allows the significance of the Proposed Scheme, with respect to both relative and absolute impact, to be determined both temporally and spatially.

Receptor Locations

Fourteen locations were modelled close to the route of the Proposed Scheme. The receptors modelled represent the worst-case locations along the M7 mainline and the M9 mainline and were chosen due to their close proximity to the Proposed Scheme as well as the existing M7 and M9. One receptor was modelled on Main St. in the town of Naas, the location of this receptor was chosen in order to determine whether the proposed scheme will have a positive or negative impact on the air quality in the town of Naas. Details of the assessment locations are provided in **Table 16.7** and shown on **Figures 15.1 – 15.9, EIS Volume 3.**

Annual average traffic speeds are required as an input to the DMRB screening model (UK DEFRA 2007).

Table 16.7 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Details of Assessment Locations.

Receptor	Location / Townland	Chainage	Co-ordinates
1	Greatconnell 1	600	282507 213637
2	Oldtown	M9	283234 212838
3	Greatconnell 2	1630	283371 214131
4	Near Hoare's Bridge	3400	284592 215423
5	Ladytown	5100	285373 216870
6	Newhall	7000	286346 218459
7	Jigginstown	7300	286538 218674
8	Ploopluck	8700	287044 219988
9	Osberstown 1	9850	287705 220882
10	Osberstown 2	11600	289042 221943
11	Osberstown 3	11900	289337 222070
12	Roseborough	14400	291573 221424
13	Palmerstown	14900	292095 221665
14	South Main St	N/A	289229 219232

<u>Modelling Results and Impact Assessment</u>

CO and Benzene

The results of the modelled impact of the Proposed Scheme for CO and benzene in the opening and design years are shown in **Tables 16.8 – 16.9**. Predicted pollutant concentrations in the region of the M7 and M9 with the Proposed Scheme in place are below the ambient standards at all locations. Levels of both pollutants range from 25 - 30% of the respective limit values in 2015.

Future trends indicate similarly low levels of CO and benzene. Levels of both pollutants are below the relevant limit values, ranging from 26 – 32% of their respective limits in 2030.

The impact of the Proposed Scheme can be assessed relative to "Do Nothing" levels in 2015 and 2030 (see **Tables 16.8 – 16.9**). Relative to baseline levels, some small increases and decreases in pollutant levels at the worst-case receptors are predicted as a result of the Proposed Scheme. With regard to impacts at individual receptors, none of the 14 receptors assessed will experience an increase or decrease in concentrations of greater than 5% of the limit value in either 2015 or 2030 and thus the magnitude of the changes in air quality is either small or imperceptible at all receptors based on the criteria outlined in **Table 16.2**.

The greatest impact on CO and benzene concentrations in either 2015 or 2030 will be an increase of 0.6% of their respective limit values at Receptor 6. Furthermore, the greatest improvement in CO and benzene concentrations will be a decrease of 0.9% of their respective limit values at Receptor 7.

Thus, using the assessment criteria for NO_2 and PM_{10} outlined in **Tables 16.2 and 16.3**, and applying these criteria to CO and benzene, the impact of the Proposed Scheme in terms of CO and benzene is negligible.

Table 16.8 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Predicted Maximum 8-Hour CO Concentrations.

Receptor	Location	Maximum 8-Hour CO Concentrations (mg/m^3)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
1	Great Connell 1	2.6	2.8	2.6	2.8
2	Oldtown	2.5	2.6	2.5	2.6
3	Great Connell 2	2.7	2.9	2.7	2.9
4	Near Hoare's Bridge	2.6	2.8	2.6	2.8
5	Ladytown	2.6	2.8	2.6	2.8
6	Newhall	2.6	2.8	2.7	2.8
7	Jigginstown	2.8	3.0	2.7	2.9
8	Ploopluck	2.6	2.7	2.6	2.7
9	Osberstown 1	2.5	2.6	2.5	2.6
10	Osberstown 2	2.6	2.8	2.6	2.8
11	Osberstown 3	2.7	2.8	2.7	2.8
12	Roseborough	2.7	2.8	2.7	2.8
13	Palmerstown	2.7	2.9	2.7	2.9
14	South Main St.	2.7	2.9	2.7	2.9
Ambient Limit Value[Note 1]		10 mg/m^3	10 mg/m^3	10 mg/m^3	10 mg/m^3

Note 1 Maximum 8-hour CO Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC

Table 16.9 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Predicted Annual Mean Benzene Concentrations.

Receptor	Location	Annual Mean Benzene Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
1	Great Connell 1	1.45	1.52	1.44	1.52
2	Oldtown	1.40	1.47	1.40	1.47
3	Great Connell 2	1.47	1.55	1.47	1.55
4	Near Hoare's Bridge	1.47	1.54	1.46	1.54
5	Ladytown	1.46	1.53	1.46	1.54
6	Newhall	1.45	1.52	1.47	1.55
7	Jigginstown	1.49	1.57	1.49	1.57
8	Ploopluck	1.45	1.53	1.45	1.53
9	Osberstown 1	1.42	1.49	1.42	1.49

Receptor	Location	Annual Mean Benzene Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	*2030*	*2015*	*2030*
10	Osberstown 2	1.47	1.55	1.47	1.55
11	Osberstown 3	1.49	1.57	1.49	1.57
12	Roseborough	1.50	1.58	1.50	1.58
13	Palmerstown	1.51	1.60	1.51	1.60
14	South Main St.	1.47	1.55	1.47	1.55
Ambient Limit Value[Note 1]		5 $\mu g/m^3$	5 $\mu g/m^3$	5 $\mu g/m^3$	5 $\mu g/m^3$

Note 1 Annual Average Benzene Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC

PM_{10}

The results of the modelled impact of the Proposed Scheme for PM_{10} in the opening and design years are shown in **Table 16.10**. Predicted annual average concentrations in the region of the Proposed Scheme are below the ambient standards at all worst-case receptors, ranging from 45 - 51% of the limit value in 2015. In addition, the 24-hour limit value will be exceeded four times in 2015.

Future trends with the Proposed Scheme in place indicate similarly low levels of PM_{10}. Annual average PM_{10} concentrations range from 44 - 50% of the limit in 2030. Furthermore, the results show that the 24-hour limit value will be exceeded three times in 2030.

The impact of the Proposed Scheme can be assessed relative to "Do Nothing" levels in 2015 and 2030 (see **Table 16.10**). Relative to baseline levels, some small increases and decreases in PM_{10} levels at the worst-case receptors are predicted as a result of the Proposed Scheme. With regard to impacts at individual receptors, none of the 14 receptors assessed will experience an increase or decrease in concentrations of over 5% of the limit value in 2015 and 2030. Thus the magnitude of the changes in air quality is small or imperceptible at all receptors based on the criteria outlined in **Table 16.2**.

The greatest impact on PM_{10} concentrations in the region of the Proposed Scheme in either 2015 or 2030 will be an increase of 0.9% of the annual limit value at Receptor 6. Furthermore, the greatest improvement in PM_{10} concentrations will be a decrease of 0.8% of the annual limit value at Receptor 7.

Thus, using the assessment criteria outlined in **Tables 16.2 – 16.4,** the impact of the Proposed Scheme with regard to PM_{10} is negligible at all 14 of the receptors assessed.

Table 16.10 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By- Pass Upgrade Scheme. Predicted Annual Mean PM10 Concentrations.

Receptor	Location	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	*2030*	*2015*	*2030*
1	Great Connell 1	19.5	19.2	19.5	19.2
2	Oldtown	17.9	17.6	17.9	17.6

Receptor	Location	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
3	Great Connell 2	19.8	19.6	19.9	19.6
4	Near Hoare's Bridge	19.6	19.3	19.6	19.3
5	Ladytown	19.5	19.2	19.4	19.2
6	Newhall	19.2	18.9	19.5	19.2
7	Jigginstown	20.2	20.0	19.9	19.7
8	Ploopluck	19.2	18.9	19.3	19.0
9	Osberstown 1	18.3	17.9	18.3	17.9
10	Osberstown 2	19.6	19.3	19.6	19.4
11	Osberstown 3	20.2	20.0	20.2	20.0
12	Roseborough	19.5	19.2	19.5	19.2
13	Palmerstown	19.8	19.6	19.8	19.5
14	South Main St.	18.9	18.5	18.9	18.5
Ambient Limit Value[Note 1]		40 $\mu g/m^3$	40 $\mu g/m^3$	40 $\mu g/m^3$	40 $\mu g/m^3$

Note 1 Annual Average PM10 Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC

$PM_{2.5}$

The results of the modelled impact of the Proposed Scheme for $PM_{2.5}$ in the opening and design years are shown in **Table 16.11**. Predicted annual average concentrations in the region of the Proposed Scheme are below the ambient standard at all worst-case receptors, ranging from 46 - 55% of the limit value in 2015. Future trends with the Proposed Scheme in place indicate similarly low levels of $PM_{2.5}$. Annual average $PM_{2.5}$ concentrations range from 45 - 55% of the limit in 2030. The impact of the Proposed Scheme can be assessed relative to "Do Nothing" levels in 2015 and 2030 (see **Table 16.11**). Relative to baseline levels, some small increases and decreases in $PM_{2.5}$ levels at the worst-case receptors are predicted as a result of the proposed road. With regard to impacts at individual receptors, none of the 14 receptors assessed will experience an increase or decrease in concentrations of over 5% of the limit value in 2015 and 2030. Thus the magnitude of the changes in air quality is small or imperceptible at all receptors based on the criteria outlined in **Table 16.2**.

The greatest impact on $PM_{2.5}$ concentrations in the region of the Proposed Scheme in either 2015 or 2030 will be an increase of 1.4% of the annual limit value at Receptor 6. Furthermore, the greatest improvement in $PM_{2.5}$ concentrations will be a decrease of 1.3% of the annual limit value at Receptor 7.

Thus, using the assessment criteria outlined in **Tables 16.2 and 16.3**, the impact of the Proposed Scheme with regard to $PM_{2.5}$ is negligible at all receptors assessed.

Table 16.11 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Predicted Annual Mean $PM_{2.5}$ Concentrations.

Receptor	Location	Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
1	Great Connell 1	13.1	12.9	13.1	12.9
2	Oldtown	11.5	11.3	11.5	11.3
3	Great Connell 2	13.4	13.3	13.4	13.3
4	Near Hoare's Bridge	13.2	13.0	13.2	13.1
5	Ladytown	13.0	12.9	13.0	12.9
6	Newhall	12.8	12.6	13.1	13.0
7	Jigginstown	13.8	13.7	13.5	13.4
8	Ploopluck	12.8	12.7	12.8	12.7
9	Osberstown 1	11.9	11.6	11.9	11.7
10	Osberstown 2	13.2	13.1	13.2	13.1
11	Osberstown 3	13.8	13.7	13.8	13.7
12	Roseborough	13.1	12.9	13.1	12.9
13	Palmerstown	13.4	13.3	13.4	13.3
14	South Main St.	12.5	12.2	12.5	12.2
Ambient Limit Value[Note 1]		25 $\mu g/m^3$	25 $\mu g/m^3$	25 $\mu g/m^3$	25 $\mu g/m^3$

Note 1 Annual Average PM2.5 Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC

NO_2

The results of the assessment of the impact of the Proposed Scheme for NO_2 in the opening and design years are shown in **Tables 16.12 – 16.13**. The annual average concentration is within the limit value at all worst-case receptors. Future trends, with the Proposed Scheme in place, indicate similarly low levels of NO_2. Levels of NO_2 range from 22 - 63% of the annual limit value in 2015 and 2030.

Maximum one-hour NO_2 levels with the Proposed Scheme in place will be significantly below the limit value, with levels at the worst-case receptor reaching 63% of the limit value in 2015 and 45% of the limit value in 2030.

The impact of the Proposed Scheme on maximum one-hour NO_2 levels can be assessed relative to "Do Nothing" levels in 2015 and 2030 (see **Tables 16.12 – 16.13**). Relative to baseline levels, some small increases and decreases in NO_2 levels at the worst-case receptors are predicted as a result of the proposed road. With regard to impacts at individual receptors, none of the 14 receptors assessed will experience an increase in concentrations of over 5% of the limit value in 2015 and 2030. One receptor will experience a decrease in concentrations of over 5% of the limit value in 2015 and 2030. Thus the magnitude of the changes in air quality is medium at one receptor and small or imperceptible at all remaining receptors based on the criteria outlined in **Table 16.2**.

The greatest impact on NO_2 concentrations in the region of the Proposed Scheme in either 2015 or 2030 will be an increase of 4% of the annual or maximum 1-hour limit value at Receptor 6. Furthermore, the greatest improvement in NO_2 concentrations will be a decrease of 5.7% of the annual or maximum 1-hour limit value at Receptor 7.

Thus, using the assessment criteria outlined in **Tables 16.2 and 16.3**, the impact of the Proposed Scheme in terms of NO_2 is negligible at all 14 of the receptors assessed.

Table 16.12 DMRB Screening Air Quality Assessment, Proposed M7Newbridge By-Pass Upgrade Scheme. Predicted Annual Average NO2 Concentrations.

Receptor	Location	Annual Average NO_2 Concentrations (µg/m^3)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
1	Great Connell 1	21.4	14.0	21.4	14.3
2	Oldtown	15.8	8.9	15.9	8.9
3	Great Connell 2	24.6	17.3	24.8	17.5
4	Near Hoare's Bridge	21.8	14.5	21.8	14.5
5	Ladytown	21.3	14.0	21.3	14.0
6	Newhall	21.6	14.2	23.1	15.8
7	Jigginstown	26.4	18.8	24.2	16.8
8	Ploopluck	20.5	13.3	20.6	13.4
9	Osberstown 1	17.1	10.1	17.1	10.1
10	Osberstown 2	22.1	14.7	22.1	14.8
11	Osberstown 3	23.9	16.4	24.0	16.6
12	Roseborough	23.6	16.1	23.5	16.1
13	Palmerstown	25.2	18.1	25.2	18.0
14	South Main St.	21.6	14.0	21.6	14.0
Ambient Limit Value[Note 1]		40 µg/m^3	40 µg/m^3	40 µg/m^3	40 µg/m^3

Note 1 Annual Average NO2 Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC

Table 16.13 DMRB Screening Air Quality Assessment, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Details Predicted Maximum 1-Hour NO2 Concentrations.

Receptor	Location	Maximum 1-Hour NO_2 Concentrations (µg/m^3)			
		Do Nothing		*Do Something*	
		2015	***2030***	***2015***	***2030***
1	Greatconnell 1	107.0	70.2	106.8	71.4
2	Oldtown	79.2	44.6	79.3	44.6
3	Greatconnell 2	122.9	86.5	124.0	87.6
4	Near Hoare's Bridge	109.2	72.4	109.1	72.4
5	Ladytown	106.4	69.8	106.3	69.8
6	Newhall	108.0	71.0	115.6	78.9
7	Jigginstown	132.2	94.2	120.8	84.0
8	Ploopluck	102.7	66.5	103.0	67.0
9	Osberstown 1	85.5	50.5	85.6	50.6

Receptor	Location	Maximum 1-Hour NO_2 Concentrations ($\mu g/m^3$)			
		Do Nothing		*Do Something*	
		2015	*2030*	*2015*	*2030*
10	Osberstown 2	110.5	73.6	110.7	74.0
11	Osberstown 3	119.7	82.2	120.0	82.9
12	Roseborough	117.8	80.5	117.7	80.4
13	Palmerstown	126.2	90.7	126.2	90.2
14	South Main St.	108.1	70.0	108.0	69.8
Ambient Limit Value[Note 1]		200 $\mu g/m^3$	200 $\mu g/m^3$	200 $\mu g/m^3$	200 $\mu g/m^3$

Note 1 Maximum 1-Hour NO2 Limit Value: S.I. No. 180 of 2011 & EU Directive 2008/50/EC (as a 99.8th%ile)

16.5 Screening Assessment of R445 in Naas

A screening assessment has been carried out in the opening year (2015) and design year (2030) at a worst-case receptor (Receptor 14) along the existing R445 (South Main St.) in Naas Town in order to determine the air quality impact of the scheme on the centre of Naas (see **Tables 16.8 – 16.13**).

For the existing situation, levels of the five key pollutants (CO, benzene, NO_2, PM_{10} & $PM_{2.5}$) peak at between 27 – 54% of the limit values in 2015 and at between 29 - 49% of the limit values in 2030 (see **Tables 16.8 – 16.13**).

The impact of the scheme, at the worst-case receptor in the centre of Naas is to improve air quality by up to 0.1% of the limit values. Levels of the five key pollutants range from 27 – 54% of the limit values in 2015 and from 29 - 49% of the limit values in 2030 (see **Tables 16.8 – 16.13**).

Thus, the impact of the scheme on a worst case receptor in the centre of Naas is negligible based on the assessment criteria outlined in **Tables 16.2 – 16.4**.

16.6 Air Quality Impacts on Sensitive Ecosystems

The NRA guidelines (NRA 2011) state that as the potential impact of a scheme is limited to a local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated site lies within 200m of the road centre line.

The impact of NO_x (i.e. NO and NO_2) emissions resulting from the proposed road at the Grand Canal pNHA was assessed. This section of the M7 encroaches the Grand Canal pNHA at Osberstown (Chainage 11,200) and Herbertstown (Chainage 2,700). Dispersion modelling and prediction was carried out at typical traffic speeds at both of these locations. Ambient NO_x concentrations predicted for the opening and design years along a transect of up to 200m within the Grand Canal pNHA are given in **Tables 16.14 – 16.15**. The road contribution to dry deposition along the transect is also given and was calculated using the methodology of the NRA (NRA 2011).

The predicted annual average NO_x level in the Grand Canal pNHA near Osberstown exceeds the limit value of 30 $\mu g/m^3$ for the "do Nothing" scenario in 2015 and 2030, with NO_x concentrations reaching 193% of this limit in 2015 and 145% in 2030. Levels with the proposed development in place are similar reaching 195% of the limit value for the "do something" scenario in 2015 and 148% of the limit value in 2030.

The predicted annual average NO_x levels at the Grand Canal pNHA near Osberstown exceed the limit value of 30 µg/m^3 for the "do something" scenario in both the opening and design years. The impact of the Proposed Scheme leads to an increase in NO_x concentrations of at most 0.9 µg/m^3 within the Grand Canal pNHA. The NRA guidelines state in Appendix 9 that where the scheme 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.

The road contribution to the NO_2 dry deposition rate along the 200m transect within the pNHA at Osberstown is also detailed in Table 16.14. The maximum increase in the NO_2 dry deposition rate is 0.03 Kg(N)/ha/yr in 2015 and 0.04 Kg(N)/ha/yr in 2030. This reaches only 0.8% of the critical load for inland and surface water habitats of 5-10 Kg(N)/ha/yr (NRA 2011).

The predicted annual average NO_x level in the Grand Canal pNHA near Herbertstown exceeds the limit value of 30 µg/m^3 for the "do nothing" scenario in 2015, with NO_x concentrations reaching 117% of the limit value and is below the limit value for the "do nothing" scenario in 2030, with NO_x concentrations reaching 68% of this limit. Levels with the proposed development in place are similar reaching 117% of the limit value for the "do something" scenario in 2015 and 68% of the limit value in 2030.

The predicted annual average NO_x levels at the Grand Canal pNHA near Herbertstown exceed the limit value of 30 µg/m^3 for both the "do nothing" and "do something" scenario in 2015. The impact of the Proposed Scheme leads to an increase in NO_x concentrations of at most 0.01 µg/m^3 within the Grand Canal pNHA.

The road contribution to the NO_2 dry deposition rate along the 200m transect within the pNHA at Herbertstown is also detailed in Table 16.15. There is no increase in the NO_2 dry deposition rate in 2015 and the maximum increase in the NO_2 dry deposition rate is 0.001 Kg(N)/ha/yr in 2030. This reaches only 0.02% of the critical load for inland and surface water habitats of 5-10 Kg(N)/ha/yr (NRA 2011).

The sensitivity of the Grand Canal pNHA to NO_x at Osberstown (Chainage 11,200) and Herbertstown (Chainage 2,700) was assessed by the project ecologist. The assessment is detailed in Chapter 7 of this EIS. It has been concluded by the project ecologist that the increases in NO_x concentrations as a result of the proposed scheme are not sufficient to result in any measurable change in the aquatic ecology of the canal.

Table 16.14 Air Quality Assessment of Ecosystems, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Assessment of Impact Along Transect From Proposed Road Through the Grand Canal pNHA at Osberstown (Chainage 11,200).

Dist. To Road (m) Note 1	NO_x Conc. (µg/m^3) - 2015			NO_x Conc. (µg/m^3) - 2030			NO_2 Dry Deposition Rate Impact (Kg(N) /ha/yr)	
	Do Nothing	Do Something	Impact	Do Nothing	Do Something	Impact	2015	2030
17 & 4	57.96	58.62	0.65	43.36	44.25	0.90	0.03	0.04
27 & 14	50.80	51.32	0.52	36.31	37.01	0.70	0.03	0.03
37 & 24	45.55	45.95	0.40	31.10	31.63	0.54	0.02	0.03
47 & 34	41.63	41.93	0.31	27.21	27.63	0.42	0.02	0.02
57 & 44	38.61	38.85	0.24	24.22	24.55	0.33	0.01	0.02
67 & 54	36.25	36.44	0.19	21.88	22.14	0.26	0.01	0.01
77 & 64	34.38	34.53	0.15	20.03	20.24	0.20	0.01	0.01
87 & 74	32.88	33.00	0.12	18.56	18.72	0.16	0.01	0.01
97 & 84	31.70	31.79	0.09	17.38	17.51	0.13	0.01	0.01
107 & 94	30.76	30.83	0.07	16.46	16.56	0.10	0.00	0.01
117 & 104	30.03	30.09	0.06	15.74	15.81	0.08	0.00	0.00
127 & 114	29.48	29.52	0.04	15.19	15.25	0.06	0.00	0.00
137 & 124	29.07	29.11	0.03	14.79	14.83	0.05	0.00	0.00
147 & 134	28.80	28.83	0.03	14.51	14.55	0.04	0.00	0.00
157 & 144	28.64	28.67	0.02	14.36	14.39	0.03	0.00	0.00
167 & 154	28.58	28.60	0.02	14.29	14.33	0.03	0.00	0.00
177 & 164	28.43	28.45	0.02	14.14	14.17	0.03	0.00	0.00
187 & 174	28.25	28.27	0.02	13.97	14.00	0.02	0.00	0.00
197 & 184	28.08	28.09	0.01	13.80	13.82	0.02	0.00	0.00
200 & 194	28.02	28.0	0.01	13.74	13.76	0.02	0.00	0.00
Standards	30 µg/m^3	30 µg/m^3	-	30 µg/m^3	30 µg/m^3	-	5 - 10 Kg(N)/ha/yr	

Note 1 First Distance is from the M7, second distance is from the L2006.

Table 16.15 Air Quality Assessment of Ecosystems, Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme. Assessment of Impact Along Transect From Proposed Road Through the Grand Canal pNHA at Herbertstown (Chainage 2,700).

Dist. To Road (m) Note 1	NO_x Conc. ($\mu g/m^3$) - 2015			NO_x Conc. ($\mu g/m^3$) - 2030			NO_2 Dry Deposition Rate Impact (Kg(N) /ha/yr)	
	Do Nothing	Do Something	Impact	Do Nothing	Do Something	Impact	2015	2030
71	35.02	35.00	-0.02	20.44	20.45	0.01	0.00	0.00
81	33.40	33.38	-0.02	18.88	18.90	0.01	0.00	0.00
91	32.11	32.10	-0.01	17.65	17.66	0.01	0.00	0.00
101	31.09	31.08	-0.01	16.67	16.67	0.01	0.00	0.00
111	30.28	30.28	-0.01	15.90	15.90	0.01	0.00	0.00
121	29.66	29.66	-0.01	15.30	15.31	0.00	0.00	0.00
131	29.20	29.20	-0.01	14.86	14.86	0.00	0.00	0.00
141	28.87	28.87	0.00	14.54	14.55	0.00	0.00	0.00
151	28.66	28.66	0.00	14.34	14.34	0.00	0.00	0.00
161	28.55	28.55	0.00	14.24	14.24	0.00	0.00	0.00
171	28.48	28.48	0.00	14.17	14.17	0.00	0.00	0.00
181	28.31	28.31	0.00	14.01	14.01	0.00	0.00	0.00
191	28.14	28.14	0.00	13.84	13.85	0.00	0.00	0.00
200	27.99	27.99	0.00	13.70	13.70	0.00	0.00	0.00
Standards	30 $\mu g/m^3$	30 $\mu g/m^3$	-	30 $\mu g/m^3$	30 $\mu g/m^3$	-	5 - 10 Kg(N)/ha/yr	

Note 1 Distance from M7

16.7 Operational Phase - Regional Air Quality

The regional impact of the proposed M7 Naas to Newbridge By-Pass Upgrade Scheme on emissions of NO_x and VOCs has been assessed using the procedures of the NRA (NRA 2011) and the UK DEFRA (UK DEFRA 2007). The results (see Table 16.17) indicate that the impact of the Proposed Scheme on Ireland's obligations under the Gothenburg Protocol is negligible. For the assessment year of 2015, the predicted impact of the proposed road is to increase NO_x levels by 0.02% of the NO_x emissions ceiling and increase VOC levels by 0.0001% of the VOC emissions ceiling which was to be complied with in 2010. For the assessment year of 2030, the predicted impact of the proposed road is to increase NO_x levels by 0.005% of the NO_x emissions ceiling and decrease VOC levels by 0.0003% of the VOC emissions ceiling which was to be complied with in 2010.

16.8 Operational Phase - Climate

The impact of the proposed M7 Naas to Newbridge By-Pass Upgrade Scheme on emissions of CO_2 was also assessed (see Table 16.16). The results show that the impact of the Proposed Scheme will be to increase CO_2 emissions by 0.005% and 0.007% of Ireland's Kyoto target in 2015 and 2030 respectively. Thus, the impact of the Proposed Scheme on national greenhouse gas emissions will be insignificant in terms of Ireland's obligations under the Kyoto Protocol (FCCC 1997, DEHLG 2007b).

Table 16.16 Regional Air Quality Assessment. Proposed M7 Naas to Newbridge By-Pass Upgrade Scheme

Year	Scenario	VOC (kg/annum)	NO_X (kg/annum)	CO_2 (tonnes/annum)
2015	Do Nothing	20,602	175,664	118,317
	Do Something	20,676	189,512	121,365
2030	Do Nothing	24,448	72,599	117,049
	Do Something	24,306	75,998	121,496
Increment in 2015		74 kg	13,848 kg	3,048tonnes
Increment in 2030		-142 kg	3,399 kg	4,447 tonnes
Emission Ceiling		55 kt[Note 1]	65 kt[Note 1]	62,800 kt[Note 2]
Impact in 2015		0.00013%	0.021%	0.0049%
Impact in 2030		-0.00026%	0.005%	0.0071%

Note 1 kt = kilo tonnes. National Emission Ceiling (EU Directive 2001/81/EC)

Note 2 kt = kilo tonnes. Ireland's Target Under The Kyoto Protocol

16.9 "Do Nothing" Scenario – Local Air Quality

CO and Benzene

The results of the "Do Nothing" modelling assessment for CO and benzene in the opening and design years are shown in Tables 16.8 – 16.9. Concentrations are well within the limit values at all worst-case receptors. Levels of both pollutants range from 25 - 32% of the respective limit values in 2015 and 2030.

PM_{10}

The results of the "Do Nothing" modelling assessment for PM_{10} in the opening and design years are shown in Table 16.10. Predicted annual average concentrations in the region of the M7 and M9 are below the ambient standards at all worst-case receptors, ranging from 44 - 51% of the annual limit value in 2015 and 2030. In addition, the 24-hour PM_{10} concentration was exceeded four times in 2015 and 2030.

$PM_{2.5}$

The results of the "Do Nothing" modelling assessment for $PM_{2.5}$ in the opening and design years are shown in Tables 16.11. Predicted annual average concentrations in the region of the M7 and M9 are below the ambient standards at all worst-case receptors, ranging from 45 - 55% of the annual limit value in 2015 and 2030.

NO_2

The results of the "Do Nothing" assessment of annual average and maximum 1-hour NO_2 concentrations in the opening and design years are shown in Tables 16.12 – 16.13. Predicted levels are within the limit values at all worst-case receptors, ranging from 22 - 66% of the annual limit value in 2015 and 2030.

16.10 "Do-Nothing" Scenario - Regional Air Quality

Predicted "Do Nothing" emissions of NO_x and VOCs in the region of the Proposed Scheme are provided in Table 16.16. NO_x and VOC emissions in the region without the Proposed Scheme in place represent at most 0.27% and 0.11% respectively of their national emissions ceilings in 2015 and 2030.

16.11 "Do-Nothing" Scenario - Climate

Predicted "Do Nothing" emissions of CO_2 in the region of the Proposed Scheme are provided in Table 16.16. CO_2 emissions without the scheme in place represent at most 0.19% of Ireland's limits under the Kyoto Protocol (FCCC 1997, DEHLG 2007b).

16.12 Worst Case Scenario

The worst-case scenario corresponds to the situation where the mitigation measures fail or are not implemented. Should dust mitigation measures not be implemented during the construction phase, significant dust nuisance is likely in areas close to the construction site. Furthermore, there is also the potential for exceedances of the PM_{10} and $PM_{2.5}$ air quality standards during the construction period. The results of the air dispersion modelling assessment show that no mitigation measures are required during the operational phase and therefore the worst-case scenario is not applicable.

16.13 Remedial and Mitigation Measures

Construction Phase

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 activities.

In order to minimise dust emissions during construction, a series of mitigation measures have been prepared and will be included in the EOP for implementation during the construction phase of the project. A description of the EOP can be found in Chapter 4 of this EIS. These mitigation measures are listed in the NRA guidelines (NRA 2011) and consist of the following:

- Site roads will be regularly cleaned and maintained. Hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads will be restricted to essential site traffic only. Any road that has the potential to give rise to fugitive dust will be regularly watered during dry and/or windy conditions;
- Vehicles using site roads will have their speeds restricted where there is a potential for dust nuisance at nearby properties;
- Where practicable, vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads. This will ensure that mud and other wastes are not tracked onto public roads. Public roads outside the site will 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;
- 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;
- The dust minimisation procedures put in place will be monitored and assessed by the contractor. In the event of dust nuisance occurring outside the site boundary, the effectiveness of existing measures will be reviewed and further mitigation will be implemented to rectify the problem.

Provided the dust minimisation measures outlined above are adhered to, the air quality impacts during the construction phase will be not be significant.

Operational Phase - Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (REGULATION (EC) No 715/2007) for passenger cars to be complied with in 2009 (Euro V) and 2014 (Euro VI). With regard to heavy duty vehicles, EU Directive 2005/78/EC defines the emission standard currently in force, Euro IV, as well as the next stage (Euro V) which has entered into force since October 2009. In addition, it defines a non-binding standard called Enhanced Environmentally-friendly Vehicle (EEV). In relation to fuel quality, SI No. 407 of 1999 and SI No. 72 of 2000 have introduced significant reductions in both sulphur and benzene content of fuels.

In relation to design and operational aspects of road schemes, emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems (UK DEFRA 2009b).

Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fuelled vehicles and the introduction of cleaner fuels.

Operational Phase - Climate

CO_2 emissions for the average new car fleet will be reduced to 120 g/km by 2012 through EU legislation on improvements in vehicle motor technology and by an increased use of biofuels. This measure will reduce CO_2 emissions from new cars by an average of 25% in the period from 1995 to 2008/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone (DEHLG 2000).

Additional measures included in the National Climate Change Strategy (DEHLG 2006, 2007b) include:

(i) VRT and Motor Tax rebalancing to favour the purchase of more fuel-efficient vehicles with lower CO_2 emissions;

(ii) Continuing the Mineral Oils Tax Relief (MOTR) II Scheme and introduction of a biofuels obligation scheme;

(iii) Implementation of a national efficient driving awareness campaign, to promote smooth and safe driving at lower engine revolutions; and

(iv) Enhancing the existing mandatory vehicle labelling system to provide more information on CO_2 emission levels and on fuel economy.

16.14 Residual Impacts of the Proposed Scheme

The results of the air dispersion modelling study show that the residual impacts of the Proposed Scheme on air quality and climate will be insignificant.

16.15 Monitoring

No monitoring is required.

16.16 References

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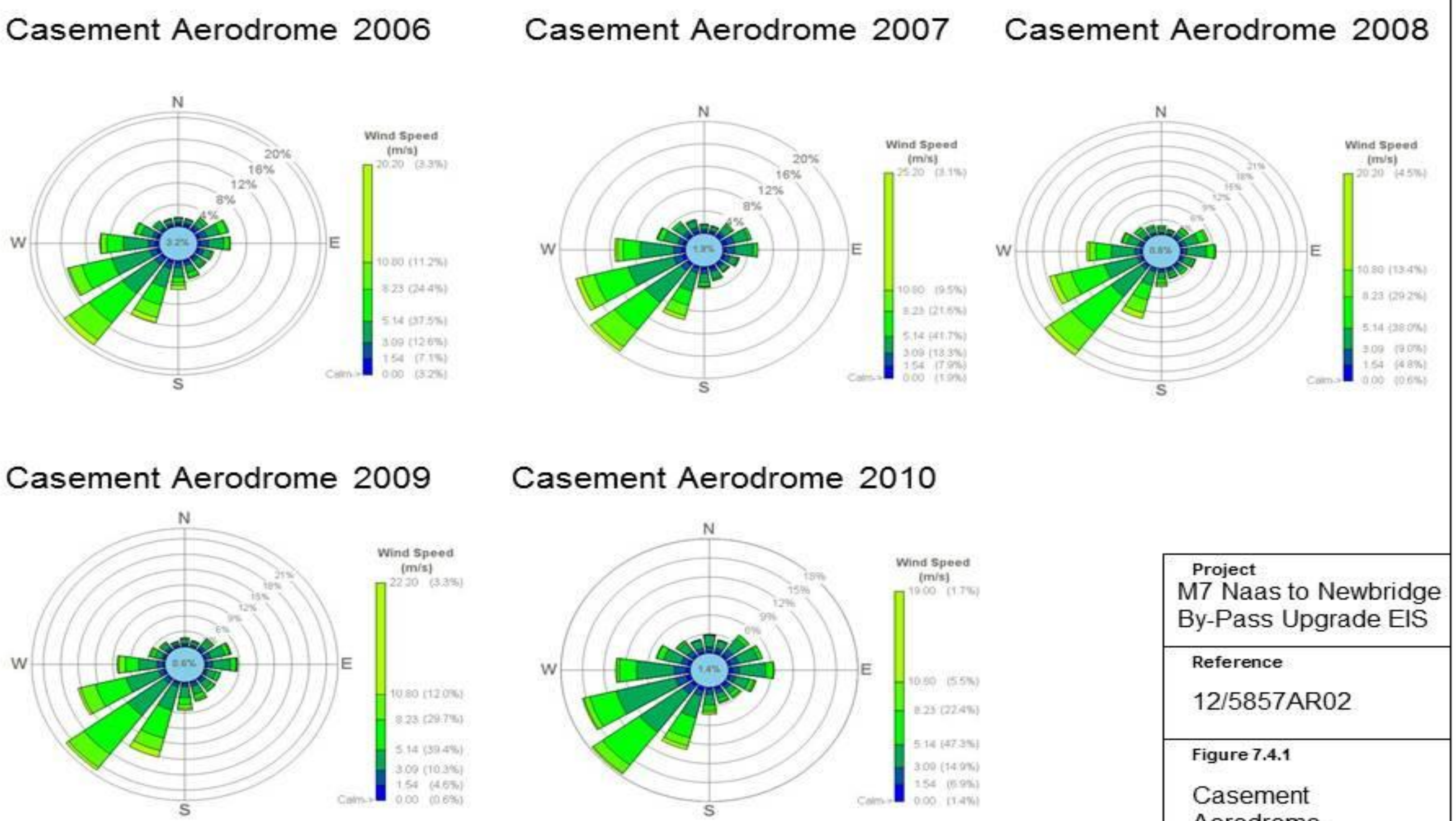

Project
M7 Naas to Newbridge By-Pass Upgrade EIS

Reference
12/5857AR02

Figure 7.4.1
Casement Aerodrome Windrose 2006 - 2010

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Appendix 16.1

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. In response to the problem of acid rain, 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 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, was 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 does so every 12 months by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, details 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. Council Directive 2008/50/EC combines the previous Air Quality Framework Directive and its subsequent daughter directives. This has also been passed into Irish Law under the Air Quality Standards Regulations 2011 (S.I. 180 of 2011). Provisions were also made for the inclusion of new ambient limit values relating to $PM_{2.5}$. 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 $PM_{2.5}$ is 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 $\mu g/m^3$ has been 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 2008/50/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 2008/50/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 2008/50/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 2008/50/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 III of EU Directive 2008/50/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 21 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[(A1)]. Using this input data the model predicts ambient ground level concentrations at the worst-case sensitive receptor using generic meteorological data.

The DMRB underwent an extensive validation exercise(A2) 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(A2).

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 ±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(A2).

References

(A1) UK DEFRA (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 - HA207/07 (Document & Calculation Spreadsheet)

(A2) UK DEFRA (2001) DMRB Model Validation for the Purposes of Review and Assessment

Appendix 16.2

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 dust minimisation plan will be included in the EOP for implementation during the construction phase of the project. A description of the EOP can be found in Chapter 3 of this EIS. 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. 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.

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.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented to rectify the problem.

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.