Chapter 07
Air Quality

Contents

7. Air Quality

7.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) has considered the potential air quality impacts associated with the Construction and Operational Phases of the Blanchardstown to City Centre Scheme (hereafter referred to as the Proposed Scheme).

During the Construction Phase, the potential air quality impacts associated with the development of the Proposed Scheme have been assessed. This included construction activities such as utility diversions, road carriageway / cycleway / footway resurfacing and kerb road realignments. Construction traffic construction access routes are also assessed as part of the study area for this phase of the works.

During the Operational Phase, the potential air quality impacts associated with altered traffic flows along the Proposed Scheme, reallocated traffic lanes and displaced traffic flows have been assessed.

The assessment has been carried out according to best practice and guidelines relating to air quality.

The aim of the Proposed Scheme when in operation is to provide enhanced walking, cycling and bus infrastructure on this key access corridor in the Dublin region, which will enable and deliver efficient, safe, and integrated sustainable transport movement along the corridor. The objectives of the Proposed Scheme are described in Chapter 1 (Introduction. The Proposed Scheme which is described in Chapter 4 (Proposed Scheme Description) has been designed to meet these objectives.

The design of the Proposed Scheme has evolved through the application of a comprehensive design iteration process with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme undertaken throughout the option selection and design development programme have been incorporated where appropriate.

7.2 Methodology

The assessment has been undertaken with reference to the most applicable guidance documents relating to air quality which are set out in the following sections of this Chapter.

An overview of the methodology undertaken for the air quality impact assessment is outlined below:

- A detailed baseline air monitoring study has been undertaken in order to characterise the existing ambient environment in areas along the Proposed Scheme. This has been undertaken through a review of available published ambient air monitoring data and site-specific ambient air monitoring at sensitive locations along the Proposed Scheme;
- A review of the most applicable standards and guidelines has been reviewed in order to define the air quality significance criteria for the Construction and Operational Phases of the Proposed Scheme;
- Predictive calculations and impact assessments relating to the likely Construction Phase air quality impacts have been undertaken at the nearest sensitive locations to the construction work areas associated with the Proposed Scheme;
- Predictive calculations have been performed to assess the potential air quality impacts associated with traffic alterations associated with the operation of the Proposed Scheme at the most sensitive locations; and
- A schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential air quality impacts associated with the Proposed Scheme.

7.2.1 Study Area

The study area for this assessment covers the length of the Proposed Scheme, approximately 10.9 kilometre (km) from the N3 Blanchardstown Junction to Ellis Quay in the City Centre, and the area either side of the Proposed Scheme up to a maximum distance of 350 metres (m) during the Construction Phase, and 200m during the

Operational Phase. For the Construction Phase assessment, the focus is on air quality sensitive receptors adjacent to the proposed works (e.g. utility diversions, road widening works, road excavation works (where required), road reconfiguration and resurfacing works) that are susceptible to air quality impacts but also those receptors along construction traffic access routes or routes along which traffic is redistributed within the study area (please see Chapter 5 (Construction) of this EIAR for more information on construction traffic access routes). The extent of the overall study area is typically up to a maximum of 350m from a specific area of construction work, as per the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (hereafter referred to as the IAQM Guidance) (IAQM, 2014), with the key impacted study areas focused up to a maximum of 100m depending on the air emission sources in question and the local area under consideration. For the Operational Phase, assessment of the dust impacts from maintenance of the route has been scoped out on the basis that these activities have low potential for dust release and are likely to have a negligible impact on air quality sensitive receptors.

For the Construction Phase and Operational Phase traffic assessment, the focus is on air quality sensitive receptors which bound the Proposed Scheme and those along diverted traffic routes within the study area. Highly sensitive air quality receptors during the construction phase include residential properties, hospitals, schools and residential care homes, whilst commercial and workplace properties are generally viewed as being of medium sensitivity (IAQM 2014). Sensitive receptor locations include residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present (TII 2011). Designated areas of conservation (either Irish or European designation) are also considered sensitive air quality receptors (TII 2011). Potential impacts to air quality relate to alterations to traffic patterns (e.g. introduction of a new bus lane or due to redistributed traffic), with particular attention focused on those areas where the Proposed Scheme will be encroaching closer to air quality receptors, specifically where bus or traffic lanes are moving closer to air quality receptors.

For the Construction Phase and Operational Phase traffic assessment, the focus is on air quality receptors within an overall study area of 200m from the Proposed Scheme, as per the Transport Infrastructure Ireland (TII) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (hereafter referred to as the TII Air Quality Guidelines) (TII 2011) or diverted routes within the key impacted study areas focused within 50m to 100m. The range of air quality sensitive receptors for the five geographical sections are discussed in Table 7.1. The locations of sensitive receptors are provided initially in Table 7.19 and also in Figures 7.3 to 7.8 in Volume 3 of this EIAR.

Table 7.1: Description of Air Quality Receptors within the Study Area

Geographical Section	Description of Study Area
N3 Blanchardstown Junction to Snugborough Road	The key air quality sensitive properties are residential dwellings to the north and west in the Coolmine Cottages, Whitestown Grove and Hillbrook Woods estates, within 5 to 50m of the Proposed Scheme. There are some areas with less sensitive commercial receptors within the Blanchardstown Shopping Centre site to the east of the Proposed Scheme between Blakestown Way junction and the northern corner of Blanchardstown Shopping Centre site. Less sensitive receptors also include the Crowne Plaza Blanchardstown hotel and Liberty Insurance offices, which are within 5 to 10m of the Proposed Scheme.
Snugborough Road to N3/M50 Junction	Within this study area the key air quality sensitive areas are predominately residential properties, which bound the southwest and northeast of the Proposed Scheme within 25 to 35m of the road edge between Snugborough junction / N3 and Snugborough Road / Waterville Road junction. Key air quality sensitive residential receptors are within 5 to 50m south of the road edge between Herbert Road and River Road. Connolly Hospital and St Francis Hospice Blanchardstown are within 220 to 300m of the Proposed Scheme.
N3/M50 Junction to Navan Road/Ashtown Road Junction	Within this study area, the key air quality sensitive areas are predominately residential dwellings, which are located between 10 to 50m to the north and south. The Proposed Scheme passes within 10 to 15m of Travelodge Dublin Phoenix Park.
Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction	Within this study area, the key air quality sensitive areas are predominately residential dwellings, which are located between 5 to 75m to the north and south of the R147 Navan Road. The Proposed Scheme passes within 10 to 50m of Ashgrove House, St. Vincent’s Special National School, St Vincent’s Centre- Chapel, Daughters of Charity Disability Support, St. John Bosco Junior Boy’s School, Our Lady Help of Christians Parish Church, Holy Family School for the Deaf, Deaf Village Ireland and Navan Road Medical and Dental. Medical receptors within 100 to 200m of the Proposed Scheme include Assisi House and Santa Sabina House Nursing Home. Amenity areas within 10 to 20m south of the Proposed Scheme are Belvedere Sports Ground and Cabra Library.

Geographical Section	Description of Study Area
Navan Road/Old Cabra Road Junction to Ellis Quay	Within this study area, the key air quality sensitive areas are predominately residential dwellings, which are located less than 20m from the Proposed Scheme, lining either side of the R147 Navan Road, R805 Old Cabra Road, Prussia Street, Manor Street, Stoneybatter, Blackhall Place, R804 Brunswick Street North, George Lane, King Street North, Queen Street, Cabra Road, Phibsborough Road, Church Street and Constitution Hill.

7.2.2 Relevant Guidelines, Policy and Legislation

The Environmental Protection Agency (EPA) Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022) were considered and consulted in the preparation of this Chapter.

The statutory ambient air quality standards in Ireland are outlined in S.I. No. 180 of 2011 Air Quality Standards Regulations 2011 (hereafter referred to as the Air Quality Regulations), which incorporate the ambient air quality limits set out in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (hereafter referred to as the CAFE Directive), for a range of air pollutants. The statutory ambient air quality guidelines are discussed in greater detail in Section 7.2.2.1.

In addition to the specific statutory air quality standards, the assessment has made reference to national guidelines, where available, in addition to international standards and guidelines relating to the assessment of ambient air quality impacts from road schemes. These are summarised below:

- Institute of Air Quality Management Guidance (IAQM 2014 2020);
- The Transport Infrastructure Ireland Air Quality Guidelines (TII 2011);
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (hereafter referred to as the TII Ecological Guidelines) (TII 2009);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission 2013);
- Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report (European Commission 2017);
- United Kingdom (UK) Department of Environment Food and Rural Affairs (DEFRA) Part IV of the Environment Act 1995: Local Air Quality Management Policy Guidance (PG16) (hereafter referred to as LAQM (PG16)) (DEFRA 2016);
- Part IV of the Environment Act 1995: Local Air Quality Management Technical Guidance (TG16) (hereafter referred to as LAQM (TG16)) (DEFRA 2018);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) – LA 105 Air Quality (hereafter referred to as LA 105 Air Quality) (UKHA 2019); and
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2005 (hereafter referred to as the WHO Air Quality Guidelines) (WHO 2006).

7.2.2.1 Ambient Air Quality Standards / Limit Values

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. The applicable legal standards in Ireland are outlined in the Air Quality Regulations, which incorporate the CAFE Directive. The Air Quality Regulations set limit values for the pollutants nitrogen dioxide (NO_2) and nitrogen oxides (NO_X), particulate matter (PM) with an aerodynamic diameter of less than 10 microns (PM_{10}), PM with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$), lead (Pb), sulphur dioxide (SO_2), benzene and carbon monoxide (CO) (see Table 7.2).

Table 7.2: Air Quality Regulations (based on the CAFE Directive)

Pollutant	Regulation*	Limit Type	Value
NO_2	S.I. 180 of 2011	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200μg/m³ NO_2

Pollutant	Regulation*	Limit Type	Value
		Annual limit for protection of human health	40µg/m^3 NO_2
Nitrogen Oxides (NO + NO_2)		Critical limit for the protection of vegetation and natural ecosystems	30µg/m^3 NO + NO_2
Lead	S.I. 180 of 2011	Annual limit for protection of human health	0.5µg/m^3
SO_2	S.I. 180 of 2011	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350µg/m^3
		Daily limit for protection of human health - not to be exceeded more than three times/year	125µg/m^3
		Critical limit for the protection of vegetation and natural ecosystems (calendar year and winter)	20µg/m^3
PM (as PM_{10})	S.I. 180 of 2011	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50µg/m^3
		Annual limit for protection of human health	40µg/m^3
PM (as $PM_{2.5}$)	S.I. 180 of 2011	Annual limit for protection of human health	25µg/m^3
Benzene	S.I. 180 of 2011	Annual limit for protection of human health	5µg/m^3
CO	S.I. 180 of 2011	8-hour limit (on a rolling basis) for protection of human health	10mg/m^3

* CAFE Directive replaces the previous Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management and daughter directives, Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air and Directive 2000/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air

** µg/m^3 (micrograms per cubic metre); mg/m^3 (milligrams per cubic metre)

The WHO Air Quality Guidelines (WHO 2006) values relating to NO_2, PM_{10} and $PM_{2.5}$ are shown in Table 7.3. The WHO Air Quality Guideline values are more stringent than the European Union (EU) statutory limit values for PM_{10} and $PM_{2.5}$. In relation to NO_2, the compliance limit values are equivalent. However, the WHO one-hour guideline value is an absolute value while the EU standards allows this limit to be exceeded for 18 hours / annum without breaching the statutory limit value.

In May 2020, as part of the joint WHO / United Nations Environment Program (UNEP) / World Bank *BreatheLife* campaign, the four Dublin local authorities signed a commitment to achieve the WHO Air Quality Guidelines by a target date of 2030.

The appropriate compliance limit values for the assessment of air quality impacts of the Proposed Scheme are those outlined in the Air Quality Regulations, which incorporate the CAFE Directive. Both the compliance limit value and WHO guideline value for NO_2, the pollutant most likely to exceed either, are 40 µg/m^3. The assessment therefore considers both compliance with the EU limit and meeting the WHO guideline value.

Table 7.3: WHO Air Quality Guidelines (WHO 2006)

Pollutant	Regulation	Limit Type	Value
NO_2	WHO Air Quality Guidelines	Hourly limit for protection of human health	200μg/m^3 NO_2
		Annual limit for protection of human health	40μg/m^3 NO_2
PM (as PM_{10})		24-hour limit for protection of human health	50μg/m^3 PM_{10}
		Annual limit for protection of human health	20μg/m^3 PM_{10}
PM (as $PM_{2.5}$)		24-hour limit for protection of human health	25μg/m^3 PM2.5
		Annual limit for protection of human health	10μg/m^3 PM2.5

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. Dublin City Council (DCC) has published a guidance document titled Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition (DCC, 2018). However, this guidance does not specify a guideline value.

The Verein Deutscher Ingenieure (VDI) German Technical Instructions on Air Quality Control – TA Luft standard for dust deposition (VDI, 2002) (non-hazardous dust) sets a maximum permissible emission level for dust deposition of 350mg/(m^2*day) averaged over a one-year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Health and Local Government (DEHLG) Quarries and Ancillary Activities, Guidelines for Planning Authorities (DEHLG, 2004) apply the Bergerhoff limit of 350mg/(m^2*day) measured over monitoring periods of between 28 - 32 days which are then averaged over a one-year period to the site boundary of quarries. This guidance value is applied to dust impacts from the construction of the Proposed Scheme.

7.2.2.2 National Air Emission Targets

Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (hereafter referred to as the National Emissions Reduction Directive) was published in December 2016. The National Emissions Reduction Directive applied the limits set out in Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (hereafter referred to as the National Emission Ceiling Directive) until 2020 and established new national emission reduction commitments which are applicable from 2020 and 2030 for SO_2, NO_X, non-methane volatile organic compounds (NMVOC), ammonia (NH_3), $PM_{2.5}$ and methane (CH_4). In relation to Ireland, the 2020 to 2029 emission targets are 25kt (kilotonnes) for SO_2 (65% on 2005 levels), 65kt for NO_X (49% reduction on 2005 levels), 43kt for NMVOCs (25% reduction on 2005 levels), 108kt for NH_3 (1% reduction on 2005 levels) and 10kt for $PM_{2.5}$ (18% reduction on 2005 levels) as shown in Table 7.4. In relation to 2030, Ireland's emission targets are 85% below 2005 levels for SO_2, 69% reduction for NO_x, 32% reduction for VOCs, 5% reduction for NH_3 and 41% reduction for $PM_{2.5}$, also shown in Table 7.4.

Table 7.4: National Air Emission Targets (Ireland's Air Pollutant Emissions 2020 to 2030)

Pollutant	2020 to 2029 Reduction Commitments (kilotonnes) (and % Reduction Compared to 2005 Levels)	2030 Reduction Commitments (kilotonnes) (and % Reduction Compared to 2005 Levels)
SO2	25.6	11.0
	-65%	-85%
NOX	66.8	40.6
	-49%	-69%
NMVOC	56.3	51.1
	-25%	-32%
NH3	112.1	107.5
	-1%	-5%
PM2.5	15.6	11.2
	-18%	-41%

7.2.2.3 Regional Policy

In 2009, the Dublin Regional Air Quality Management Plan 2009-2012 (DCC, 2009) was published and a range of strategies defined to improve air quality in the Dublin region. The strategies included an improvement in co-ordination to build on the good work to date, to mainstream air quality management into all major policy areas, strengthen the decision-making by improving sharing of information on air quality, introduce measures related to local authority activities that will reduce air emissions and identify and prioritise the main potential threats to air quality.

In relation to specific policies, Policy 6 states that the local authorities shall:

> *'support and encourage the rapid implementation of Quality Bus Corridors and other bus priority measures along the routes identified in the Dublin Transportation Initiative strategy within their functional areas.'*

The Dublin Regional Air Quality Management Plan for Improvements in Levels of Nitrogen Dioxide in Ambient Air Quality (DCC, 2011) was a companion document to the Dublin Regional Air Quality Management Plan 2009 - 2012. The document reviewed the measured levels of NO_2 in Dublin City. The document defined the current strategic planning approach as the promotion of *'consolidated urban development based on enhanced public transport*' and outlines a range of measures and policies which will help to improve ambient levels of NO_2.

As a result of an exceedance of the annual mean NO_2 ambient air quality limit value at the St John's Road West monitoring station in 2019 (EPA, 2020a), an Air Quality Action Plan by Dublin Local Authorities in conjunction with the EPA was legally required by the end of 2021. The plan was subject to public consultation, which gave interested members of the public the opportunity to share their views and input to the plan, which is now complete and was issued to the Minister for the Environment and the EU Commission at the end of 2021. The plan sets out 14 broad measures and a number of associated actions to address the exceedance of the nitrogen dioxide annual limit value. This location of exceedance is outside the study area of the Proposed Scheme.

7.2.3 Data Collection and Collation

The baseline ambient air quality environment has been characterised through a desk study of publicly available published data sources and site-specific baseline ambient monitoring surveys.

7.2.3.1 Desk Study

A desk-based air quality assessment was carried out following guidelines described in the publication by TII (TII 2011). TII states that wherever possible use should be made of existing certified air quality data such as that undertaken by the EPA. Air quality monitoring programmes have been undertaken in recent years by the EPA and Local Authorities in the Dublin region. The most recent annual report, Air Quality in Ireland 2019 (EPA 2020a), details the range and scope of monitoring undertaken throughout Ireland. The Urban Environmental Indicators: Nitrogen dioxide levels in Dublin report (EPA 2020b) assessed spatial variations in ambient air quality in Dublin using diffusion tube sampling and detailed air dispersion modelling. The study found that there were potential exceedances of the ambient air quality standards for NO_2 close to busy City Centre road junctions, near the Dublin Port Tunnel entrance and exit and along the M50 Motorway. The baseline air quality data collected through the desk study is detailed in Section 7.3.2.1.

A review of potentially sensitive ecological areas has also been conducted using the National Parks and Wildlife Services (NPWS) online mapping services. This review is discussed in Section 7.2.4.3.

7.2.3.2 Site-Specific Baseline Surveys

A site-specific baseline monitoring study was undertaken at monthly intervals from November 2019 to June 2020 as part of the air quality assessment for NO_2 using diffusion tube monitoring at 10 locations as detailed in Section 7.3.2.2 and as shown in Figure 7.1 of Volume 3 of this EIAR. Passive sampling of NO_2 involves the molecular diffusion of NO_2 molecules through a polycarbonate tube and their subsequent adsorption onto a stainless steel disc coated with triethanolamine. Following a month of sampling, the tubes were analysed using ultraviolet (UV) spectrophotometry, at a United Kingdom Accreditation Service (UKAS) accredited laboratory (SOCOTEC Laboratories in Burton-on-Trent, UK).

The TII Air Quality Guidelines (TII 2011) note that NO_2 diffusion tube monitoring provides a simple, cost-effective means of monitoring at a number of locations across an area and can provide useful information on spatial distributions. The baseline study overlapped in time with traffic surveys being conducted as part of the Traffic Impact Assessment (TIA). Details of the baseline data collected is discussed in Section 7.3.2.

7.2.4 Appraisal Method for the Assessment of Impacts

7.2.4.1 Air Quality Impact Assessment from Traffic Emissions

The air quality assessment has been carried out following the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA 2022) and using the methodology outlined in LA 105 Air Quality (UKHA 2019), LAQM (PG16) (DEFRA 2016) and LAQM (TG16) (DEFRA 2018). The general approach outlined in the LA 105 Air Quality, LAQM (PG16) and LAQM (TG16) guidance documents and the methodology outlined within has been recommended for use in assessing Irish road schemes by the TII Air Quality Guidelines (TII 2011) as discussed in Section 7.2.4.1.1 below.

The potential changes in regional air emissions due to the Construction Phase and Operational Phase traffic impacts of the Proposed Scheme have been assessed using the National Transport Authority (NTA) Environmental Appraisal Tool (2015), which is based on the Environmental Evaluation Model (hereafter referred to as ENEVAL). The data also takes into account the modal shift from private car to bus (walk or cycle).

A validation study of ENEVAL was undertaken by Jacobs Systra in 2016 (Jacobs Systra 2016) which involved running the module on all the Regional Modelling System (RMS) base models to produce a national emission figure for CO_2 production against the national figure provided by the Department of Transport, Tourism and Sport (DTTAS) of 12 megatonnes. The resultant figure was 8.1 megatonnes for ENEVAL. The DTTAS figure included non-transport related fuel (agricultural and industrial use) and in addition the ENEVAL modelled year was 2012 whilst the DTTAS figures were based on 2015 which would be expected to have higher flows. Therefore, ENEVAL is deemed to be valid for the purposes of calculating regional emissions.

7.2.4.1.1 Local Air Quality Screening Assessment

In 2019 the UKHA DMRB air quality guidance was revised with the publication of LA 105 Air Quality (UKHA 2019) replacing a number of historical guidance documents (HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15). The revised document outlines a number of changes of approach when assessing the air quality impact of road schemes.

LA 105 Air Quality states that modelling should be conducted for NO_2 for the base, construction and opening years for both the Do Minimum and Do Something scenarios (please see Chapter 6 (Traffic & Transport) for the definition of these terms). Modelling of PM_{10} is only required for the base year to demonstrate that the air quality limit values in relation to PM_{10} are not breached. Where the air quality modelling indicates exceedances of the PM_{10} air quality limits in the base year then PM_{10} should be included in the air quality model in the Do-Minimum and Do-Something scenarios. LA 105 Air Quality guidance states that modelling of $PM_{2.5}$ is not required, as modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value. However, as outlined in Section 7.2.2.1, the four Dublin local authorities have signed up for the *BreatheLife* campaign (https://breathelife2030.org/) to work towards achieving the goal of compliance with the WHO Air Quality Guidelines (WHO 2006) by 2030. Modelling of PM_{10} and $PM_{2.5}$ was undertaken to consider the impact of the Proposed Scheme on these concentrations.

Historically modelling of CO, lead and benzene was required by UK HA Guidance (UKHA 2007) and TII Guidance. However, guidance has now been updated by the UK HA (LA 105 Air Quality). As concentrations of these pollutants have been monitored to be significantly below their air quality limit values in recent years, even in urban centres (see Section 7.3.2.1) CO, lead and benzene have been scoped out of detailed assessment (EPA, 2020a).

LA 105 Air Quality states that the following scoping criteria shall be used to determine whether the air quality impacts of a project can be scoped out or require an assessment based on the changes between the Do Something traffic (with the Proposed Scheme) compared to the Do Minimum traffic (without the Proposed Scheme):

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV – includes goods vehicles, buses and other heavy vehicles) AADT changes by 200 or more;
- A change in speed band; and
- A change in carriageway alignment by 5m or greater.

The above scoping criteria have been used in the current assessment to determine the road links required for inclusion in the modelling assessment. Sensitive receptors within 200m of impacted road links were included within the modelling assessment as detailed in LA 105 Air Quality.

7.2.4.1.2 Atmospheric Dispersion Modelling System (ADMS)-Roads Dispersion Model

The TII Air Quality Guidelines (TII, 2011) state 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).

Guidance from LA 105 Air Quality states that a detailed assessment must be conducted where the sensitivity of the environment is medium or above when combined with a high-risk project, due to a risk of exceeding air quality thresholds.

Considering the scale of the Proposed Scheme, its risk should be considered high as it has the potential to have an impact on ambient air quality over a large geographical area.

Guidance from LA 105 Air Quality states that a medium sensitivity environment includes areas that have annual mean NO_2 concentrations of 36µg/m^3 or above combined with sensitive receptors within 50m of the impacted roads. NO_2 concentrations (Section 7.3.2.1 and Section 7.2.3.2) were found to be generally below 36µg/m^3 along the suburban areas along the Proposed Scheme. However, towards the City Centre, ambient NO_2 concentrations were measured in excess of 36µg/m^3. The LA 105 Air Quality guidance states a detailed assessment should consider a representative number of receptors and all receptors with the likelihood of exceeding the air quality limit values.

Vehicle-derived air emissions for areas impacted by significant changes in AADT were modelled using the detailed ADMS-Roads dispersion model (Version 5.1) which has been developed by Cambridge Environmental Research Consultants (CERC) (CERC, 2020). The model is a steady-state Gaussian plume model used to assess ambient pollutant concentrations associated with road sources.

The ADMS-Roads dispersion model (Version 5.1) has been used to predict the ground level concentrations (GLC) of NO_2 and PM_{10} / $PM_{2.5}$ in the vicinity of the impacted areas for the baseline year of 2019, the peak construction year of 2024 and the opening and design years of 2028 and 2043 respectively.

The modelling incorporated the following features:

- Hourly-sequenced meteorological information for Casement Aerodrome in 2019 has been used in the model (see Diagram 7.2) (Met Éireann 2020). The selection of the appropriate meteorological data has followed the guidance issued by the LAQM (TG16) (DEFRA, 2018). A primary requirement is that the data used should have a data capture of greater than 90% for all parameters; and
- Specific air sensitive receptors (ASRs) were also mapped into the model. Receptor heights were input at 1.5m to represent breathing height. Concentrations were reported for each ASR modelled for all modelling scenarios.

It is intended that the Proposed Scheme will have a peak construction year of 2024 and an opening year of 2028. Road traffic emission rates are derived using traffic data for the peak construction year of 2024 and the Opening Year of 2028 and Design Year of 2043 provided in Chapter 6 (Traffic & Transport) and using emission factors from the COPERT V database (EMISIA 2020) which has been incorporated into the UK DEFRA Emission Factor Toolkit (EFT) Version 10.1 (DEFRA 2020).

The EFT Version 10.1 has been incorporated into the ADMS-Roads model. The toolkit provides emission rates from 2017 to 2030 and traffic emissions for the Proposed Scheme were based on the following assumptions:

- EFT Version 10.1 is based on eight vehicle categories including petrol cars, diesel cars, diesel Light Goods Vehicles (LGV), rigid (Heavy Goods Vehicles (HGV) and buses;
- Systra (ENEVAL) fleet composition data for Ireland (2016 base year) were selected to input car, LGV and HGV proportions (Table 7.5). 2019 projections were used for detailed modelling of the 2019 base year, 2022 projections and 2024 projections were used as conservatively representative of the 2024 peak construction year and 2028 opening year respectively;
- National Transport Model (NTM) fleet projections provided in UK TAG (UK Department for Transport, 2020) have been used to estimate the proportions of cars, LGV and HGV in 2043. No fleet projection tools currently exist, Irish or UK based, that accurately predict the proportion of electric vehicles in 2043, or which take the 2021 Climate Action Plan measures into account. A conservative approach is therefore inevitable, and on consultation from Systra, is based on the use of the UK NTM as the most up to date and robust alternative to the older 2016 base year Systra fleet;
- Predicted bus fleet composition data was developed for 2019, 2028 and 2043 (Table 7.5). The 2019 bus fleet was also applied to the 2024 construction year;
- Emissions have been calculated using predicted emissions factors for 2019 (to represent the Base Year 2020), 2022 (to represent the peak construction year 2024), 2024 (to represent the Opening Year 2028) and 2030 (to represent the Design Year 2043). A conservative approach to emission years has been taken, similarly to the fleet projections, to counteract some of the uncertainty associated with improved vehicle standards;
- EFT Version 10.1 incorporates updated NO_X (defined as NO and NO_2) and PM speed emission coefficient equations for Euro 5 and 6 vehicles, taken from the European Environment Agency (EEA) COPERT V emission calculation tool which reflects the most recent evidence on the real-world emission performance of these vehicles;
- Fleet composition based on European emission standards from pre-Euro 1 to Euro 6/VI. Systra fleet data was used to estimate Euro class proportions for cars, LGV, and HGV. The NTA provided Euro class proportions for the bus fleet; and
- Improvements in the quality of fuel and some degree of retrofitting; technology conversion in the national fleet.

Table 7.5:Summary of Fleet Proportions

Vehicle Type		Base Year 2019	Construction Year 2024	Operational Year 2028	Design Year 2043
Car	Petrol Car	41%	38%	36%	38%
	Diesel Car	57%	60%	63%	25%
	Electric Car	2%	2%	2%	37%
LGV	LGV	99.9%	99.9%	99.9%	81.5%
	Electric LGV	0.1%	0.1%	0.1%	18.5%
HGV	Rigid HGV	86%	86%	86%	86%
	Artic HGV	14%	14%	14%	14%
Bus	Plug-in Hybrid Bus	0%	0%	24%	0%
	Fuel Cell Electric Bus	0%	0%	70%	100%
	Diesel Bus	100%	100%	6%	0%

Advancements in engine technology and the addition of a higher percentage of electric vehicles to the fleet will assist in significantly reducing emissions between 2028 and 2043, even in circumstances where the number of vehicles using a road link increases. Emissions per road link using the EFT Version 10.1 were calculated for the 2043 Do Something scenario and compared to the 2028 Do Something scenario. Conservative assumptions were made for future fleet and uptake of electric vehicles. Across the Proposed Scheme, emissions decreased in 2043, therefore 2028 modelled impacts can be considered worst case. As a result, detailed modelling of the design year 2043 was scoped out for all pollutants on the basis that emissions will be lower compared to 2028 emissions.

7.2.4.1.3 Verification Study – Year 2019 Traffic Data

Model verification investigates the level of agreement between modelled and measured concentrations. Differences between modelled and measured pollutant concentrations can arise due to uncertainties in or limitations to the model input data (such as traffic data and meteorological data), uncertainties in monitoring data and inherent modelling limitations. As outlined in LAQM.TG16 (DEFRA, 2018), an adjustment to the modelled results is usually required in order to ensure that the final concentrations presented are representative of monitoring information in the area.

A verification study was undertaken using the traffic data for the study area which was received from the NTA Eastern Regional Model (ERM) traffic model (See Section 7.2.4.1.2 and Chapter 6 (Traffic & Transport)) for year 2020. The study compared the ambient NO_2 monitored concentration at a range of diffusion tube locations with the ADMS-Roads model output at these locations. DCC has undertaken a diffusion tube monitoring program at a range of locations in the study area for both 2018 and 2019. This data has been used to compare model predictions of NO_2 to monitored NO_2 concentrations.

Background data was based on NO_2 levels from Ballyfermot for 2019. Ballyfermot was selected as a suitable suburban background station as it is an ambient air monitoring station suitably removed from Dublin City Centre and at a distance of over 200m from a main roadway. The backgrounds were also utilised in the 2024 and 2028 modelling.

The emission data for the ADMS-Roads model was based on EFT Version 10.1 and the ADMS-Roads model input parameters selected is summarised in Table 7.6.

Table 7.6:Summary of the ADMS-Roads Model Input Parameters

Parameter	Description	Input Value
Coordinate System	Spatial data in ADMS-Roads is linked to a Cartesian coordinate system, measured in meters.	Irish Transverse Mercator (ITM) Coordinate system was used.

Pollutants	A range of preset pollutants can be selected in ADMS-Roads for modelling.	NO_X, NO_2 and PM_{10} were specifically modelled.
Road Source Emissions	Road sources emissions can be entered manually or calculated from traffic flow data.	Road emissions have been calculated from traffic flow data.
Street Canyons	ADMS-Roads has to the ability to model street canyon effects either by using the Basic Street Canyon module or the Advance Street Canyon Module to simulate turbulent flow patterns along streets with relatively tall buildings.	Basic Street Canyon module has been used where canyons have been identified.
Road Emission Factors	ADMS-Roads has a range of emission factors including the recent UK Emission Factor Tool (EFT) v.9.0 dataset.	UK Emission Factor Tool (EFT) v.10.1 (8 VC) dataset has been used based on Northern Ireland (Urban)
Traffic Speed	ADMS-Roads can adjust pollutant emission factors to take account of traffic speed.	Average traffic speed specific to each link, as advised by traffic consultant, has been used in the model.
Meteorological Data	ADMS-Roads requires hourly meteorological data from a suitable meteorological station for a full year.	2019 data from Casement Aerodrome has been used in the model.
Surface Roughness	The model requires a representative surface roughness value for both the modelling domain and the meteorological station.	A value of 1.0m has been selected for the modelling domain with a value of 0.1m selected for Casement Aerodrome
Time-varied Emissions	The model can accept a range of profiles including 3-day and 7-day diurnal profiles	3-day diurnal profile (Weekdays, Saturday, Sunday) has been used in the model.
Primary NO2	Model will assume that a certain percentage of NOX emissions are NO2 when modelling chemistry	Primary NO2 fractions (%) were calculated using the EFT for each modelled scenario: • 2020 Base – 28.2% • 2024 Do Minimum – 28.9% • 2024 Do Something – 28.9% • 2028 Do Minimum – 29.6% • 2028 Do Something – 29.6%.
Complex Terrain	Where terrain exceeds 1;10, terrain effects may be modelled	Flat terrain has been used in the modelling domain

The first step of model verification, in line with LAQM.TG16, is to consider the performance of the model, prior to any adjustment, by comparing modelled and measured road NO_X contribution at each of the site specific survey and DCC diffusion tube locations. Some of the monitoring locations were not considered suitable for model verification, due to missing traffic or monitoring data, or other spatial considerations. A total of 19 monitoring sites were included in the verification exercise. The comparison is shown in Diagram 7.1, as the red points and trendline, and also in Table 7.7. This shows that on average, the unadjusted model under predicts total NO_2 concentrations by approximately 17%.

Table 7.7: Diffusion Tube Monitoring Data Used for Model Verification

Diffusion Tube location	Modelled NO_X concentration (µg/m³)	Modelled NO_2 concentration (µg/m³)	Monitored NO_X concentration (µg/m³)	Monitored NO_2 concentration (µg/m³)	Difference [(modelled – monitored)/(monitored) *100]	Adjustment Factor
Heuston Stn Environs 2	41.8	40.0	68.9	51.3	-22%	2.08
Heuston Stn Environs 3	27.1	33.3	54.9	45.6	-27%	
Heuston Stn Environs 4	9.1	24.5	21.7	30.7	-20%	
Heuston Station Revenue Site	20.0	29.9	48.7	43.0	-31%	
Doctor Steeven	25.7	32.6	56.5	46.3	-30%	
Chancery Park	10.6	25.2	24.0	31.8	-21%	
5.10	15.3	27.6	53.2	44.9	-39%	1.09
5.7	9.8	24.8	33.2	36.1	-31%	
5.9	12.0	25.9	40.8	39.5	-34%	
3.9	17.5	28.7	29.2	34.3	-16%	
5.1	7.0	23.4	11.9	25.9	-10%	
5.8	7.0	23.4	12.0	25.9	-10%	
5.6	8.5	24.2	12.3	26.1	-7%	
5.3	30.2	34.7	34.1	36.5	-5%	
5.2	21.3	30.5	22.3	31.0	-1%	
5.4	19.1	29.4	19.4	29.6	-1%	
5.5	20.9	30.3	16.0	27.9	9%	
Darling Estate, Navan Road	7.3	23.5	12.9	26.4	-11%	

In line with LAQM.TG16, the model adjustment was based on NO_X rather than NO_2 with the NO_2 diffusion tube data first converted to NO_X using the NO_X to NO_2 Calculator (DEFRA, 2020). Additionally, the adjustment was applied to the road source contribution only rather than total NO_X, again in line with LAQM.TG16. This process identified that the model performed better at some locations than others, and the adjustment of model bias took this into account.

The comparison of road NO_X contributions provided the following collective bias adjustment factors across the study area, which were then applied to the modelled road contributions at the air quality sensitive receptors most represented by them, before being converted into total NO_2 concentrations:

- 2.08 – "More congested". Applied to modelled receptors closest to roads R805 Old Cabra Rd into city centre, R108 Phibsborough Rd into city centre, N1 city centre, R806 Aughrim St, R109 Parkgate St, R148 Wolfe Tone Quay, R148 Victoria Quay, R148 Usher's Quay, R148 Ellis Quay, R148 Arran Quay, and various city centre streets; and
- 1.09 – "Less congested". Applied to all other receptors.

Following the application of the model bias adjustment factor, the modelled and measured values at these locations included in the verification exercise were compared again. This comparison is shown in Diagram 7.1 as the blue points and trendline. This shows that on average, the adjusted model is within the target 10% of the air quality standard, with a root mean square error (RMSE) of 3.87 µg/m³. In the absence of measured PM_{10} and

$PM_{2.5}$ at roadside locations in the study area, the same factors calculated for the modelled road NO_X contribution were applied to the road PM_{10} and road $PM_{2.5}$ contributions.

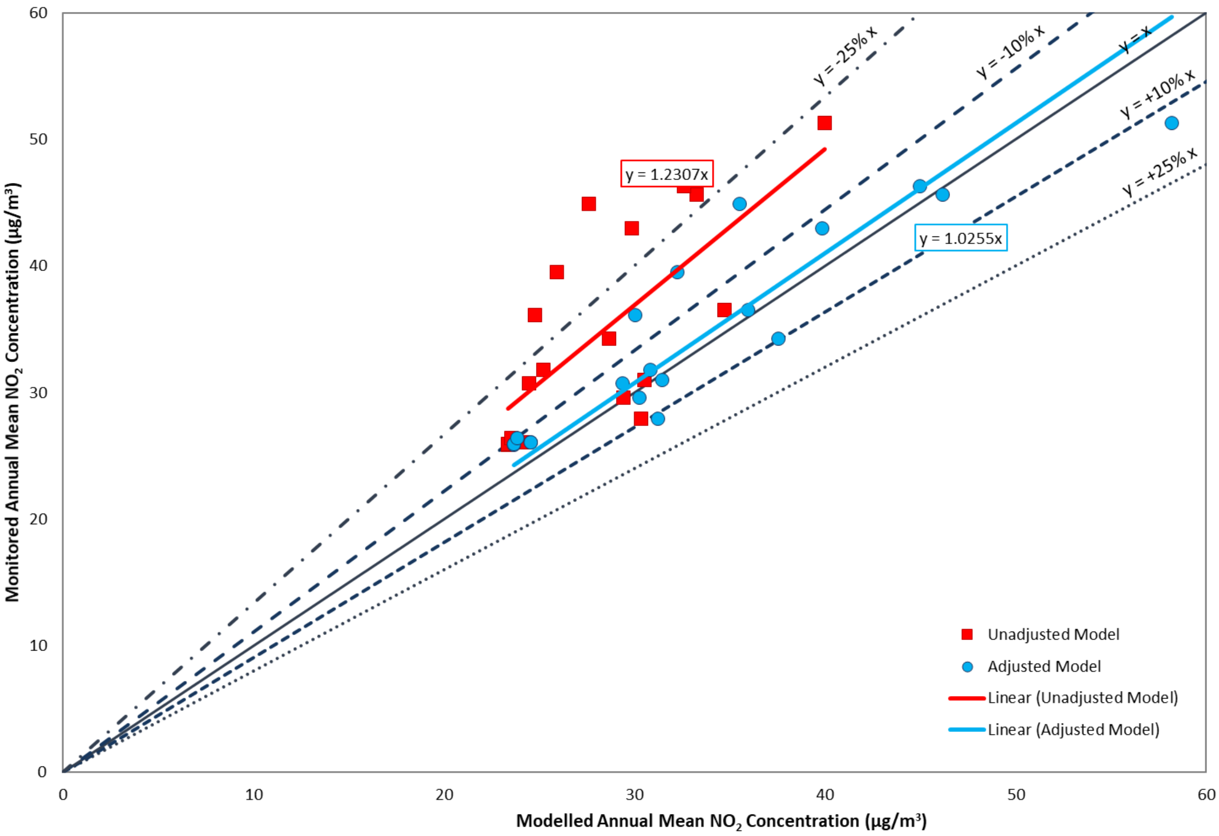

Diagram 7.1: Dispersion Model Verification - Comparison of Monitored and Modelled NO_2 Concentrations (µg/m³)

7.2.4.1.4 Air Quality Impact Significance Criteria

The TII Air Quality Guidelines (TII, 2011) detail the methodology for determining air quality impact significance criteria for road schemes in Ireland. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. The significance criteria have been adopted for the Proposed Scheme and are detailed in Table 7.8, Table 7.9 and Table 7.10. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40µg/m³). However, the criteria have also been applied to the predicted annual $PM_{2.5}$ concentrations for the purpose of this assessment.

Table 7.8: 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 µg/m³	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥ 4µg/m³	Increase / decrease >4 days	Increase / decrease ≥ 2.5µg/m³
Medium	Increase / decrease 2µg/m³ - < 4µg/m³	Increase / decrease 3 or 4 days	Increase / decrease 1.25µg/m³ - <2.5µg/m³
Small	Increase / decrease 0.4µg/m³ - < 2µg/m³	Increase / decrease 1 or 2 days	Increase / decrease 0.25µg/m³ - <1.25µg/m³
Imperceptible	Increase / decrease < 0.4µg/m³	Increase / decrease <1 day	Increase / decrease < 0.25µg/m³

Table 7.9: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

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

* Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Table 7.10: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Proposed 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 Proposed 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

** Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible*

7.2.4.2 Regional Air Quality Assessment

The change in regional air quality emissions due to Operational Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Module. Emissions from the zonal level ENEVAL tool can provide information on the emissions of pollutants including NO_2, PM_{10}, CO_2 and VOCs for the different traffic scenarios on a regional basis. The ENEVAL software is recommended by Codema in the publication

Developing CO_2 Baselines – A Step-by-Step Guide for Your Local Authority (Codema 2017). The ENEVAL tool is discussed in more detail in Section 7.2.4.1.

7.2.4.3 Ecology

For routes which pass within 2km of a designated area of conservation (either Irish or European designation) the TII Air Quality Guidelines (TII 2011) requires the air quality specialist to consult with the project ecologist. However, in practice the potential for impact on an ecological site is highest within 200m of the Proposed Scheme and within 200m of roads where significant changes in AADT (Section 7.2.4.1) occur. Sites identified within these parameters are considered Key Ecological Receptors.

The TII Ecological Guidelines (TII 2009) and the Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DEHLG 2010) provide details regarding the legal protection of designated conservation areas. Further guidance can also be found in the IAQM document A Guide to The Assessment Of Air Quality Impacts On Designated Nature Conservation Sites (IAQM 2020) and in the DMRB guidance LA105 Air Quality (UKHA 2019), both of which describe N deposition as the most likely source of significant impacts from road traffic. Pollutants such as CO_2, CO, SO_2, ammonia, particulate matter and volatile organic compounds have been scoped out of detailed assessment.

The following assessment criteria, in accordance with TII guidance, is used to determine whether an assessment for nitrogen deposition should be conducted:

- There is a designated area of conservation within 200m of the Proposed Scheme; and
- There is a significant change in AADT flows (see Section 7.2.4.1).

In circumstances where the above criteria are met, there is the potential for impacts on ecology as a result of nitrogen deposition and thus an assessment should be undertaken. For road transport sources within 200m of a designated habitat, individual ecological receptors along a transect at 10m intervals are modelled. Ecological receptors are modelled up to a maximum distance of 200m regardless of whether the habitat extends beyond 200m. It is considered that the greatest impacts will have occurred in proximity to the road. LA 105 notes that only sites that are sensitive to nitrogen deposition need to be included in the assessment, it is not necessary to include sites for example that have been designated as a geological feature or water course. The ecological receptors along the 200m transect are modelled using the methodology for sensitive human receptors in Section 7.2.4.1.2.

There are two designated sites within 2km of the boundary of the Proposed Scheme which are the Liffey Valley proposed Natural Heritage Area (pNHA) (Site Code 000128) and the Royal Canal pNHA (Site Code 002103). These are shown in Figure 12.3 in Volume 3 of this EIAR. Consultation with the project's ecologist has been undertaken and habitats of particular ecological importance at this is site are: Canal (FW3), Dry Meadow / Grassy Verges (GS2), Reed and Large Sedge Swamps (FS1) and Tall-herb Swamps (FS2). Species of particular ecological importance include *Tolypella intricata* and Opposite-leaved Pondweed.

The Air Quality Regulations outline an annual critical level for NO_X for the protection of vegetation and natural ecosystems in general. The CAFE Directive defines 'Critical Levels' as:

> '*a level fixed on the basis of scientific knowledge, above which direct adverse effects may occur on some receptors, such as trees, other plants or natural ecosystems but not on humans*'.

The TII Ecological Guidelines reference the United Nations Economic Commission for Europe (UNECE) Critical Loads for Nitrogen where a *'Critical Load*' is defined by the UNECE as:

> '*a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*' (UNECE 2003).

The guidance states that where the predicted environmental concentration (PEC) is less than 70% of the long-term critical level / load, the process contribution (PC) is likely to be insignificant.

The TII Ecological Guidelines outline a methodology to derive the road contribution to dry deposition and thereafter to compare with the published critical loads for the appropriate habitat.

The UNECE critical loads were subsequently updated in the 2010 Review and Revision of Empirical Critical Loads and Dose-Response Relationships (UNECE 2010). The pNHAs are not currently designated for the protection of a specific habitat type. In the absence of a specific designation, the most stringent published critical load in the 2010 Review and Revision of Empirical Critical Loads and Dose-Response Relationships for inland and surface water habitats (5kg(N)/ha/yr to 10kg(N)/ha/yr) (kilogrammes of nitrogen per hectare per year) has been used in the assessment.

In order to calculate the nitrogen deposition, the NO_2 / NO_X concentration determined through modelling including the background concentration must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency publication 'AGTAG06 – Technical Guidance On Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air' (EA, 2014):

Dry deposition flux (μg m^{-2} s^{-1}) = ground-level concentration (μg/m^3) x deposition velocity (m/s)

Deposition velocities are provided in both the TII (TII, 2011) and IAQM Guidance document (IAQM 2020) for NO_2 in grassland and forestry. Once the dry deposition flux (μg m^{-2} s^{-1}) is calculated it must then be converted to nitrogen equivalent acidification flux (k_{eq} ha^{-1} $year^{-1}$) for comparison with critical loads.

In order to convert the dry deposition flux from units of μg m^{-2} s^{-1} to units of kg ha^{-1} $year^{-1}$ the dry deposition flux is multiplied by the conversion factors. For NO_2 this factor is 96. In order to convert kg ha^{-1} $year^{-1}$ to k_{eq} ha^{-1} $year^{-1}$, where k_{eq} is a unit of equivalents (a measure of how acidifying the chemical species can be), the deposition flux in units of kg ha^{-1} $year^{-1}$ is multiplied by the conversion factor (taken from AQTAG06 (EA, 2014)). The conversion factor for nitrogen is 0.071428. LA 105 Air Quality (UKHA 2019) states that if the change in N deposition is greater than 0.4kg N/ha/yr or 1% of the critical level/load consultation with the ecologist should occur.

7.2.4.4 Construction Phase Assessment

The greatest potential impact on air quality during the Construction Phase is from construction dust emissions, PM_{10} / $PM_{2.5}$ emissions and the potential for nuisance dust. Dust is characterised as encompassing PM with a particle size of between 1 micron and 75 microns (1 μm to 75μm). Deposition of dust typically occurs in close proximity to the source and with IAQM Guidance (IAQM, 2014) defining a maximum impact area of 350m from the dust generating activity. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

An appraisal has been carried out to assess the risk to sensitive receptors as a result of dust soiling, health impacts and ecology impacts due to the Construction Phase in accordance with the IAQM's Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014). This appraisal reviews the sensitivity of the site's location with respect to dust nuisance, human health and ecological impacts and then calculates a risk of impact using the magnitude of site activities.

Receptor sensitivity can be described as follows with respect to nuisance dust as per the IAQM guidance (IAQM, 2014):

- High sensitivity receptor with respect to dust nuisance – surrounding land where:
  - Users can reasonably expect enjoyment of a high level of amenity;
  - The appearance, aesthetics or value of their property would be diminished by soiling;
  - The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land; or
  - Examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.
- Medium sensitivity receptor with respect to dust nuisance – surrounding land where:

  - Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home;
  - The appearance, aesthetics or value of their property could be diminished by soiling;
  - The people or property would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land; or
  - Indicative examples include parks and places of work.
- Low sensitivity receptor with respect to dust nuisance – surrounding land where:
  - The enjoyment of amenity would not reasonably be expected;
  - Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling;
  - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land; or
  - Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.

Receptor sensitivity can be described as follows with respect to human health as per the IAQM guidance (IAQM, 2014):

- High sensitivity receptor with respect to human health – surrounding land where:
  - Locations where members of the public are exposed over a time period relevant to the air quality limit value objective for PM_{10} (in the case of the 24-hour limit value objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); or
  - Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.
- Medium sensitivity receptor with respect to human health – surrounding land where:
  - Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality limit value objective for PM_{10} (in the case of the 24-hour limit value objectives, relevant location would be one where individuals may be exposed for eight hours or more in a day); or
  - Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.
- Low sensitivity receptor with respect to human health – surrounding land where:
  - Locations where human exposure is transient; or
  - Indicative examples include public footpaths, playing fields, parks and shopping streets.

Receptor sensitivity can be described as follows with respect to ecology as per the IAQM guidance (IAQM, 2014):

- High sensitivity receptor with respect to ecology – surrounding land where:
  - Locations with an international or national designation and the designated features may be affected by dust soiling; or
  - Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
- Medium sensitivity receptor with respect to ecology – surrounding land where:
  - Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
  - Indicative example is a National Heritage Area (NHA) with dust sensitive features.
- Low sensitivity receptor with respect to ecology – surrounding land where:
  - Locations with a local designation where the features may be affected by dust deposition; or
  - Indicative example is a local Nature Reserve with dust sensitive features.

Prior to assessing the impact from dust emissions, the sensitivity of the area must be established. The sensitivity of the area is determined using the headings:

- Dust Soiling Effects on People and Property;
- Human Health Impacts; and
- Ecological Impacts.

The sensitivity of the area is considered as per the criteria outlined in the IAQM guidance (and reproduced in Table 7.11, Table 7.12 and Table 7.13.

In terms of the sensitivity of the area to dust soiling effects on people and property, the receptor sensitivity, number of receptors and their distance from the source are considered. Using these criteria as outlined in Table 7.11 the sensitivity of the area to dust soiling can be established.

The IAQM guidelines (IAQM, 2014) also outline the criteria for assessing the human health impact from PM_{10} emissions from construction activities based on the current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors effected as per Table 7.12.

An assessment of the Proposed Scheme was completed with respect to the sensitivity criteria in Table 7.11 and Table 7.12. Where the number of receptors was not clear i.e. for an apartment building, conservative sensitivities were assumed. In addition, when calculating the sensitivity with respect to human health, the background concentrations of particulates was reviewed. The background air quality in the region of the Proposed Scheme is discussed in Section 7.3.2.

Table 7.11: Sensitivity of the Area to Dust Soiling Effects on People and Property (IAQM, 2014)

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 7.12: Sensitivity of the Area to Human Health Impacts (IAQM, 2014)

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
High	> 32µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28µg/m^3 - 32µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24µg/m^3 - 28µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	< 24µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
		1-10	Low	Low	Low	Low	Low
Medium	> 32µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28µg/m³ - 32µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24µg/m³ - 28µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	< 24µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	1+	Low	Low	Low	Low	Low

Dust deposition impacts on ecology can occur due to chemical or physical effects. This includes reduction in photosynthesis due to smothering from dust on the plants and chemical changes such as acidity to soils. Often impacts will be reversible once the works are completed, and dust deposition ceases. Designated sites within 50m of the boundary of the site or within 50m of the Proposed Scheme used by construction vehicles on public highways up to a distance of 500m from a construction site entrance can be affected according to the IAQM Guidance. The sensitivity of the area to ecological impacts are considered using the sensitivity criteria outlined in Table 7.13. The Royal Canal pNHA (Site Code 002103) is within 50m of the Proposed Scheme.

Table 7.13: Sensitivity of the Area to Ecological Impacts (IAQM, 2014)

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

In order to determine the level of dust mitigation required during the Construction Phase, the potential dust emission magnitude for each dust generating activity needs to be taken into account, along with the already established sensitivity of the area. These major dust generating activities are divided into four types (where relevant) to reflect their different potential impacts as outlined below:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

Trackout is defined by the IAQM as the transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

7.3 Baseline Environment

The following sections describe the baseline conditions in the vicinity of the Proposed Scheme based on a review of published data and onsite monitoring.

7.3.1 Meteorological Conditions

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 ($PM_{2.5}$ to PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

Casement Aerodrome meteorological station, which is located approximately 11km south- west of the Proposed Scheme at the closest point, collects meteorological data in the correct format for the purposes of this assessment and has a data collection of greater than 90%. Long-term hourly observations at Casement Aerodrome meteorological station provide an indication of the prevailing wind conditions for the region (see Diagram 7.2). Results indicate that the prevailing wind direction is from south to westerly in direction over the period 2015 to 2019.

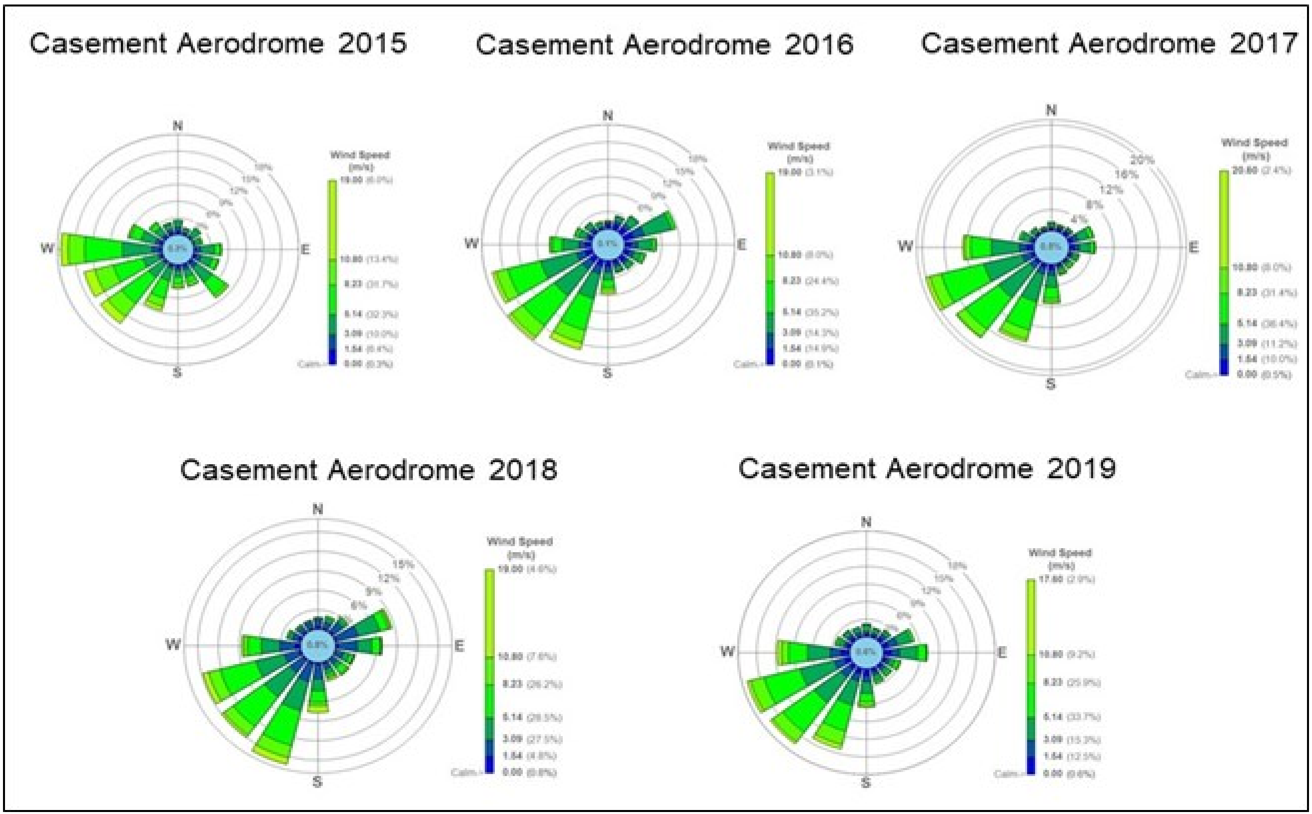

Diagram 7.2: Casement Aerodrome Meteorological Station Windrose 2015 to 2019 (Met Éireann 2020)

7.3.2 Baseline Ambient Air Quality

Background air quality is the air quality at a specific location when the local emissions of air quality have been subtracted from the measured air quality. Thus, a ‘background’ air concentration is usually representative of a wider area (such as an urban area or suburban area). Baseline air quality is the current air quality at a specific location including all local and non-local sources.

A desk study of the EPA air quality monitoring programs has been undertaken. The most recent annual report on air quality in Ireland 2019 (EPA 2020b) details the range and scope of monitoring undertaken throughout Ireland. In addition, scheme specific baseline air quality monitoring has been conducted. The data collected has been included to provide site specific baseline concentrations of NO_2 in areas which have the potential to be impacted by the Proposed Scheme.

7.3.2.1 EPA Data

As part of the implementation of S.I. No. 271/2002 - Air Quality Standards Regulations 2002, four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2020a). 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 zoning, the area of the Proposed Scheme is located within Zone A, as shown in Figure 7.2 Volume 3 of this EIAR (EPA, 2020a).

With regard to NO_2, continuous monitoring data from the EPA Zone A stations was reviewed. The stations representative of the Proposed Scheme are Rathmines, Swords and Ballyfermot. Sufficient data was available for the station in Rathmines, which is located roughly 800m from the Proposed Scheme, to review long-term trends over a five-year period (2015 to 2019) as shown in Table 7.14. Long-term annual average levels at Rathmines range from 17µg/m^3 to 22µg/m^3 over the period 2015 to 2019, with an average concentration of 22µg/m^3 in 2019.

In addition to the stations in close proximity to the Proposed Scheme, sufficient data was available for suburban stations in Swords and Ballyfermot to observe long-term trends over the period 2015 to 2019. Results average between 15µg/m^3 to 22µg/m^3 for the annual mean concentrations at each location compared to the annual limit value of 40µg/m^3 with no exceedances of the one-hour limit value of 200µg/m^3. Swords and Ballyfermot had average NO_2 concentrations of 19µg/m^3 in 2019.

Long-term trends at the City Centre location of Winetavern Street are available, which is located near the City Centre end of the Proposed Scheme. Concentrations of NO_2 were below the annual and 1-hour limit values, with annual average levels ranging from 27µg/m^3 to 37µg/m^3 over the period 2015 to 2019 compared to the annual limit value of 40µg/m^3. The average concentration in 2019 was 28µg/m^3.

The ambient NO_2 monitoring results for Winetavern Street, Swords, Blanchardstown, Ballyfermot and Rathmines over the period 2015 to 2019, based on a three-year rolling average, are shown in Diagram 7.3. The data and trend line indicate that levels are reasonably constant at each location over the five-year period.

Table 7.14: Trends in Suburban and Urban NO_2 Concentration (µg/m^3) In Dublin 2015 to 2019

Station	Station Classification Council Directive 96/62/EC*	Averaging Period	Year					Limit Value
			2015	2016	2017	2018	2019	
Winetavern Street	Urban Traffic	Annual Mean NO_2 (µg/m^3)	31	37	27	29	28	40
		99.8th%ile 1-hr NO_2 (µg/m^3)	128	120	110	115	115	200
Rathmines	Urban Background	Annual Mean NO_2 (µg/m^3)	18	20	17	20	22	40
		99.8th%ile 1-hr NO_2 (µg/m^3)	105	88	86	87	102	200
Ballyfermot	Suburban Background	Annual Mean NO_2 (µg/m^3)	16	17	17	17	20	40
		99.8th%ile 1-hr NO_2 (µg/m^3)	127	90	112	101	101	200
Blanchardstown	Urban Traffic	Annual Mean NO_2 (µg/m^3)	25	30.2	26	25	31	40

Station	Station Classification Council Directive 96/62/EC*	Averaging Period	Year 2015	2016	2017	2018	2019	Limit Value
		99.8th%ile 1-hr NO_2 (µg/m³)	141	128	147	131	143	200
Swords	Suburban Background	Annual Mean NO_2 (µg/m³)	13	16	14	16	15	40
		99.8th%ile 1-hr NO_2 (µg/m³)	93	96	79	85	80	200

* Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management

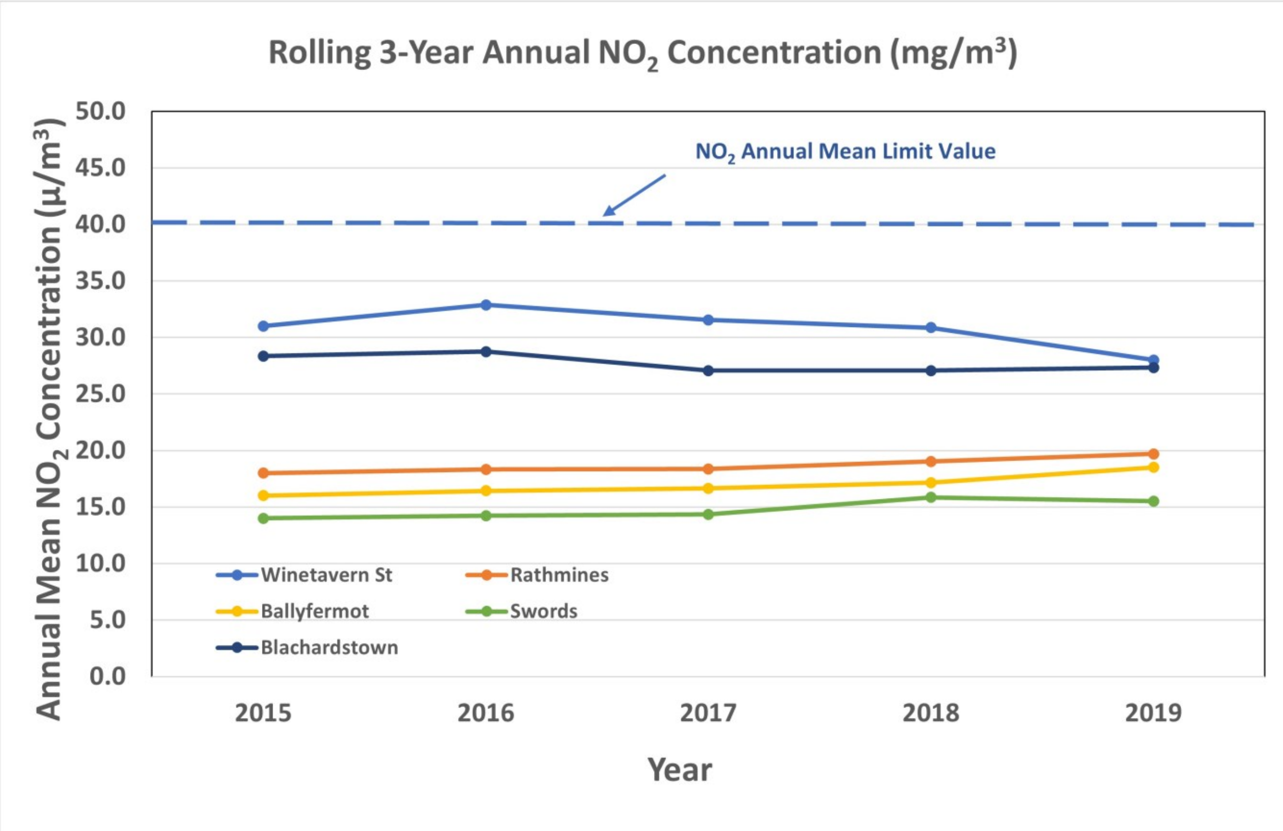

Diagram 7.3: Rolling Three-Year Annual NO_2 Concentration (µg/m³)

In addition to the continuous monitoring stations, the EPA has gathered NO_2 data using the passive diffusion tube methodology in proximity to the proposed scheme (EPA, 2020c). The diffusion tube sampling was carried out in conjunction with Dublin City Council. Monitoring is for single year periods, therefore long-term averages are not available at diffusion tube locations. Further details on the diffusion tube methodology are discussed in Section 7.3.2.2 as part of the site-specific monitoring study. Five monitoring locations at Heuston Stn Environs 2 and 3, Heuston Station Revenue Site and Doctor Steeven, and Heuston Stn Environs 1 were found to exceed the annual mean NO_2 concentration in 2019.

Table 7.15 EPA NO_2 Diffusion Tube Monitoring Data

Monitoring Site	Monitoring Year	Annual Mean NO_2 Concentration (µg/m³)
Beach park Avenue, Castleknock, D15	2019	29.8
Darling Estate, Navan Road	2019	26.4
Heuston Stn Environs 1	2018	43.0

Heuston Stn Environs 2	2018	51.3
Heuston Stn Environs 3	2018	45.6
Heuston Stn Environs 4	2018	30.7
Heuston Station Revenue Site	2018	46.2
Doctor Steeven	2018	46.3
Chancery Park	2019	31.8

With regard to PM_{10}, continuous monitoring data from the EPA Zone A stations was reviewed. The stations representative of the Proposed Scheme are Ballyfermot, Blanchardstown, Dún Laoghaire, Phoenix Park, Rathmines, Tallaght and Winetavern Street. Sufficient data is available to review long-term trends over a five year period (2015 to 2019), as outlined in Table 7.16. Long-term annual average levels at the urban and suburban sites of Ballyfermot, Dun Laoghaire, Rathmines and Phoenix Park from 9µg/m^3 to 16µg/m^3 over the period 2015 to 2019 compared to the annual limit value of 40µg/m^3, with an average concentration of 13µg/m^3 over this period. Levels ranged between 11µg/m^3 - 15µg/m^3 in 2019, with a maximum of nine exceedances (at Rathmines) of the 24-hour limit value of 50µg/m^3 (35 exceedances are permitted per year).

Average PM_{10} levels at the urban traffic monitoring location of Blanchardstown Station, which is in close proximity to the Proposed Scheme, were reviewed. The annual averages range from 15µg/m^3 to 19µg/m^3 in 2015 to 2019, with between 2 and 11 exceedance of the 24-hour limit value of 50µg/m^3. The City Centre monitoring location of Winetavern Street has a long-term average (2015 to 2019) of 14µg/m^3 with an annual average in 2019 of 15µg/m^3.

Continuous $PM_{2.5}$ monitoring carried out at the Zone A locations of Ballyfermot, Phoenix Park, Davitt Road, Ringsend, Finglas, Rathmines and Marino showed average levels of 9µg/m^3 in 2019. The Phoenix Park monitoring station is located near sections of the Proposed Scheme. The annual average concentration measured in Phoenix Park was 8µg/m^3 in 2019, with the average concentrations of 6µg/m^3 in 2018 compared to the annual limit value of 25µg/m^3. Phoenix Park monitors both PM_{10} and $PM_{2.5}$ allowing a ratio of PM_{10} to $PM_{2.5}$ to be calculated. The average $PM_{2.5}/PM_{10}$ ratio in Marino was 0.73 in 2019.

Table 7.16 Trends in Suburban and Urban PM_{10} Concentration (µg/m^3) In Dublin 2015 to 2019

Station	Station Classification Council Directive 96/62/EC*	Averaging Period	Year					Limit Value
			2015	2016	2017	2018	2019	
Blanchardstown	Urban Traffic	Annual Mean PM_{10} (µg/m^3)	17	18	15	17	19	40
		90th%ile 24-hr PM_{10} (µg/m^3)	36	33	36	32	31	50
Winetavern Street	Urban Traffic	Annual Mean PM_{10} (µg/m^3)	14	14	13	14	15	40
		90th%ile 24-hr PM_{10} (µg/m^3)	25	23	21	24	25	50
Ballyfermot	Suburban Background	Annual Mean PM_{10} (µg/m^3)	12	11	12	16	14	40
		90th%ile 24-hr PM_{10} (µg/m^3)	22	21	21	24	26	50
Tallaght	Suburban Background	Annual Mean PM_{10} (µg/m^3)	14	14	12	15	12	40
		90th%ile 24-hr PM_{10} (µg/m^3)	26	28	22	24	21	50
Phoenix Park	Urban Background	Annual Mean PM_{10} (µg/m^3)	12	11	9	11	11	40
		90th%ile 24-hr PM_{10} (µg/m^3)	20	20	16	18	18	50
Rathmines	Urban Background	Annual Mean PM_{10} (µg/m^3)	15	15	13	15	15	40

Station	Station Classification Council Directive 96/62/EC*	Averaging Period	Year					Limit Value
			2015	2016	2017	2018	2019	
		90th%ile 24-hr PM_{10} (µg/m³)	28	28	24	25	24	50

7.3.2.2 Site-Specific Monitoring Data

Monitoring of NO_2 in proximity to the Proposed Scheme, and roads that have the potential to be impacted by it, was carried out using passive diffusion tubes. The baseline monitoring study was carried out close to the alignment of the Proposed Scheme, with monitoring focusing on areas of greatest potential impact. The results of the monitoring survey allow for an indicative comparison with the annual limit value for NO_2. Diffusion tubes are a useful tool for assessing the spatial variation of NO_2 as they do not require an electrical connection and allow for multiple locations to be monitored at the same time. The results also provide information on the influence of road sources relative to the prevailing background level of these pollutants in the area. The spatial variation in NO_2 levels away from air emission sources is particularly important, as a complex relationship exists between NO, NO_2 and O_3 leading to a non-linear variation of NO_2 concentrations with distance from these sources.

A baseline NO_2 monitoring survey was undertaken as part of the air quality assessment for the BusConnects Dublin - Core Bus Corridors Infrastructure Works (hereafter referred to as the Proposed Works). Monitoring at 112 locations was completed for a seven-month data collection period (with six diffusion tube change overs between 15 November 2019 to 8 June 2020). However, due to COVID-19 impacts on the baseline traffic environment, the final two data sets (16 March 2020 to 8 June 2020) are considered non 'typical' baseline data and therefore are not included in the baseline data set.

Under TII Air Quality Guidelines (TII 2011) a minimum of one month baseline monitoring is required, ideally extending to at least three months. The TII Air Quality Guidelines specifically state that:

> *'Monitoring should ideally be carried out for a period of six months, including both summer and winter periods. However, for practical reasons, the monitoring period may be shorter, but, wherever possible, should extend for at least 3 months and should not be less than 1 month'.*

In general, four months of typical (i.e. prior to COVID-19 conditions) baseline data was collected which achieves the minimum monitoring period recommended in the TII Air Quality Guidelines.

Studies in the UK have shown that diffusion tube monitoring results generally have a positive or negative bias when compared to continuous analysers. This bias is laboratory specific and is dependent on the specific analysis procedures at each laboratory. A diffusion tube bias of 0.77 was obtained for the SOCOTEC laboratory (which analysed the diffusion tubes) from the UK DEFRA website (DEFRA, 2018). In addition, three diffusion tubes were co-located with the continuous EPA NO_2 monitors at a number of locations across the Proposed Works in order to develop a local bias adjustment factor specific to the Proposed Works in order to develop a local bias adjustment factor specific to the Proposed Scheme. A bias adjustment factor was calculated for the St. John's Road (near Heuston Station) monitor of 0.76. A bias adjustment factor of 0.77 was selected for the diffusion tube monitoring results as this value was the more conservative of the laboratory derived and site-specific biases.

In addition to the bias adjustment, an annualisation factor is required as the monitoring period did not extend to a full year. The annualisation factor was prepared as per LAQM (TG16) (DEFRA, 2018). The annualisation factor is necessary as NO_2 concentrations vary across the year and this should be accounted for within the baseline monitoring. The factor was calculated using 2019 monitoring data from Ballyfermot, Winetavern, Davitt Road and St. Johns Road using Box 7.10 of LAQM (TG16). This factor was calculated to be 0.986 for the period of the diffusion tube monitoring.

The ten monitored locations in the vicinity of the Proposed Scheme are shown Table 7.17 and Figure 7.1 in Volume 3 of this EIAR. Table 7.18 and Diagram 7.4 outlines the results of the baseline NO2 diffusion tube monitoring over the period 15 November 2019 to 16 March 2020.

The highest four-month average concentration was recorded at a roadside location at 38 Blackhall Place (tube no. 5.10) which was the closest monitoring location to the City Centre. Concentrations at this location were 44.9µg/m^3 or 112% of the annual mean limit value with the bias adjustment and annualisation factor applied. This was the only location to show an exceedance in the annual mean limit value for NO2. The nearby location at Brunswick Street North shows an annual mean value of 39.5µg/m3 or 99% of the limit value.

The lowest concentration was recorded at the Blanchardstown Shopping Centre, in proximity to the north- western end of the Proposed Scheme (tube no. 5.1) (25.9µg/m^3). This location is a commercial shopping area and located along the Proposed Scheme.

A co-location triplicate was placed at the Blanchardstown EPA monitoring station. For the four-month monitoring period the annualised value was 27.1µg/m^3. This shows good agreement with the range of annual average levels at the urban traffic Blanchardstown location which ranged from 25µg/m^3 to 31µg/m^3 over the period 2014 to 2018, with an average concentration of 25µg/m^3 in 2018 as shown in Table 7.18.

Based on guidance from DEFRA, it can be considered that exceedances of the NO_2 one-hour limit value objective may occur at roadside sites if the annual mean is above 60µg/m^3 (DEFRA, 2018). None of the ten sites monitored are considered likely to exceed the NO_2 one-hour limit value objective.

Table 7.17: Air Quality Monitoring Locations

Tube No.	Reference	Site	East (ITM)	North (ITM)
5.1	CBC0005DT001	Blanchardstown Shopping Centre	706849	739334
5.2	CBC0005DT002	Blanchardstown EPA Collocation	708438	738512
5.3	CBC0005DT003	391 Navan Road	711072	737039
5.4	CBC0005DT004	Daughters of Charity Disability Support	711506	736802
5.5	CBC0005DT005	St. Josephs School for Deaf Boys	712835	736186
5.6	CBC0005DT006	108 Cabra Road	713949	735915
5.7	CBC0005DT007	71 Old Cabra Road	713641	735700
5.8	CBC0005DT008	33 Aughrim Street	713909	735144
5.9	CBC0005DT009	Brunswick Street	714658	734748
5.10	CBC0005DT010	38 Blackhall Place	714399	734581

Table 7.18: Air Quality Monitoring Results

Tube No.	Site	15 Nov – 15 Dec 2019 (µg/m³)	15 Dec 2019 – 15 Jan 2020 (µg/m³)	15 Jan – 17 Feb 2020 (µg/m³)	15 Feb – 16 Mar 2020 (µg/m³)	Average (µg/m³)	Locally Bias adjusted and annualised NO_2 Concentration (µg m^{-3}) Note 1, Note 2
5.1	Blanchardstown Shopping Centre	37.7	40.9	33.9	23.9	34.1	25.9
5.2	Blanchardstown EPA Collocation	51.4	37.3	31.9	22.4	35.8	27.1
5.3	391 Navan Road	57.7	50.9	Lost	35.8	48.1	**36.5**
5.4	Daughters of Charity Disability Support	49.1	42.4	Lost	25.5	39.0	29.6
5.5	St. Josephs School for Deaf Boys	43.8	40.4	38.7	24.1	36.8	27.9
5.6	108 Cabra Road	41.1	32.0	29.9	Lost	34.3	26.1
5.7	71 Old Cabra Road	60.1	47.6	Lost	35.0	47.6	**36.1**
5.8	33 Aughrim Street	48.9	Lost	29.3	24.2	34.1	25.9
5.9	Brunswick Street	64.0	53.0	47.9	43.4	52.1	**39.5**
5.10	38 Blackhall Place	71.7	58.5	Lost	47.2	59.1	**44.9**
Average		52.6	44.8	35.3	31.3	42.1	32.0
Max		71.7	58.5	47.9	47.2	59.1	44.9
Min		37.7	32	29.3	22.4	34.1	25.9

Note 1: Bias adjustment factor: 0.77, Annualisation factor: 0.986

Note 2: Locally bias adjusted concentrations in bold exceed the 90% threshold value for screening modelling

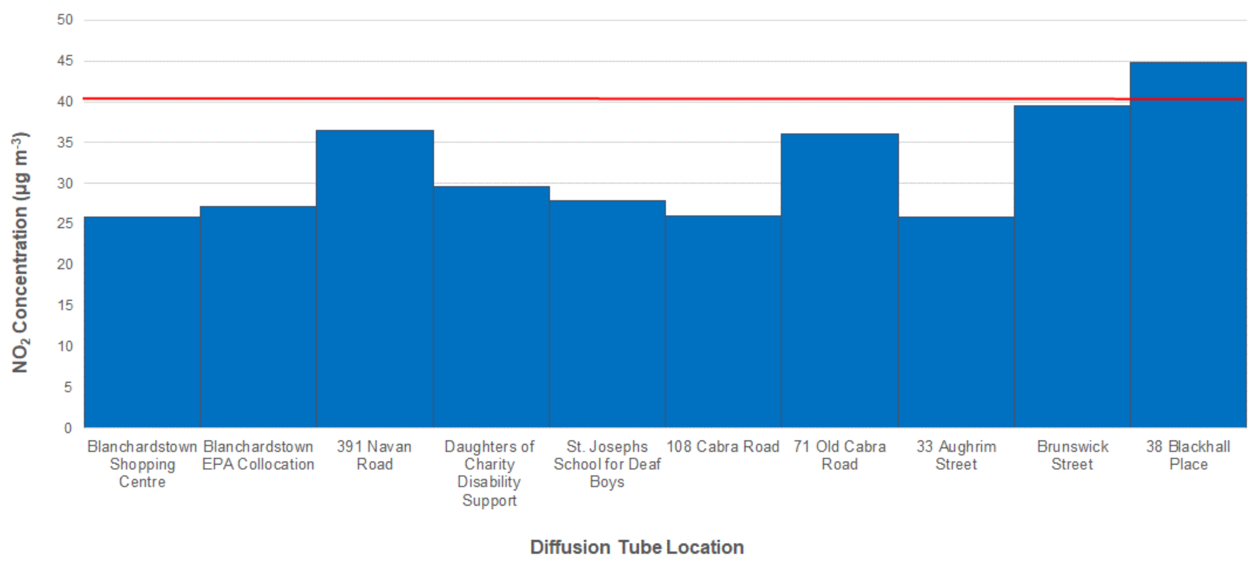

Diagram 7.4: Locally Bias Adjusted and Annualised NO_2 Concentration (µg/m³)

* Annual mean limit value denoted by red line.

7.3.3 Existing Modelled Baseline Scenario

In the Existing Baseline Scenario, the current air quality environment experienced within the study area has been modelled. The Existing Baseline modelling scenario has been modelled using AMDS-Roads for the representative baseline year of 2019, to establish baseline concentrations at receptors within the Proposed Scheme study area. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} limit value objective, at selected most impacted existing air quality sensitive receptors in the 2019 Existing Baseline scenario are listed in Table 7.19. Locations of these receptors are shown in Figures 7.3 to 7.8 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 1.1 (Appendix A7.1 – Detailed Modelling Results in Volume 4 of this EIAR).

Table 7.19: Predicted Existing Baseline Scenario Pollutant Statistics At Most Impacted Receptor Locations

Receptor	Receptor Location (ITM)	Existing Baseline (2019)			
		Annual Mean Conc. (μg/m^3)			No of PM_{10} days > 50 μg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ1	713494,735835	30.5	15.7	11.1	<1
AQ2	712077,736576	28.6	15.2	10.8	<1
AQ7	714379,734737	33.6	15.9	11.2	1
AQ8	713718,735674	28.3	15.4	10.9	<1
AQ12	713830,735544	29.0	15.5	10.9	<1
AQ14	714378,734710	33.2	15.8	11.2	<1
AQ17	713884,735539	29.1	15.4	10.9	<1
AQ25	714332,734823	34.4	16.1	11.3	1
AQ27	713987,735284	33.7	16.0	11.3	1
AQ31	714021,735199	28.3	15.2	10.8	<1
AQ35	713996,735298	31.8	15.7	11.1	<1
AQ36	713973,735329	33.9	16.1	11.3	1
AQ38	713967,735400	31.3	15.6	11.0	<1
AQ39	714526,734396	35.6	16.1	11.4	1
AQ40	714520,734385	34.9	16.0	11.3	1
AQ46	714503,734359	36.0	16.0	11.3	1
AQ49	714118,735045	27.8	15.2	10.7	<1
AQ52	714389,734384	38.3	16.1	11.4	1
AQ57	714411,734396	38.1	16.2	11.4	1
AQ63	714287,734914	33.9	16.0	11.3	1
AQ66	714289,734860	28.7	15.3	10.8	<1
AQ67	714353,734371	41.9	16.4	11.6	1
AQ71	714295,734899	34.4	16.1	11.4	1
AQ81	714527,734413	35.6	16.2	11.4	1
AQ96	714030,735193	30.8	15.6	11.0	<1
AQ98	714528,734447	32.5	15.8	11.2	<1
AQ103	714052,735163	32.7	15.9	11.2	1
AQ111	714232,734996	30.4	15.5	11.0	<1
AQ113	714058,735154	32.2	15.8	11.2	<1
AQ114	714517,734470	33.7	16.0	11.3	1
AQ116	714515,734447	35.2	16.2	11.4	1
AQ122	714249,734974	33.9	16.1	11.3	1

Receptor	Receptor Location (ITM)	Existing Baseline (2019) Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ126	713801,735612	28.9	15.5	10.9	<1
AQ129	714272,734941	33.6	16.0	11.3	1
AQ132	713784,735625	28.9	15.5	10.9	<1
AQ137	714891,734794	39.0	16.6	11.7	1
AQ142	714303,734881	31.7	15.7	11.1	<1
AQ145	714173,735008	29.4	15.3	10.8	<1
AQ150	714310,734866	32.3	15.8	11.2	<1
AQ157	714322,734844	32.9	15.9	11.2	1
AQ172	714137,735077	32.5	15.7	11.1	<1
AQ176	713788,735581	28.2	15.4	10.9	<1
AQ177	714410,734683	38.0	16.8	11.8	1
AQ186	714340,734787	30.3	15.4	10.9	<1
AQ188	714120,735063	27.7	15.1	10.7	<1
AQ191	714516,734318	41.9	17.0	11.9	1
AQ202	714127,735091	31.0	15.6	11.0	<1
AQ210	714134,735029	27.8	15.1	10.7	<1
AQ236	714188,734993	29.0	15.3	10.8	<1
AQ240	713336,735924	32.1	16.0	11.3	1
AQ253	713437,735870	30.3	15.7	11.1	<1
AQ257	713533,735817	28.8	15.4	10.9	<1
AQ262	713413,735884	30.2	15.7	11.1	<1
AQ270	713967,735474	29.9	15.3	10.8	<1
AQ283	714413,734700	34.6	16.1	11.4	1
AQ287	713557,735794	29.4	15.6	11.0	<1
AQ291	713938,735466	34.8	15.8	11.2	<1
AQ299	713965,735427	29.7	15.4	10.9	<1
AQ303	714537,734631	32.8	15.9	11.2	1
AQ306	713926,735504	35.9	16.0	11.3	1
AQ308	713907,735517	32.0	15.6	11.1	<1
AQ309	713862,735512	31.1	15.7	11.1	<1
AQ310	713871,735503	32.3	15.9	11.2	1
AQ315	713856,735481	30.5	15.6	11.0	<1
AQ316	714532,734591	33.0	15.9	11.3	1
AQ196	714529,734315	39.8	16.8	11.8	1
AQ318	713479,735855	28.1	15.3	10.8	<1
AQ205	714810,734154	38.8	16.6	11.7	1
AQ323	714526,734551	33.5	16.0	11.3	1
AQ330	713694,735693	27.8	15.3	10.8	<1
AQ331	714352,734774	30.8	15.5	11.0	<1

Receptor	Receptor Location (ITM)	Existing Baseline (2019)			
		Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ368	714560,734595	31.2	15.7	11.1	<1
AQ372	714540,734545	35.2	16.3	11.5	1
AQ375	713988,735531	29.5	15.4	10.9	<1
AQ426	714798,734245	46.2	16.7	11.8	1
AQ21	714029,735222	38.2	16.7	11.8	1
AQ29	714347,734803	36.6	16.3	11.5	1
AQ43	714381,734400	44.4	16.9	11.9	1
AQ44	714380,734413	42.7	17.0	11.9	1
AQ45	714362,734427	38.6	16.5	11.6	1
AQ50	714516,734358	37.0	16.1	11.4	1
AQ74	714044,735196	37.3	16.6	11.7	1
AQ77	714058,735176	36.3	16.4	11.6	1
AQ294	714434,734680	32.8	15.9	11.2	1
AQ106	714258,734954	37.5	16.6	11.7	1
AQ118	714194,735028	36.1	16.2	11.4	1
AQ135	714203,735020	35.6	16.1	11.4	1
AQ140	714177,735042	37.8	16.4	11.6	1
AQ233	714497,734253	36.6	16.3	11.5	1
AQ247	714373,734779	36.4	16.3	11.5	1
AQ292	714066,735162	38.7	16.8	11.8	1
AQ296	714107,735115	36.1	16.4	11.5	1
AQ304	714083,735143	36.3	16.4	11.6	1
AQ332	714373,734749	37.1	16.4	11.6	1
AQ10	714400,734722	39.6	16.6	11.7	1
AQ134	714422,734735	44.2	17.3	12.2	1
AQ152	714164,735052	40.1	16.7	11.8	1
AQ73	714438,734330	40.1	16.6	11.7	1
AQ84	714473,734325	40.3	16.6	11.7	1
AQ208	714333,734278	36.5	16.2	11.4	1
AQ412	714044,734365	38.8	17.2	12.0	1
AQ429	715146,734807	37.7	16.8	11.8	1
AQ107	714879,734584	39.1	17.0	11.9	1
AQ108	714878,734543	39.8	17.1	12.0	1
AQ206	713546,734464	38.5	16.8	11.8	1
AQ421	714878,734499	39.8	16.9	11.9	1
AQ422	714878,734515	39.8	17.0	11.9	1
AQ423	714862,734651	39.2	17.0	11.9	1
AQ424	714879,734672	42.0	17.6	12.3	1
AQ425	714879,734630	40.0	17.2	12.0	1

Receptor	Receptor Location (ITM)	Existing Baseline (2019)			
		Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2019 Existing Baseline scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas; 11 exceedances were modelled at receptors on the N1 Church St, R805 Manor St, R804 Blackhall Place and the R148 Ellis Quay and Arran Quay. Concentrations for these receptors can be found in Table 1.1 in Appendix A7.1 Detailed Modelling Results in Volume 4 of this EIAR . Some of these have been excluded from results tables in this chapter as these locations do not exceed the NO_2 limit value in the DM or DS scenarios and they experience a negligible impact due to the Scheme. They are therefore not considered most impacted receptors. Annual mean NO_2 concentrations did not exceed 60 µg/m^3, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objective in 2019 for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than two exceedances of the 50 µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value objective for all modelled receptors.

7.4 Potential Impacts

7.4.1 Characteristics of the Proposed Scheme

In the context of the Proposed Scheme, the potential air quality impact on the surrounding environment must be considered for two distinct stages:

- Construction Phase; and
- Operational Phase.

7.4.2 Construction Phase

During the Construction Phase of the Proposed Scheme, works will involve predominately utility diversions, road widening works, road excavation works (where required), road and junction reconfiguration and resurfacing works, public realm improvements including landscaping, and construction traffic access routes including movement of machinery and materials within and to and from the three construction compounds along the Proposed Scheme.

Other works specific to the Proposed Scheme include:

- Preparatory and site clearance works including ground investigations and partial demolition of the Tolka River Bridge (BR01) and the Mill Road Bridge (BR02);
- The setting up of three construction compounds; and
- A range of structural works including widening of Tolka River Bridge (BR01) and Mill Road Bridge (BR02), pedestrian stair and ramp access (RW07), and retaining walls (various).

Potential air quality impacts associated with the Proposed Scheme will be associated with the Construction Phase and the long term Operational Phase. During the Construction Phase, site clearance and preparation, landscaping, road and junction construction works all have the potential to generate dust and gaseous air emissions on site.

Chapter 5 (Construction) provides a full description of the proposed construction phasing and works for the Proposed Scheme.

For the purposes of the EIAR, five individual construction sections are set out. Sections may be completed simultaneously and combined in certain areas. Table 5.1 in Chapter 5 (Construction) includes a summary of each section with the estimated time for the completion of works in these areas.

It is envisaged that construction may be completed in the following sections:

- **Section 1:** N3 Blanchardstown Junction to Snugborough Road:
  - **Section 1a:** Old Navan Road;
  - **Section 1b:** Blanchardstown Slip Roads;
  - **Section 1c:** Blanchardstown Road;
  - **Section 1d:** Blakestown Roundabout;
  - **Section 1e:** Blakestown Roundabout to Blanchardstown Shopping Centre Roundabout 1;
  - **Section 1f:** Blanchardstown Shopping Centre Roundabout 1;
  - **Section 1g:** Blanchardstown Shopping Centre Roundabout 1 to Roundabout 2, including Bus Depot;
  - **Section 1h:** Blanchardstown Shopping Centre Roundabout 2;
  - **Section 1i:** Blanchardstown Shopping Centre Roundabout 2 to Blanchardstown Road;
  - **Section 1j:** Blanchardstown Shopping Centre Roundabout 2 to Roundabout 3;
  - **Section 1k:** Blanchardstown Shopping Centre Roundabout 3; and
  - **Section 1l:** Blanchardstown Shopping Centre Roundabout 3 to Snugborough Tie In.
- **Section 2:** Snugborough Road to N3 / M50 Junction:
  - **Section 2a:** N3 Dual Carriageway Slip Roads;
  - **Section 2b:** N3 Dual Carriageway to Navan Road;
  - **Section 2c:** N3 Structure Widening; Central Reservation;
  - **Section 2d:** N3 Structure Widening; Mill Road South;
  - **Section 2e:** N3 Structure Widening; Mill Road North;
  - **Section 2f:** Old Navan Road to M50 Roundabout; and
  - **Section 2g:** M50 Roundabout.
- **Section 3:** N3 / M50 Junction to Navan Road / Ashtown Road Junction:
  - **Section 3a:** M50 Roundabout to Railway Station;
  - **Section 3b:** Railway Station to Ashtown Road Roundabout; and
  - **Section 3c:** Ashtown Road Roundabout.
- **Section 4:** Navan Road / Ashtown Road Junction to Navan Road / Old Cabra Road Junction:
  - **Section 4a:** Ashtown Road Roundabout to Baggot Road;
  - **Section 4b:** Baggot Road to Skreen Road;
  - **Section 4c:** Skreen Road to Railway Line; and
  - **Section 4d:** Ratoath Road Junction.
- **Section 5:** Navan Road / Old Cabra Road Junction to Ellis Quay:
  - **Section 5a:** Railway Line to Aughrim Street;
  - **Section 5b:** Aughrim Street to Brunswick Street;
  - **Section 5c:** Blackhall Place;
  - **Section 5d:** Queens Street;
  - **Section 5e:** Brunswick Street North;
  - **Section 5f:** Kings Street North;
  - **Section 5g:** Blackhall Street;
  - **Section 5h:** Georges Lane; and
  - **Section 5i:** Off-line Sections.

Road works by their nature are transient in nature as the works progress along the length of the route of the Proposed Scheme. This includes excavation and fill works and road completion works.

The potential air quality impacts associated with this phase are set out within Sections 7.4.2.1 and 7.4.2.2.

7.4.2.1 Construction Dust Assessment

In order to determine the level of dust mitigation required during the proposed works, the potential dust emission magnitude for each dust generating activity needs to be taken into account, in conjunction with the sensitivity of the area, as outlined above (Section 7.2.4.4).

The Institute of Air Quality Management (IAQM) has issued guidelines (IAQM, 2014) which also outline the assessment criteria for assessing the impact of dust emissions from construction activities based on both receptor sensitivity and the number of receptors affected. In terms of receptor sensitivity, the study area is characterised as having high, medium and low sensitivity receptors within 350m of the construction activities associated with the Proposed Scheme.

Table 7.11 identifies how the sensitivity of an area may be determined for dust soiling taking into account the number of receptors, the receptor sensitivity and distance from the source. The area in proximity to the Proposed Scheme would be an area of high sensitivity with greater than 100 receptors within 20m of the construction activities.

In addition, the IAQM guidelines outline the assessment criteria for assessing the impact of PM_{10} emissions from construction activities based on current annual mean PM_{10} concentration, receptor sensitivity and the number of receptors affected. The current PM_{10} concentration in Zone A locations as reported in Section 7.3.2.1 is approximately 15 $\mu g/m^3$. Based on the criteria outlined in Table 7.12 the risk to human health from PM_{10} emissions at the nearest residential receptor (high sensitivity, distance less than 20m and with receptor numbers between >100) is considered medium under this guidance.

Table 7.13 identifies how the sensitivity of an area may be determined for ecological impacts taking into account the distance from the source to an ecological receptor and this sensitivity of the ecological receptor. The Royal Canal pNHA is an ecological receptor of medium sensitivity in proximity to the Proposed Scheme with a particularly important plant species, where its dust sensitivity is uncertain or unknown within 20m of the construction activities.

The major dust generating activities are divided into four types within the IAQM guidance (IAQM, 2014) to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

7.4.2.1.1 Demolition

Demolition will primarily involve the partial demolition of the Tolka River Bridge (BR01) and the Mill Road Bridge (BR02). The dust emission magnitude from demolition can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total building volume > 50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities > 20 m above ground level;
- **Medium:** Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- **Small:** Total building volume < 20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities < 10 m above ground, demolition during wetter months.

The dust emission magnitude for the proposed demolition activities can be classified as small as the total building volume is likely to be less than 20,000m^3 and there is low potential for dust release as only partial demolition of Tolka River Bridge and Mill Road Bridge will take place.

The magnitude for each dust generating activity is combined with the sensitivity of the area to define the risk of dust impacts in the absence of mitigation. The sensitivity of the area is considered to be high for dust soiling and medium for human health impacts. As outlined in Table 7.20 this results in an overall low risk of temporary dust soiling impacts and a low risk of temporary human health impacts as a result of the proposed demolition activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed earthwork activities is described as low.

Overall, in order to ensure that no dust nuisance occurs during the demolition activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will not have a significant impact at nearby receptors.

Table 7.20:Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

7.4.2.1.2 Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling activities. Activities such as site preparation and landscaping works are also considered under this category. The dust emission magnitude from earthworks can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total site area > 10,000 m^2, potentially dusty soil type (e.g. clay which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved >100,000 tonnes;
- **Medium:** Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8 m in height, total material moved 20,000 – 100,000 tonnes; and
- **Small:** Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 20,000 tonnes, earthworks during wetter months.

The dust emission magnitude for the proposed earthwork activities required for the Proposed Scheme can be classified as large. The proposed construction compounds plus the Proposed Scheme construction site areas will have a total site area greater than 10,000 m^2 and there may be more than ten heavy earth moving vehicles in use at any one time during construction. There is also likely to be potentially dusty material type such as clay and a total material movement of 100,000 tonnes.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. The sensitivity of the area would be described as high for dust soiling and medium for human health impacts. As outlined in Table 7.21, this results in an overall high risk of temporary dust soiling impacts and an overall high risk of temporary human health impacts as a result of the proposed earthworks activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed earthwork activities is described as high.

Overall, in order to ensure that no dust nuisance occurs during the proposed earthworks activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will not have a significant impact at nearby receptors.

Table 7.21:Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

7.4.2.1.3 Construction

Dust emission magnitude from construction can be classified as small, medium or large based on the definitions from the IAQM guidance as transcribed below:

- **Large:** Total building volume > 100,000 m^3, on-site concrete batching, sandblasting;
- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on-site concrete batching; and
- **Small:** Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The dust emission magnitude for the proposed construction activities can be classified as large. There will be greater than 100,000 m^3 being constructed as part of the works and there may be need for on-site concrete batching. The key construction activities after earthworks are installation of the paving materials.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 7.22, this results in an overall high risk of temporary dust soiling impacts and an overall high risk of temporary human health impacts as a result of the proposed construction activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed construction activities is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the construction activities, a range of dust mitigation measures associated with a high risk of dust impacts will be implemented. When the dust mitigation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will not have a significant impact at nearby receptors.

Table 7.22:Risk of Dust Impacts - Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

7.4.2.1.4 Trackout

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

- **Large:** > 50 HDV (> 3.5 t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100 m;
- **Medium:** 10 - 50 HDV (> 3.5 t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 - 100 m; and
- **Small:** < 10 HDV (> 3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.

The dust emission magnitude for the proposed trackout can be classified as large with greater than 50 HDV outward movements in any one day.

The sensitivity of the area is combined with the dust emission magnitude for each dust generating activity to define the risk of dust impacts in the absence of mitigation. As outlined in Table 7.23, this results in an overall high risk of temporary dust soiling impacts and an overall high risk of temporary human health impacts as a result of the proposed trackout activities. In relation to ecological impact, as the receptor is of medium sensitivity, the risk associated with the proposed trackout is described as medium.

Overall, in order to ensure that no dust nuisance occurs during the trackout activities, a range of dust mitigation measures associated with a high risk of dust impacts must be implemented. When the dust mitigation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the Proposed Scheme will be insignificant and will not pose significant nuisance at nearby receptors.

Table 7.23:Risk of Dust Impacts - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Summary of Potential Dust Impacts

The risk of dust impacts as a result of the Proposed Scheme are summarised in Table 7.24 for each activity. The magnitude of risk determined is used to prescribe the level of site specific mitigation required for each activity in order to prevent significant impacts occurring.

In accordance with the EPA Guidelines (EPA 2022) the impacts associated with the Construction Phase dust emissions pre-mitigation are overall negative, not significant and short-term.

Table 7.24:Summary of Dust Impact Risk Used to Define Site-Specific Mitigation

Potential Impact	Dust Emission Magnitude			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	High Risk	High Risk	High Risk
Human Health	Low Risk	High Risk	High Risk	High Risk
Ecological	Low Risk	Medium Risk	Medium Risk	Medium Risk

7.4.2.2 Construction Traffic Assessment

In addition to direct impacts from the construction works including site compounds, there is also the potential for air impacts from construction traffic along public roads.

A detailed analysis of construction traffic volumes has been conducted to determine the expected HDV movements required to transport the materials extracted and delivered to site. A total of 22 public roads has been identified as required construction access routes where construction traffic will be permitted to travel along. Whilst the overall construction period is forecast as 24 months, construction traffic movements are assumed to occur over a 12-month period along construction access roads accessing specific work zones as a worst-case. For national and regional roads serving multiple work zones, a construction period of 18 months has been assumed.

Traffic volumes for the base scenario are based on the 2024 Do Minimum flows projected along the local road network. These are AADT flows with percentage HDV flows. An additional 720 HDV vehicles per day associated with construction traffic along each road including construction deliveries and earthworks material haulage are added to the base traffic volumes. The estimated construction traffic volumes are based on the peak construction period volumes and are therefore a worst-case assumption. In reality, the Proposed Scheme will be constructed in phases with lower volumes and the corridor of the Proposed Scheme will be used for a large bulk of construction delivery vehicles along its route.

In order to determine the potential air quality impacts associated with additional construction traffic on the identified construction access routes, a comparison between ambient air concentrations for the 2024 Do Minimum scenario and the 2024 Do Something (construction) scenario was carried out.

7.4.2.2.1 'Do Minimum' Scenario

The Do Minimum (DM) is a defined scenario within the traffic modelling analysis in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, not including construction traffic associated with the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the construction year of 2024. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} limit value objective, at selected most impacted existing air quality sensitive receptors in the 2024 DM scenario are listed in Table 7.25. Locations of these receptors are shown in Figures 7.6 to 7.9 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 2.1 (Appendix A7.1 in Volume 4 of this EIAR). 'Most impacted' refers to those receptors with non-negligible impacts due to the Construction Phase of the Scheme.

Table 7.25: Predicted 2024 Do Minimum Construction Pollutant Statistics At Most Impacted Receptor Locations

DM (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ1	713494,735835	30.2	15.7	15.0	1
AQ2	712077,736576	27.9	15.1	14.7	<1
AQ39	714526,734396	35.3	16.1	15.3	1
AQ43	714381,734400	43.4	16.8	15.8	1
AQ44	714380,734413	41.8	17.0	15.9	1
AQ45	714362,734427	37.9	16.5	15.6	1
AQ52	714389,734384	37.4	16.0	15.3	1
AQ57	714411,734396	36.8	16.1	15.3	1
AQ67	714353,734371	40.4	16.4	15.5	1
AQ71	714295,734899	34.5	16.1	15.3	1
AQ81	714527,734413	35.2	16.1	15.3	1
AQ114	714517,734470	33.4	16.0	15.2	1
AQ116	714515,734447	34.8	16.2	15.4	1
AQ134	714422,734735	39.8	16.8	15.8	1
AQ135	714203,735020	35.8	16.2	15.4	1
AQ167	712762,736797	25.8	14.9	14.6	<1
AQ168	712729,736917	25.4	14.9	14.5	<1
AQ191	714516,734318	41.2	16.9	15.8	1
AQ196	714529,734315	39.1	16.7	15.7	1
AQ208	714333,734278	36.2	16.2	15.4	1
AQ233	714497,734253	36.5	16.3	15.5	1

DM (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ240	713336,735924	31.8	16.0	15.2	1
AQ253	713437,735870	30.0	15.7	15.0	1
AQ283	714413,734700	34.2	16.1	15.3	1
AQ284	712018,736596	28.0	15.1	14.7	<1
AQ294	714434,734680	32.6	15.9	15.2	1
AQ332	714373,734749	36.7	16.4	15.5	1
AQ10	714400,734722	38.9	16.6	15.6	1
AQ21	714029,735222	38.7	16.9	15.8	1
AQ29	714347,734803	36.3	16.3	15.5	1
AQ50	714516,734358	36.6	16.0	15.3	1
AQ74	714044,735196	37.6	16.7	15.7	1
AQ77	714058,735176	36.6	16.5	15.6	1
AQ106	714258,734954	37.7	16.6	15.6	1
AQ118	714194,735028	36.3	16.2	15.4	1
AQ140	714177,735042	38.0	16.4	15.5	1
AQ152	714164,735052	40.3	16.7	15.7	1
AQ177	714410,734683	37.6	16.8	15.7	1
AQ247	714373,734779	36.0	16.3	15.4	1
AQ292	714066,735162	39.1	16.9	15.8	1
AQ296	714107,735115	36.5	16.5	15.5	1
AQ304	714083,735143	36.6	16.5	15.6	1
AQ412	714044,734365	38.2	17.1	15.9	1
AQ107	714879,734584	39.0	16.9	15.8	1
AQ108	714878,734487	39.3	16.9	15.8	1
AQ137	714891,734794	38.7	16.6	15.6	1
AQ411	713806,734404	45.7	17.9	16.4	2
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2024 DM scenario annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas; seven exceedances were modelled at receptors on the R805 Manor St, R109 Parkgate St, R804 Blackhall Place and the R148 Arran Quay. Concentrations at all receptors with exceedances can be found in Table 2.1 (Appendix A7.1, Volume 4 of this EIAR). Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations did not exceed 60 µg/m^3, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objective for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than two exceedances of the 50 µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value objective for all modelled receptors.

7.4.2.2.2 'Do Something' Scenario

The Do Something (DS) is a defined scenario within the traffic modelling analysis in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, including the construction traffic associated with the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the construction year of 2024 in line with the methodology set out in Section 7.2.4.1. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24 hour PM_{10} limit value objective, at selected most impacted existing air quality sensitive receptors in the 2024 DS scenario are listed in Table 7.26. Locations of these receptors are shown in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 2.2 (Appendix A7.1 in Volume 4 of this EIAR). 'Most impacted' refers to those receptors with non-negligible impacts due to the Construction Phase of the Scheme.

Table 7.26: Predicted 2024 Do Something Construction Scenario Pollutant Statistics At Most Impacted Receptor Locations

DS (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ1	713494,735835	26.7	15.1	14.7	<1
AQ2	712077,736576	23.9	14.5	14.3	<1
AQ39	714526,734396	33.2	15.8	15.1	1
AQ43	714381,734400	42.1	16.6	15.7	1
AQ44	714380,734413	40.3	16.7	15.7	1
AQ45	714362,734427	36.6	16.3	15.4	1
AQ52	714389,734384	36.7	15.9	15.2	1
AQ57	714411,734396	36.1	16.0	15.3	1
AQ67	714353,734371	39.9	16.3	15.4	1
AQ71	714295,734899	32.5	15.8	15.1	1
AQ81	714527,734413	33.1	15.8	15.1	1
AQ114	714517,734470	31.2	15.6	15.0	1
AQ116	714515,734447	32.4	15.8	15.1	1
AQ134	714422,734735	39.1	16.7	15.7	1
AQ135	714203,735020	33.4	15.8	15.2	1
AQ167	712762,736797	20.7	15.0	14.6	<1
AQ168	712729,736917	20.5	15.0	14.6	<1
AQ191	714516,734318	39.8	16.7	15.7	1
AQ196	714529,734315	38.0	16.6	15.6	1
AQ208	714333,734278	35.8	16.1	15.3	1
AQ233	714497,734253	35.6	16.2	15.4	1
AQ240	713336,735924	27.7	15.2	14.7	<1
AQ253	713437,735870	26.5	15.1	14.7	<1
AQ283	714413,734700	32.0	15.7	15.1	1
AQ284	712018,736596	24.0	14.6	14.3	<1
AQ294	714434,734680	30.1	15.6	15.0	1
AQ332	714373,734749	34.7	16.1	15.3	1
AQ10	714400,734722	36.5	16.2	15.4	1

DS (2024)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ21	714029,735222	36.4	16.5	15.6	1
AQ29	714347,734803	34.2	16.1	15.3	1
AQ50	714516,734358	34.6	15.8	15.1	1
AQ74	714044,735196	35.2	16.3	15.4	1
AQ77	714058,735176	34.2	16.2	15.3	1
AQ106	714258,734954	35.4	16.3	15.4	1
AQ118	714194,735028	33.8	15.9	15.2	1
AQ140	714177,735042	35.1	16.1	15.3	1
AQ152	714164,735052	37.0	16.3	15.5	1
AQ177	714410,734683	34.7	16.3	15.4	1
AQ247	714373,734779	34.0	16.0	15.3	1
AQ292	714066,735162	36.3	16.5	15.6	1
AQ296	714107,735115	34.1	16.1	15.3	1
AQ304	714083,735143	34.2	16.2	15.3	1
AQ412	714044,734365	26.7	17.3	16.0	1
AQ107	714879,734584	40.7	17.2	16.0	1
AQ108	714878,734487	40.9	17.2	16.0	1
AQ137	714891,734794	39.3	16.7	15.7	1
AQ411	713806,734404	46.5	18.1	16.6	2
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2024 DS scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas; six exceedances were modelled at receptors on the N1, R109 Parkgate St and the R804 Blackhall Place. This is a decrease from seven exceedances modelled in the DM scenario. Concentrations at all receptors with exceedances can be found in Table 2.2 (Appendix A7.1, Volume 4 of this EIAR). Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations did not exceed 60 µg/m^3, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objectives for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than two exceedances of the 50 µg/m^3 ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value objectives for all modelled receptors.

7.4.2.2.3 Comparison of Do Something with Do Minimum

Table 7.27 provides the predicted change in and impact on pollutant concentrations, between the DM and DS in 2024. Statistics for the full list of modelled receptors can be found in Table 2.3 (Appendix A7.1 in Volume 4 of this EIAR). 'Most impacted' refers to those receptors with non-negligible impacts due to the Construction Phase of the Scheme.

Table 7.27: Predicted Changes in Construction DM and DS and Impact Significance Criteria At Most Impacted Receptor Locations

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (μg/m³)			Change in No of PM_{10} days > 50 μg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ1	719556,731057	-3.5	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ2	719556,731058	-4.1	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ39	719556,731095	-2.0	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ43	719556,731099	-1.3	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ44	719556,731100	-1.6	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ45	719556,731101	-1.3	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ52	719556,731108	-0.7	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ57	719556,731113	-0.7	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ67	719556,731123	-0.6	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ71	719556,731127	-2.1	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ81	719556,731137	-2.2	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ114	719556,731170	-2.2	-0.4	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ116	719556,731172	-2.4	-0.4	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ134	719556,731190	-0.7	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ135	719556,731191	-2.4	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ167	719556,731223	-5.1	0.1	0.1	<1	Slight Beneficial	Negligible	Negligible
AQ168	719556,731224	-4.9	0.1	0.1	<1	Slight Beneficial	Negligible	Negligible
AQ191	719556,731247	-1.4	-0.2	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ196	719556,731252	-1.1	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ208	719556,731264	-0.4	<0.1	<0.1	0	Slight Beneficial	Negligible	Negligible
AQ233	719556,731289	-0.9	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ240	719556,731296	-4.1	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ253	719556,731309	-3.6	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ283	719556,731339	-2.2	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ284	719556,731340	-4.0	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ294	719556,731350	-2.4	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ332	719556,731388	-2.0	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ10	719556,731066	-2.4	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ21	719556,731077	-2.3	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ29	719556,731085	-2.1	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ50	719556,731106	-2.1	-0.2	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ74	719556,731130	-2.5	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ77	719556,731133	-2.4	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ106	719556,731162	-2.2	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ118	719556,731174	-2.6	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ140	719556,731196	-2.9	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ152	719556,731208	-3.3	-0.4	-0.3	0	Moderate Beneficial	Negligible	Negligible
AQ177	719556,731233	-2.9	-0.5	-0.3	0	Moderate Beneficial	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50 µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ247	719556,731303	-2.0	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ292	719556,731348	-2.8	-0.4	-0.3	0	Moderate Beneficial	Negligible	Negligible
AQ296	719556,731352	-2.4	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ304	719556,731360	-2.4	-0.4	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ412	719556,731468	-11.5	0.1	0.1	0	Moderate Beneficial	Negligible	Negligible
AQ107	719556,731163	1.7	0.3	0.2	0	Slight Adverse	Negligible	Negligible
AQ108	719556,731164	1.7	0.3	0.2	0	Slight Adverse	Negligible	Negligible
AQ137	719556,731193	0.6	0.1	0.1	0	Slight Adverse	Negligible	Negligible
AQ411	719556,731467	0.7	0.2	0.1	0	Slight Adverse	Negligible	Negligible

The significance of the changes in the concentration of each of the ambient receptors has been determined in the context of the TII significance criteria (TII 2011). As shown in Table 7.27 and Figure 7.6 in Volume 3 of this EIAR, the majority of modelled receptors are estimated to experience a negligible impact due to the Proposed Scheme in terms of the annual mean NO_2 concentration. A slightly beneficial impact is estimated at 27 receptors and a moderate beneficial impact at 16 receptors. All beneficial impacts are modelled along the Proposed Scheme due to the diversion of traffic off these routes. A slight adverse impact is expected at four receptors. As shown in Table 7.27 and Figure 7.7 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of annual mean PM_{10} concentrations, with all receptors experiencing a negligible impact. As shown in Table 7.27, Table 7.33 and Figure 7.8 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of the annual mean $PM_{2.5}$ concentration with all receptors experiencing a negligible impact.

In accordance with the EPA Guidelines (EPA 2022) the impacts associated with the Construction Phase traffic emissions are overall neutral and short-term.

7.4.2.2.4 Ecological Assessment

An assessment of the impact of the Proposed Scheme has been undertaken using the approach outlined in the IAQM guidance document A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1) (IAQM 2020). The guidance states that where the PEC is less than 70% of the long-term critical level / load, the PC is likely to be insignificant. Where the process contribution is greater than 1% of the critical level / load it is recommended that the project ecologist should be consulted.

The impact of the Proposed Scheme on the nearby ecologically sensitive areas within 200m of roads impacted by the Proposed Scheme, as defined in Section 7.2.4.1, is outlined in Table 7.28. The annual mean NO_X concentration has been compared to the critical level of 30µg/m³ at each of the designated habitat sites. All sites exceed the critical level for NO_X in both the DM and the DS scenarios.

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Table 7.29. Most sites are below the lower critical load for the designated habitat site in both the DM and the DS scenarios. The lower critical load is exceeded in both the DM and DS by the M50 southbound at the Liffey Valley pNHA and by the western side of the M50 near the Royal Canal pNHA. However, NO_2 concentrations decrease at most sites due to the Proposed Scheme. The lower critical load is exceeded in the DM by the eastern side of the M50 near the Royal Canal pNHA and by the eastern side of the N3 Navan Rd near the Royal Canal pNHA, but NO_2 concentrations decrease below this critical load in the DS.

In accordance with the EPA Guidelines (EPA, 2022) the ecological impacts associated with the Construction Phase traffic emissions are overall negative, slight and short-term.

Table 7.28: Significance of Impacts at Key Ecological Receptors (NO_X Annual Mean Concentration In 2024)

Annual Mean NO_X in 2024 At Closest Point Within Ecological Site to Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (µg/m³)**	**Distance from road beyond which concentration is below critical level (30 µg/m³) (m)**	**Do Something (µg/m³)**	**Distance from road beyond which concentration is below critical level (30 µg/m³) (m)**	**Impact (DS – DM) (µg/m³)**	**Change as a percentage of critical level (30 µg/m³) (%)**
Liffey Valley pNHA (M50 northbound)	707624, 735853	80.9	>200m	80.9	>200m	0.0	0%
Liffey Valley pNHA (M50 southbound)	707647, 735872	128.9	>200m	128.9	>200m	-0.1	0%
Royal Canal pNHA (Binn's Bridge, western side)	715830, 736004	76.2	>200m	76.7	>200m	0.5	2%
Royal Canal pNHA (Binn's Bridge, eastern side)	715846, 735998	85.9	>200m	86.5	>200m	0.6	2%
Royal Canal pNHA (Cross Guns Bridge, western side)	715015, 736301	57.2	>200m	57.7	>200m	0.5	2%
Royal Canal pNHA (Cross Guns Bridge, eastern side)	715027, 736292	65.3	>200m	65.8	>200m	0.6	2%
Royal Canal pNHA (Longford Bridge, western side)	710930, 737442	39.2	>200m	41.4	>200m	2.2	7%
Royal Canal pNHA (Longford Bridge, eastern side)	710936, 737442	43.0	>200m	46.2	>200m	3.2	11%
Royal Canal pNHA (M50, western side)	708917, 738188	109.6	>200m	108.7	>200m	-0.9	-3%
Royal Canal pNHA (M50, eastern side)	708945, 738206	99.2	>200m	98.4	>200m	-0.8	-3%
Royal Canal pNHA (M50 slip road)	709083, 738203	64.0	>200m	62.1	>200m	-1.9	-6%
Royal Canal pNHA (Navan	708803,	79.1	>200m	67.7	180m	-11.5	-38%

Annual Mean NO_X in 2024 At Closest Point Within Ecological Site to Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (μg/m³)**	**Distance from road beyond which concentration is below critical level (30 μg/m³) (m)**	**Do Something (μg/m³)**	**Distance from road beyond which concentration is below critical level (30 μg/m³) (m)**	**Impact (DS – DM) (μg/m³)**	**Change as a percentage of critical level (30 μg/m³) (%)**
Road N3, western side)	738183						
Royal Canal pNHA (Navan Road N3, eastern side)	708815, 738184	99.6	>200m	82.3	>200m	-17.2	-57%
Royal Canal pNHA (Navan Road R806, eastern side)	708997, 738189	74.7	>200m	70.5	>200m	-4.2	-14%
Royal Canal pNHA (Navan Road R806, western side)	708985, 738190	69.1	>200m	65.8	>200m	-3.3	-11%
Royal Canal pNHA (Ratoath Road Bridge, western side)	712628, 737394	47.0	>200m	49.7	>200m	2.7	9%
Royal Canal pNHA (Ratoath Road Bridge, eastern side)	712652, 737367	54.9	>200m	58.9	>200m	3.9	13%
Royal Canal pNHA (New Dunsink Lane, western side)	709275, 738155	48.3	>200m	47.8	>200m	-0.5	-2%
Royal Canal pNHA (New Dunsink Lane, eastern side)	709295, 738103	52.2	>200m	51.6	>200m	-0.6	-2%
Royal Canal pNHA (Royal Canal Avenue)	711722, 737477	32.1	>200m	32.3	150m	0.3	1%
Royal Canal pNHA (Whitworth Road)	715183, 736244	34.0	>200m	33.9	>200m	-0.1	0%

Table 7.29: Significance of Impacts at Key Ecological Receptors (N Deposition In 2024)

Annual Mean N Deposition In 2024 At Closest Point Within Ecological Site To Road									
Receptor	Receptor Location (ITM)	Lower critical load for most sensitive feature (kgN/ha/yr)	Do Minimum (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Do Something (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition kgN/ha/yr
Liffey Valley pNHA (M50 northbound)	707624, 735853	5	4.50	0m	4.50	0m	0%	0m	<0.01
Liffey Valley pNHA (M50 southbound)	707647, 735872	5	6.39	30m	6.39	30m	0%	0m	<0.01
Royal Canal pNHA (Binn's Bridge, western side)	715830, 736004	5	4.30	0m	4.32	0m	0%	0m	0.02
Royal Canal pNHA (Binn's Bridge, eastern side)	715846, 735998	5	4.71	0m	4.74	0m	1%	10m	0.03
Royal Canal pNHA (Cross Guns Bridge, western side)	715015, 736301	5	3.43	0m	3.46	0m	1%	10m	0.03
Royal Canal pNHA (Cross Guns Bridge, eastern side)	715027, 736292	5	3.81	0m	3.84	0m	1%	10m	0.03
Royal Canal pNHA (Longford Bridge, western side)	710930, 737442	5	2.55	0m	2.66	0m	2%	10m	0.11
Royal Canal pNHA (Longford Bridge, eastern side)	710936, 737442	5	2.75	0m	2.91	0m	3%	20m	0.16
Royal Canal pNHA (M50, western side)	708917, 738188	5	5.66	20m	5.63	20m	-1%	0m	-0.03
Royal Canal pNHA (M50, eastern side)	708945, 738206	5	5.26	0m	5.23	0m	-1%	0m	-0.03
Royal Canal pNHA (M50 slip road)	709083, 738203	5	3.75	0m	3.67	0m	-2%	0m	-0.09
Royal Canal pNHA (Navan Road N3, western side)	708803, 738183	5	4.42	0m	3.92	0m	-10%	0m	-0.50
Royal Canal pNHA (Navan Road N3, eastern side)	708815, 738184	5	5.27	10m	4.56	0m	-14%	0m	-0.71
Royal Canal pNHA (Navan Road R806, eastern side)	708997, 738189	5	4.23	0m	4.05	0m	-4%	0m	-0.18

Annual Mean N Deposition In 2024 At Closest Point Within Ecological Site To Road									
Receptor	Receptor Location (ITM)	Lower critical load for most sensitive feature (kgN/ha/yr)	Do Minimum (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Do Something (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition kgN/ha/yr
Royal Canal pNHA (Navan Road R806, western side)	708985, 738190	5	3.98	0m	3.84	0m	-3%	0m	-0.15
Royal Canal pNHA (Ratoath Road Bridge, western side)	712628, 737394	5	2.94	0m	3.07	0m	3%	20m	0.13
Royal Canal pNHA (Ratoath Road Bridge, eastern side)	712652, 737367	5	3.33	0m	3.52	0m	4%	10m	0.19
Royal Canal pNHA (New Dunsink Lane, western side)	709275, 738155	5	3.01	0m	2.98	0m	0%	0m	-0.02
Royal Canal pNHA (New Dunsink Lane, eastern side)	709295, 738103	5	3.20	0m	3.17	0m	-1%	0m	-0.03
Royal Canal pNHA (Royal Canal Avenue)	711722, 737477	5	2.18	0m	2.20	0m	0%	0m	0.01
Royal Canal pNHA (Whitworth Road)	715183, 736244	5	2.3	0m	2.28	0m	0%	0m	<0.01

7.4.2.3 Regional Air Quality Assessment

The potential changes in regional air emissions due to the Construction Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. ENEVAL measures the regional emissions associated with road transport based on the various road links and their corresponding emissions.

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the construction year 2024 of the Construction Phase are shown in Table 7.30. The Proposed Scheme is overall detrimental, with increases in emissions of all pollutants modelled. The majority of these emission increases result from redistribution of vehicles onto other longer diversion routes, while the construction of the scheme takes place. To produce these emissions estimates, the traffic model and therefore the ENEVAL tool have applied the peak construction day in 2024 across the whole year. Emissions are therefore worst-case and likely to be lower in reality.

Table 7.30. Construction Phase Regional Pollutant Emissions (tonnes) – Construction Year 2024

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	1,624	489	18.4	17.5	86	1,951	1.5	1.21
DS		1,628	490	18.5	17.6	87	1,957	1.5	1.21
Change		4	1.21	0.05	0.04	0.24	5.45	0.005	0.005
% Change		0.25%	0.25%	0.25%	0.25%	0.28%	0.28%	0.34%	0.38%
DM	Goods	1,436	408	11.3	10.7	43	223	0.36	0.47
DS		1,441	409	11.3	10.7	43	223	0.36	0.47
Change		4	1.06	0.03	0.03	0.11	0.75	0.002	0.002
% Change		0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.5%	0.4%
DM	Urban Bus	44	4.5	0.74	0.71	1.95	8.86	0	0.05
DS		45	4.5	0.75	0.72	1.98	8.97	0	0.05
Change		0.77	0.08	0.01	0.01	0.03	0.11	0	0.0006
% Change		1.8%	1.8%	1.4%	1.4%	1.5%	1.2%	0%	1.3%
DM	**Total**	**3,105**	**901**	**30**	**29**	**132**	**2,183**	**1.84**	**1.7**
DS		**3,114**	**904**	**31**	**29**	**132**	**2,189**	**1.84**	**1.7**
Change		**8**	**2.3**	**0.08**	**0.08**	**0.38**	**6.3**	**0.007**	**0.007**
% Change		**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.3%**	**0.4%**	**0.4%**

In accordance with the EPA Guidelines (EPA 2022), the regional impacts associated with the Construction Phase traffic emissions pre-mitigation are considered overall neutral and short-term.

7.4.3 Operational Phase

7.4.3.1 'Do Minimum' Scenario

The Do Minimum (DM) is a defined scenario within the traffic modelling exercise in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, not including the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using ADMS-Roads for the opening year of 2028. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} objective, at selected most impacted existing air quality sensitive receptors in the 2028 DM scenario are listed in Table 7.31.

Locations of these receptors are shown in Figures 7.3 to 7.5 in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 3.1 (Appendix A7.1 in Volume 4 of this EIAR). 'Most impacted' refers to those receptors with non-negligible impacts due to the Operational Phase of the Scheme.

Table 7.31: Predicted 2028 Do Minimum Scenario Pollutant Statistics At Most Impacted Receptor Locations

DM (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (μg/m^3)			No of PM_{10} days > 50 μg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ1	713494,735835	30.3	15.7	11.0	<1
AQ7	714379,734737	33.8	15.8	11.1	1
AQ8	713718,735674	27.9	15.4	10.8	<1
AQ12	713830,735544	28.6	15.4	10.8	<1
AQ14	714378,734710	33.5	15.8	11.1	<1
AQ17	713884,735539	28.8	15.4	10.8	<1
AQ25	714332,734823	34.7	16.0	11.2	1
AQ27	713987,735284	34.5	16.1	11.3	1
AQ31	714021,735199	28.6	15.3	10.8	<1
AQ35	713996,735298	32.5	15.8	11.1	1
AQ36	713973,735329	34.7	16.2	11.3	1
AQ38	713967,735400	31.9	15.7	11.0	<1
AQ39	714526,734396	35.6	16.1	11.3	1
AQ40	714520,734385	34.8	15.9	11.2	1
AQ46	714503,734359	35.5	15.9	11.2	1
AQ49	714118,735045	27.7	15.1	10.7	<1
AQ52	714389,734384	37.0	16.0	11.2	1
AQ57	714411,734396	36.6	16.1	11.3	1
AQ63	714287,734914	34.4	16.0	11.2	1
AQ66	714289,734860	28.9	15.2	10.8	<1
AQ67	714353,734371	40.1	16.4	11.4	1
AQ71	714295,734899	34.9	16.1	11.3	1
AQ81	714527,734413	35.7	16.1	11.3	1
AQ96	714030,735193	31.2	15.7	11.0	<1
AQ98	714528,734447	32.5	15.7	11.1	<1
AQ103	714052,735163	33.3	16.0	11.2	1
AQ111	714232,734996	30.7	15.5	10.9	<1
AQ113	714058,735154	32.7	15.9	11.1	1
AQ114	714517,734470	33.9	16.0	11.2	1
AQ116	714515,734447	35.3	16.2	11.3	1
AQ122	714249,734974	34.3	16.0	11.2	1
AQ126	713801,735612	28.5	15.5	10.9	<1
AQ129	714272,734941	34.0	16.0	11.2	1
AQ132	713784,735625	28.4	15.5	10.9	<1
AQ137	714891,734794	40.3	16.6	11.6	1
AQ142	714303,734881	32.1	15.7	11.0	<1
AQ145	714173,735008	29.7	15.3	10.8	<1
AQ150	714310,734866	32.7	15.8	11.1	<1

DM (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ157	714322,734844	33.2	15.9	11.1	1
AQ172	714137,735077	32.9	15.7	11.0	<1
AQ176	713788,735581	27.8	15.3	10.8	<1
AQ177	714410,734683	38.4	16.9	11.7	1
AQ186	714340,734787	30.3	15.4	10.8	<1
AQ188	714120,735063	27.7	15.1	10.6	<1
AQ191	714516,734318	40.2	16.8	11.7	1
AQ202	714127,735091	31.4	15.6	11.0	<1
AQ210	714134,735029	27.7	15.0	10.6	<1
AQ236	714188,734993	29.2	15.3	10.8	<1
AQ240	713336,735924	31.7	16.0	11.2	1
AQ253	713437,735870	30.1	15.7	11.0	<1
AQ257	713533,735817	28.5	15.4	10.8	<1
AQ262	713413,735884	30.0	15.7	11.0	<1
AQ270	713967,735474	30.0	15.3	10.8	<1
AQ283	714413,734700	35.0	16.1	11.3	1
AQ287	713557,735794	29.0	15.5	10.9	<1
AQ291	713938,735466	35.0	15.8	11.1	<1
AQ299	713965,735427	30.0	15.4	10.8	<1
AQ303	714537,734631	33.2	15.9	11.1	1
AQ306	713926,735504	35.7	15.9	11.2	1
AQ308	713907,735517	31.7	15.6	11.0	<1
AQ309	713862,735512	30.6	15.7	11.0	<1
AQ310	713871,735503	31.8	15.8	11.1	<1
AQ315	713856,735481	30.1	15.5	10.9	<1
AQ316	714532,734591	33.4	15.9	11.1	1
AQ318	713479,735855	27.9	15.3	10.8	<1
AQ323	714526,734551	33.8	16.0	11.2	1
AQ330	713694,735693	27.4	15.3	10.7	<1
AQ331	714352,734774	30.8	15.5	10.9	<1
AQ368	714560,734595	31.5	15.6	11.0	<1
AQ372	714540,734545	35.6	16.2	11.4	1
AQ375	713988,735531	29.4	15.3	10.8	<1
AQ426	714798,734245	43.2	16.5	11.6	1
AQ21	714029,735222	39.2	16.9	11.7	1
AQ29	714347,734803	36.8	16.3	11.4	1
AQ43	714381,734400	43.3	16.9	11.7	1
AQ44	714380,734413	41.8	17.0	11.8	1
AQ45	714362,734427	37.9	16.5	11.5	1

DM (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ50	714516,734358	36.9	16.0	11.2	1
AQ74	714044,735196	38.1	16.7	11.6	1
AQ77	714058,735176	37.1	16.6	11.5	1
AQ106	714258,734954	38.1	16.6	11.6	1
AQ118	714194,735028	36.6	16.2	11.3	1
AQ135	714203,735020	36.2	16.1	11.3	1
AQ140	714177,735042	38.4	16.4	11.5	1
AQ233	714497,734253	36.0	16.3	11.4	1
AQ247	714373,734779	36.5	16.2	11.4	1
AQ292	714066,735162	39.6	17.0	11.8	1
AQ296	714107,735115	36.9	16.5	11.5	1
AQ304	714083,735143	37.0	16.5	11.5	1
AQ332	714373,734749	37.3	16.3	11.4	1
AQ10	714400,734722	40.2	16.6	11.6	1
AQ134	714422,734735	44.1	17.2	12.0	1
AQ152	714164,735052	40.7	16.7	11.7	1
AQ73	714438,734330	37.2	16.4	11.5	1
AQ84	714473,734325	37.5	16.5	11.5	1
AQ208	714333,734278	35.5	16.1	11.3	1
AQ412	714044,734365	36.9	17.1	11.8	1
AQ429	715146,734807	38.0	16.7	11.6	1
AQ107	714879,734584	40.6	16.9	11.8	1
AQ108	714878,734543	41.3	17.0	11.8	1
AQ206	713546,734464	34.4	16.0	11.2	1
AQ421	714878,734499	40.6	16.9	11.8	1
AQ422	714878,734515	40.9	17.0	11.8	1
AQ423	714862,734651	40.6	16.9	11.8	1
AQ424	714879,734672	43.7	17.6	12.2	1
AQ425	714879,734630	41.6	17.1	11.9	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2028 DM scenario, annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas; 17 exceedances were modelled at receptors on the N1 Church St, R805 Manor St, R804 Blackhall Place and R148 Arran Quay. Concentrations at all receptors with exceedances can be found in Table 3.1 (Appendix A7.1 Detailed Modelling Results in Volume 4 of this EIAR). Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations did not exceed 60 µg/m³, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objectives for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than two exceedances of the 50 µg/m³ ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value limit value objectives for all modelled receptors. Reported concentrations are lower in Opening Year 2028 due to the assumed modest improvements in vehicle emissions rates between now and then.

7.4.3.2 'Do Something' Scenario

The Do Something (DS) is a defined scenario within the traffic modelling exercise in Chapter 6 (Traffic & Transport) and is based on the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, including the Proposed Scheme. The output of this analysis and its impact on air quality has been modelled using AMDS-Roads for the opening year of 2028 in line with the methodology set out in Section 7.2.4.1. Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} objective, at selected most impacted existing air quality sensitive receptors both along the Proposed Scheme and on routes affected by traffic diversions in the 2028 DS scenario are listed in Table 7.32. Locations of these receptors are shown in Volume 3 of this EIAR. Statistics for the full list of modelled receptors can be found in Table 3.2 (Appendix A7.1 in Volume 4 of this EIAR). 'Most impacted' refers to those receptors with non-negligible impacts due to the Operational Phase of the Scheme.

Table 7.32: Predicted 2028 Do Something Scenario Pollutant Statistics At Most Impacted Receptor Locations

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ1	713494,735835	23.7	14.6	10.3	<1
AQ7	714379,734737	28.8	15.0	10.6	<1
AQ8	713718,735674	23.5	14.6	10.3	<1
AQ12	713830,735544	23.9	14.6	10.4	<1
AQ14	714378,734710	29.6	15.1	10.7	<1
AQ17	713884,735539	24.0	14.6	10.4	<1
AQ25	714332,734823	26.2	14.9	10.5	<1
AQ27	713987,735284	26.7	15.0	10.6	<1
AQ31	714021,735199	23.6	14.6	10.3	<1
AQ35	713996,735298	26.3	14.9	10.6	<1
AQ36	713973,735329	26.8	15.0	10.6	<1
AQ38	713967,735400	25.9	14.9	10.5	<1
AQ39	714526,734396	33.0	15.6	11.0	<1
AQ40	714520,734385	32.5	15.5	10.9	<1
AQ46	714503,734359	33.3	15.7	11.0	<1
AQ49	714118,735045	23.5	14.5	10.3	<1
AQ52	714389,734384	35.4	15.7	11.0	<1
AQ57	714411,734396	34.9	15.8	11.1	<1
AQ63	714287,734914	26.0	14.8	10.5	<1
AQ66	714289,734860	24.6	14.6	10.4	<1
AQ67	714353,734371	39.7	16.1	11.3	1
AQ71	714295,734899	26.2	14.8	10.5	<1
AQ81	714527,734413	32.9	15.6	11.0	<1
AQ96	714030,735193	23.8	14.6	10.4	<1

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ98	714528,734447	29.6	15.3	10.8	<1
AQ103	714052,735163	24.1	14.7	10.4	<1
AQ111	714232,734996	24.6	14.6	10.4	<1
AQ113	714058,735154	23.9	14.6	10.4	<1
AQ114	714517,734470	29.9	15.3	10.8	<1
AQ116	714515,734447	31.2	15.5	10.9	<1
AQ122	714249,734974	26.4	14.8	10.5	<1
AQ126	713801,735612	23.6	14.6	10.4	<1
AQ129	714272,734941	26.1	14.8	10.5	<1
AQ132	713784,735625	23.6	14.6	10.4	<1
AQ137	714891,734794	39.8	16.5	11.5	1
AQ142	714303,734881	25.5	14.7	10.4	<1
AQ145	714173,735008	23.6	14.5	10.3	<1
AQ150	714310,734866	25.7	14.7	10.4	<1
AQ157	714322,734844	25.8	14.8	10.5	<1
AQ172	714137,735077	24.4	14.6	10.4	<1
AQ176	713788,735581	23.5	14.6	10.3	<1
AQ177	714410,734683	37.0	15.7	11.0	<1
AQ186	714340,734787	25.6	14.8	10.5	<1
AQ188	714120,735063	23.3	14.5	10.3	<1
AQ191	714516,734318	39.5	16.8	11.7	1
AQ202	714127,735091	23.8	14.6	10.3	<1
AQ210	714134,735029	23.5	14.5	10.3	<1
AQ236	714188,734993	23.7	14.5	10.3	<1
AQ240	713336,735924	27.9	14.9	10.6	<1
AQ253	713437,735870	23.8	14.6	10.3	<1
AQ257	713533,735817	23.6	14.6	10.3	<1
AQ262	713413,735884	24.4	14.6	10.4	<1
AQ270	713967,735474	24.8	14.7	10.4	<1
AQ283	714413,734700	31.5	15.3	10.8	<1
AQ287	713557,735794	24.0	14.6	10.4	<1
AQ291	713938,735466	26.4	14.9	10.5	<1
AQ299	713965,735427	25.0	14.8	10.4	<1
AQ303	714537,734631	31.0	15.5	10.9	<1
AQ306	713926,735504	27.0	14.9	10.5	<1
AQ308	713907,735517	25.2	14.8	10.4	<1
AQ309	713862,735512	24.8	14.8	10.5	<1
AQ310	713871,735503	25.4	14.8	10.5	<1

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (μg/m^3)			No of PM_{10} days > 50 μg/m^3
		NO_2	PM_{10}	$PM_{2.5}$	
AQ315	713856,735481	25.6	14.9	10.5	<1
AQ316	714532,734591	31.1	15.5	10.9	<1
AQ318	713479,735855	23.2	14.5	10.3	<1
AQ323	714526,734551	31.5	15.6	10.9	<1
AQ330	713694,735693	23.4	14.6	10.3	<1
AQ331	714352,734774	26.0	14.8	10.5	<1
AQ368	714560,734595	29.4	15.3	10.8	<1
AQ372	714540,734545	32.6	15.7	11.0	<1
AQ375	713988,735531	24.5	14.7	10.4	<1
AQ426	714798,734245	42.7	16.7	11.6	1
AQ21	714029,735222	27.3	15.1	10.7	<1
AQ29	714347,734803	27.3	15.0	10.6	<1
AQ43	714381,734400	39.7	16.1	11.3	1
AQ44	714380,734413	38.7	16.1	11.3	1
AQ45	714362,734427	35.9	15.9	11.1	1
AQ50	714516,734358	34.6	15.7	11.1	<1
AQ74	714044,735196	24.9	14.8	10.5	<1
AQ77	714058,735176	24.4	14.7	10.4	<1
AQ106	714258,734954	27.7	15.0	10.6	<1
AQ118	714194,735028	25.5	14.8	10.4	<1
AQ135	714203,735020	25.3	14.7	10.4	<1
AQ140	714177,735042	25.9	14.8	10.5	<1
AQ233	714497,734253	33.9	16.0	11.2	1
AQ247	714373,734779	27.8	15.1	10.6	<1
AQ292	714066,735162	24.9	14.8	10.5	<1
AQ296	714107,735115	24.6	14.8	10.4	<1
AQ304	714083,735143	24.5	14.7	10.4	<1
AQ332	714373,734749	29.2	15.2	10.7	<1
AQ10	714400,734722	32.8	15.4	10.9	<1
AQ134	714422,734735	34.7	15.4	10.9	<1
AQ152	714164,735052	26.3	14.8	10.5	<1
AQ73	714438,734330	38.9	16.7	11.6	1
AQ84	714473,734325	38.8	16.6	11.6	1
AQ208	714333,734278	36.5	16.2	11.3	1
AQ412	714044,734365	38.5	17.3	12.0	1
AQ429	715146,734807	38.9	16.8	11.7	1
AQ107	714879,734584	43.4	17.3	12.0	1
AQ108	714878,734543	44.5	17.5	12.1	1

DS (2028)					
Receptor	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
		NO_2	PM_{10}	$PM_{2.5}$	
AQ206	713546,734464	36.8	16.3	11.4	1
AQ421	714878,734499	43.3	17.3	12.0	1
AQ422	714878,734515	43.3	17.3	12.0	1
AQ423	714862,734651	43.0	17.3	12.0	1
AQ424	714879,734672	46.3	18.0	12.4	2
AQ425	714879,734630	44.5	17.5	12.1	1
Air Quality Limit Value Objective		**40**	**40**	**25**	**35**

In the 2028 DS scenario annual mean concentrations of NO_2 are above the relevant national air quality limit value objective in some areas; nine exceedances were modelled at receptors on the N1 and the R108 Lower Bridge St. This is a decrease from 17 exceedances modelled in the DM scenario. Concentrations at all receptors with exceedances can be found in Table 3.2 (Appendix A7.1 Detailed Modelling Results in Volume 4 of this EIAR). Some of these receptors have been excluded from this section as these locations experience a negligible impact due to the Proposed Scheme and are therefore not considered a most impacted receptor. Annual mean NO_2 concentrations did not exceed 60 µg/m³, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are below the relevant national air quality limit value objectives for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicated that there is likely to be no more than two exceedances of the 50 µg/m³ ambient limit value compared to the threshold which allows 35 daily exceedances in any one calendar year. Annual mean $PM_{2.5}$ concentrations are also below the relevant national air quality limit value objectives for all modelled receptors.

7.4.3.3 Comparison of Do Something with Do Minimum

Table 7.33 provides the predicted change in and impact on pollutant concentrations, between the DM and DS in 2028. Statistics for the full list of modelled receptors can be found in Table 3.3 in Appendix A7.1 Detailed Modelling Results in Volume 4 of this EIAR and Figure 7.3 to Figure 7.5 in Volume 3 of this EIAR. 'Most impacted' refers to those receptors with non-negligible impacts due to the operational phase of the Scheme.

Table 7.33: Predicted Changes in Operational DM and DS and Impact Significance Criteria At Most Impacted Receptor Locations

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50 µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ1	713494,735835	-6.6	-1.1	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ7	714379,734737	-5.0	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ8	713718,735674	-4.4	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ12	713830,735544	-4.7	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ14	714378,734710	-3.9	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ17	713884,735539	-4.7	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ25	714332,734823	-8.5	-1.2	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ27	713987,735284	-7.8	-1.1	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ31	714021,735199	-5.0	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ35	713996,735298	-6.2	-0.9	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ36	713973,735329	-7.9	-1.1	-0.7	<1	Slight Beneficial	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (μg/m³)			Change in No of PM_{10} days > 50 μg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ38	713967,735400	-6.0	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ39	714526,734396	-2.6	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ40	714520,734385	-2.3	-0.4	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ46	714503,734359	-2.2	-0.2	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ49	714118,735045	-4.2	-0.6	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ52	714389,734384	-1.6	-0.3	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ57	714411,734396	-1.7	-0.3	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ63	714287,734914	-8.3	-1.2	-0.8	<1	Slight Beneficial	Negligible	Negligible
AQ66	714289,734860	-4.3	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ67	714353,734371	-0.5	-0.3	-0.2	0	Slight Beneficial	Negligible	Negligible
AQ71	714295,734899	-8.7	-1.3	-0.8	<1	Slight Beneficial	Negligible	Negligible
AQ81	714527,734413	-2.8	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ96	714030,735193	-7.4	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ98	714528,734447	-2.9	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ103	714052,735163	-9.1	-1.3	-0.8	<1	Slight Beneficial	Negligible	Negligible
AQ111	714232,734996	-6.0	-0.9	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ113	714058,735154	-8.8	-1.2	-0.8	<1	Slight Beneficial	Negligible	Negligible
AQ114	714517,734470	-4.0	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ116	714515,734447	-4.1	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ122	714249,734974	-7.9	-1.2	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ126	713801,735612	-4.9	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ129	714272,734941	-7.9	-1.2	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ132	713784,735625	-4.9	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ137	714891,734794	-0.4	-0.1	-0.1	0	Slight Beneficial	Negligible	Negligible
AQ142	714303,734881	-6.7	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ145	714173,735008	-6.1	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ150	714310,734866	-7.0	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ157	714322,734844	-7.4	-1.1	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ172	714137,735077	-8.6	-1.1	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ176	713788,735581	-4.4	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ177	714410,734683	-1.4	-1.2	-0.7	<1	Slight Beneficial	Negligible	Negligible
AQ186	714340,734787	-4.7	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ188	714120,735063	-4.4	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ191	714516,734318	-0.6	<0.1	<0.1	0	Slight Beneficial	Negligible	Negligible
AQ202	714127,735091	-7.6	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ210	714134,735029	-4.2	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ236	714188,734993	-5.5	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ240	713336,735924	-3.8	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ253	713437,735870	-6.3	-1.1	-0.6	<1	Slight Beneficial	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50 µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ257	713533,735817	-5.0	-0.9	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ262	713413,735884	-5.6	-1.1	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ270	713967,735474	-5.2	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ283	714413,734700	-3.5	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ287	713557,735794	-5.0	-0.9	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ291	713938,735466	-8.6	-0.9	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ299	713965,735427	-5.0	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ303	714537,734631	-2.1	-0.4	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ306	713926,735504	-8.7	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ308	713907,735517	-6.4	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ309	713862,735512	-5.8	-0.9	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ310	713871,735503	-6.4	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
AQ315	713856,735481	-4.4	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ316	714532,734591	-2.3	-0.4	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ318	713479,735855	-4.7	-0.8	-0.5	<1	Slight Beneficial	Negligible	Negligible
AQ323	714526,734551	-2.3	-0.4	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ330	713694,735693	-4.0	-0.7	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ331	714352,734774	-4.9	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ368	714560,734595	-2.0	-0.3	-0.2	<1	Slight Beneficial	Negligible	Negligible
AQ372	714540,734545	-3.0	-0.5	-0.3	<1	Slight Beneficial	Negligible	Negligible
AQ375	713988,735531	-4.9	-0.6	-0.4	<1	Slight Beneficial	Negligible	Negligible
AQ426	714798,734245	-0.5	0.1	0.1	0	Slight Beneficial	Negligible	Negligible
AQ21	714029,735222	-12.0	-1.8	-1.1	<1	Moderate Beneficial	Negligible	Negligible
AQ29	714347,734803	-9.5	-1.3	-0.8	<1	Moderate Beneficial	Negligible	Negligible
AQ43	714381,734400	-3.6	-0.7	-0.5	0	Moderate Beneficial	Negligible	Negligible
AQ44	714380,734413	-3.1	-0.9	-0.5	0	Moderate Beneficial	Negligible	Negligible
AQ45	714362,734427	-2.0	-0.6	-0.4	0	Moderate Beneficial	Negligible	Negligible
AQ50	714516,734358	-2.3	-0.3	-0.2	<1	Moderate Beneficial	Negligible	Negligible
AQ74	714044,735196	-13.2	-1.9	-1.2	<1	Moderate Beneficial	Negligible	Negligible
AQ77	714058,735176	-12.7	-1.8	-1.1	<1	Moderate Beneficial	Negligible	Negligible
AQ106	714258,734954	-10.4	-1.6	-1.0	<1	Moderate Beneficial	Negligible	Negligible
AQ118	714194,735028	-11.1	-1.4	-0.9	<1	Moderate Beneficial	Negligible	Negligible
AQ135	714203,735020	-10.8	-1.4	-0.9	<1	Moderate Beneficial	Negligible	Negligible
AQ140	714177,735042	-12.5	-1.6	-1.0	<1	Moderate Beneficial	Negligible	Negligible
AQ233	714497,734253	-2.2	-0.3	-0.2	0	Moderate Beneficial	Negligible	Negligible
AQ247	714373,734779	-8.7	-1.2	-0.7	<1	Moderate Beneficial	Negligible	Negligible
AQ292	714066,735162	-14.7	-2.2	-1.3	<1	Moderate Beneficial	Negligible	Negligible
AQ296	714107,735115	-12.2	-1.8	-1.1	<1	Moderate Beneficial	Negligible	Negligible
AQ304	714083,735143	-12.5	-1.8	-1.1	<1	Moderate Beneficial	Negligible	Negligible

Receptor	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50 µg/m³	Impact on Annual Mean Conc.		
		NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
AQ332	714373,734749	-8.0	-1.1	-0.7	<1	Moderate Beneficial	Negligible	Negligible
AQ10	714400,734722	-7.4	-1.2	-0.8	<1	Substantial Beneficial	Negligible	Negligible
AQ134	714422,734735	-9.4	-1.8	-1.1	<1	Substantial Beneficial	Negligible	Negligible
AQ152	714164,735052	-14.4	-1.9	-1.2	<1	Substantial Beneficial	Negligible	Negligible
AQ73	714438,734330	1.7	0.2	0.1	0	Slight Adverse	Negligible	Negligible
AQ84	714473,734325	1.3	0.2	0.1	0	Slight Adverse	Negligible	Negligible
AQ208	714333,734278	1.0	0.1	0.1	0	Slight Adverse	Negligible	Negligible
AQ412	714044,734365	1.6	0.3	0.2	0	Slight Adverse	Negligible	Negligible
AQ429	715146,734807	0.9	0.2	0.1	0	Slight Adverse	Negligible	Negligible
AQ107	714879,734584	2.8	0.4	0.2	0	Moderate Adverse	Negligible	Negligible
AQ108	714878,734543	3.2	0.5	0.3	0	Moderate Adverse	Negligible	Negligible
AQ206	713546,734464	2.4	0.3	0.2	0	Moderate Adverse	Negligible	Negligible
AQ421	714878,734499	2.7	0.4	0.2	0	Moderate Adverse	Negligible	Negligible
AQ422	714878,734515	2.4	0.4	0.2	0	Moderate Adverse	Negligible	Negligible
AQ423	714862,734651	2.4	0.4	0.2	0	Moderate Adverse	Negligible	Negligible
AQ424	714879,734672	2.6	0.5	0.3	1	Moderate Adverse	Negligible	Negligible
AQ425	714879,734630	2.9	0.4	0.3	0	Moderate Adverse	Negligible	Negligible

The significance of the changes in the concentration of each of the ambient receptors has been determined in the context of the TII significance criteria (TII 2011). As shown in Table 7.33 and Figure 7.3 in Volume 3 of this EIAR, the majority of modelled receptors are estimated to experience a negligible impact due to the Proposed Scheme in terms of the annual mean NO_2 concentration. A slightly beneficial impact is estimated at 72 receptors, a moderate beneficial impact at 18 receptors and a substantial beneficial impact at three receptors due to the diversion of traffic off the Proposed Scheme routes. A slight adverse impact is expected at five receptors, and a moderate adverse impact at eight receptors on the N1 Church St. These localised moderate adverse impacts are considered negative, significant and short-term as NO_2 concentrations exceed the limit value but will decrease below the limit by 2043 due to reductions in emissions between 2028 and 2043 from advancements in engine technology and the addition of a higher percentage of electric vehicles to the fleet. As shown Table 7.33 and Figure 7.4 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of annual mean PM_{10} concentrations, with all receptors experiencing a negligible impact. As shown in Table 7.33 and Figure 7.5 in Volume 3 of this EIAR, the Proposed Scheme is overall neutral in terms of the annual mean $PM_{2.5}$ concentration with all receptors experiencing a negligible impact.

In accordance with the EPA Guidelines (EPA 2022) the impacts associated with the Operational Phase traffic emissions pre-mitigation are overall neutral and long-term.

The predictions reported are based on conservative assumptions regarding background pollutant concentrations and the improvement in vehicle emission rates. 2019 background pollutant concentrations have been used to represent 2028 and are likely be lower by the opening year than in 2019. Older fleet projections were used in the absence of a fleet that incorporates the effects of 2021 Climate Action Plan measures – a larger proportion of electric vehicles is planned by the opening year than has been modelled. In reality, total concentrations (and magnitude of change) are likely to be lower than those reported here.

7.4.3.4 Ecological Assessment

An assessment of the impact of the Proposed Scheme has been undertaken using the approach outlined in the IAQM guidance document A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1) (IAQM 2020). The guidance states that where the PEC is less than 70% of the long-term critical level / load, the PC is likely to be insignificant. Where the process contribution is greater than 1% of the critical level / load it is recommended that the project ecologist should be consulted.

The impact of the Proposed Scheme on the nearby ecologically sensitive areas within 200m of roads impacted by the Proposed Scheme, as defined in Section 7.2.4.1, is outlined in Table 7.34. The annual mean NO_X concentration has been compared to the critical level of 30µg/m^3 at each of the designated habitat sites. All sites exceed the critical level for NO_X in both the DM and the DS scenarios.

Nitrogen deposition levels have been compared to the lower critical loads for the designated habitat sites in Table 7.35. Most sites are below the lower critical load for the designated habitat site in both the DM and the DS scenarios. The lower critical load is exceeded in both the DM and DS by the M50 southbound at the Liffey Valley pNHA and by the western and eastern sides of the M50 near the Royal Canal pNHA. However, N depositions are predicted to decrease at most sites due to the Proposed Scheme. The lower critical load is exceeded in the DM by the eastern side of the N3 Navan Rd near the Royal Canal pNHA, but N depositions decrease below this critical load in the DS.

In accordance with the EPA Guidelines (EPA 2022) the ecological impacts associated with the operational phase traffic emissions are overall negative, slight and long-term.

Table 7.34: Significance of Impacts at Key Ecological Receptors (NO_X Annual Mean Concentration In 2028)

Annual Mean NO_X In 2028 At Closest Point Within Ecological Site To Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (µg/m^3)**	**Distance from road beyond which concentration is below critical level (30 µg/m^3) (m)**	**Do Something (µg/m^3)**	**Distance from road beyond which concentration is below critical level (30 µg/m^3) (m)**	**Impact (DS – DM) (µg/m^3)**	**Change as a percentage of critical level (30 µg/m^3) (%)**
Liffey Valley pNHA (M50 northbound)	707624, 735853	79.2	>200m	78.5	>200m	-0.8	-3%
Liffey Valley pNHA (M50 southbound)	707647, 735872	126.3	>200m	125.1	>200m	-1.2	-4%
Royal Canal pNHA (Binn's Bridge, western side)	715830, 736004	74.8	>200m	78.7	>200m	3.8	13%
Royal Canal pNHA (Binn's Bridge, eastern side)	715846, 735998	84.2	>200m	88.6	>200m	4.5	15%
Royal Canal pNHA (Cross Guns Bridge, western side)	715015, 736301	54.8	>200m	54.1	>200m	-0.7	-2%
Royal Canal pNHA (Cross Guns Bridge, eastern side)	715027, 736292	62.4	>200m	62.8	>200m	0.4	1%
Royal Canal pNHA (Longford Bridge, western side)	710930, 737442	38.1	>200m	35.8	>200m	-2.4	-8%
Royal Canal pNHA (Longford Bridge, eastern side)	710936, 737442	38.7	>200m	36.2	>200m	-2.6	-9%

Annual Mean NO_X In 2028 At Closest Point Within Ecological Site To Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (µg/m³)**	**Distance from road beyond which concentration is below critical level (30 µg/m³) (m)**	**Do Something (µg/m³)**	**Distance from road beyond which concentration is below critical level (30 µg/m³) (m)**	**Impact (DS – DM) (µg/m³)**	**Change as a percentage of critical level (30 µg/m³) (%)**
Royal Canal pNHA (M50, eastern side)	708945, 738206	111.6	>200m	110.3	>200m	-1.2	-4%
Royal Canal pNHA (M50, western side)	708917, 738188	101.8	>200m	100.6	>200m	-1.3	-4%
Royal Canal pNHA (M50 slip road)	709083, 738203	62.5	>200m	59.4	>200m	-3.1	-10%
Royal Canal pNHA (Navan Road N3, western side)	708803, 738183	77.0	>200m	59.1	>200m	-17.9	-60%
Royal Canal pNHA (Navan Road N3, eastern side)	708815, 738184	95.7	>200m	71.3	>200m	-24.4	-81%
Royal Canal pNHA (Navan Road R806, eastern side)	708997, 738189	76.0	>200m	58.6	>200m	-17.5	-58%
Royal Canal pNHA (Navan Road R806, western side)	708985, 738190	70.1	>200m	57.0	>200m	-13.2	-44%
Royal Canal pNHA (Ratoath Road Bridge, western side)	712628, 737394	47.9	>200m	48.4	>200m	0.5	2%
Royal Canal pNHA (Ratoath Road Bridge, eastern side)	712652, 737367	56.1	>200m	56.9	>200m	0.8	3%
Royal Canal pNHA (New Dunsink Lane, western side)	709275, 738155	49.0	>200m	46.5	>200m	-2.6	-9%
Royal Canal pNHA (New Dunsink Lane, eastern side)	709295, 738103	53.3	>200m	50.0	>200m	-3.3	-11%
Royal Canal pNHA (Royal Canal Avenue)	711722, 737477	32.3	>200m	32.9	>200m	0.6	2%
Royal Canal pNHA (Whitworth Road)	715183, 736244	33.7	>200m	34.6	>200m	0.9	3%

Table 7.35: Significance of Impacts at Key Ecological Receptors (N Deposition In 2028)

Annual Mean N Deposition In 2028 At Closest Point Within Ecological Site To Road									
Receptor	Receptor Location (ITM)	Lower critical load for most sensitive feature (kgN/ha/yr)	Do Minimum (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Do Something (kgN/ha/yr)	Distance from road beyond which deposition is below critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition (kgN/ha/yr)
Liffey Valley pNHA (M50 northbound)	707624, 735853	5	4.46	0m	4.43	0m	0.0	0m	-0.02
Liffey Valley pNHA (M50 southbound)	707647, 735872	5	6.36	30m	6.32	30m	0.0	0m	-0.03
Royal Canal pNHA (Binn's Bridge, western side)	715830, 736004	5	4.37	0m	4.53	0m	0.0	80m	0.16
Royal Canal pNHA (Binn's Bridge, eastern side)	715846, 735998	5	4.79	0m	4.97	0m	0.0	30m	0.18
Royal Canal pNHA (Cross Guns Bridge, western side)	715015, 736301	5	3.33	0m	3.29	0m	0.0	0m	-0.04
Royal Canal pNHA (Cross Guns Bridge, eastern side)	715027, 736292	5	3.69	0m	3.71	0m	0.0	0m	0.02
Royal Canal pNHA (Longford Bridge, western side)	710930, 737442	5	2.50	0m	2.38	0m	0.0	0m	-0.12
Royal Canal pNHA (Longford Bridge,	710936, 737442	5	2.53	0m	2.40	0m	0.0	0m	-0.13

Annual Mean N Deposition In 2028 At Closest Point Within Ecological Site To Road									
Receptor	**Receptor Location (ITM)**	**Lower critical load for most sensitive feature (kgN/ha/yr)**	**Do Minimum (kgN/ha/yr)**	**Distance from road beyond which deposition is below critical load (m)**	**Do Something (kgN/ha/yr)**	**Distance from road beyond which deposition is below critical load (m)**	**Change relative to lower critical load (%)**	**Distance from road beyond which the change is <1% (m)**	**Change in deposition (kgN/ha/yr)**
eastern side)									
Royal Canal pNHA (M50, eastern side)	708945, 738206	5	5.80	0m	5.76	0m	0.0	0m	-0.04
Royal Canal pNHA (M50, western side)	708917, 738188	5	5.41	10m	5.38	10m	0.0	0m	-0.04
Royal Canal pNHA (M50 slip road)	709083, 738203	5	3.70	0m	3.56	0m	0.0	0m	-0.14
Royal Canal pNHA (Navan Road N3, western side)	708803, 738183	5	4.36	0m	3.52	0m	-0.2	0m	-0.84
Royal Canal pNHA (Navan Road N3, eastern side)	708815, 738184	5	5.16	10m	4.08	0m	-0.2	0m	-1.08
Royal Canal pNHA (Navan Road R806, eastern side)	708997, 738189	5	4.32	0m	3.53	0m	-0.2	0m	-0.79
Royal Canal pNHA (Navan Road R806, western side)	708985, 738190	5	4.05	0m	3.45	0m	-0.1	0m	-0.61
Royal Canal pNHA (Ratoath Road Bridge,	712628, 737394	5	2.99	0m	3.01	0m	0.0	10m	0.03

Annual Mean N Deposition In 2028 At Closest Point Within Ecological Site To Road									
Receptor	**Receptor Location (ITM)**	**Lower critical load for most sensitive feature (kgN/ha/yr)**	**Do Minimum (kgN/ha/yr)**	**Distance from road beyond which deposition is below critical load (m)**	**Do Something (kgN/ha/yr)**	**Distance from road beyond which deposition is below critical load (m)**	**Change relative to lower critical load (%)**	**Distance from road beyond which the change is <1% (m)**	**Change in deposition (kgN/ha/yr)**
western side)									
Royal Canal pNHA (Ratoath Road Bridge, eastern side)	712652, 737367	5	3.38	0m	3.42	0m	0.0	10m	0.04
Royal Canal pNHA (New Dunsink Lane, western side)	709275, 738155	5	3.05	0m	2.94	0m	0.0	0m	-0.11
Royal Canal pNHA (New Dunsink Lane, eastern side)	709295, 738103	5	3.26	0m	3.12	0m	0.0	0m	-0.14
Royal Canal pNHA (Royal Canal Avenue)	711722, 737477	5	2.20	0m	2.23	0m	0.0	10m	0.04
Royal Canal pNHA (Whitworth Road)	715183, 736244	5	2.27	20m	2.32	20m	0.0	30m	0.05

7.4.3.5 Regional Air Quality Assessment

The potential changes in regional air emissions due to the Operational Phase traffic impacts of the Proposed Scheme have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. ENEVAL measures the regional emissions associated with road transport based on the various road links and their corresponding emissions.

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the opening year of the Operational Phase are shown in Table 7.36. The Proposed Scheme is overall beneficial, with reductions in emissions of all pollutants modelled, with the exception of a small increase (0.03 tonnes) of benzene. The majority of these reductions result from a predicted modal shift, with decreased car usage (Section 6.4.5.2.2, Chapter 6 (Traffic & Transport) and a cleaner and more efficiently routed bus fleet. The NTA has committed to replacing its diesel-powered vehicles with plug-in hybrid and fuel cell electric buses by 2028 and zero emission vehicles by

2043, so the reductions in emissions due to the Proposed Scheme are due to more efficiently operated routes, meeting the Scheme Objectives.

Table 7.36. Operational Phase Regional Pollutant Emissions (tonnes) – Opening Year 2028

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	1318	382	9	9	79	1699	0.9	1.2
DS		1314	381	9	9	79	1697	0.9	1.2
Change		-4	-1	-0.02	-0.02	-0.2	-2	-0.002	-0.002
% Change		-0.3%	-0.3%	-0.3%	-0.3%	-0.2%	-0.1%	-0.2%	-0.1%
DM	Goods	1675	473	3.8	3.6	46	248	0.4	0.5
DS		1676	473	3.8	3.6	46	248	0.4	0.5
Change		1	0.2	0.0004	0.0003	-0.01	0.8	0.004	0.001
% Change		0.1%	0.04%	0.01%	0.01%	-0.02%	0.3%	0.8%	0.2%
DM	Urban Bus	17	1.7	0.2	0.2	0.7	5.4	0	0.006
DS		17	1.7	0.2	0.2	0.7	5.3	0	0.006
Change		-0.2	-0.02	-0.004	-0.004	-0.02	-0.1	0	-0.0002
% Change		-1%	-1%	-3%	-3%	-3%	-2%	0%	-3%
DM	**Total**	**3009**	**857**	**13**	**12**	**127**	**1952**	**1.3**	**1.71**
DS		**3006**	**856**	**13**	**12**	**126**	**1951**	**1.3**	**1.71**
Change		**-3**	**-1**	**-0.03**	**-0.03**	**-0.2**	**-1**	**0.002**	**-0.001**
% Change		**-0.1%**	**-0.1%**	**-0.2%**	**-0.2%**	**-0.2%**	**-0.1%**	**0.1%**	**-0.04%**

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the design year of the Operational Phase are shown in Table 7.37. The Proposed Scheme is overall beneficial, with reductions in emissions of all pollutants modelled except NO_x, NO_2 and Benzene, where an increase in emissions from light and heavy goods vehicles offsets the reductions achieved by more electric cars in the fleet. This also reflects the technical challenges in converting particularly the heavy goods fleet to electric vehicles, which would reduce NO_X and NO_2 emissions.

Table 7.37. Operational Phase regional pollutant emissions (tonnes) – Design Year 2043

	Vehicle Class	NO_X (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DM	Car	508	147	4.3	4.1	37	654	0.4	0.6
DS		507	146	4.3	4.1	37	654	0.4	0.6
Change		-1	-0.3	-0.007	-0.007	-0.05	0.03	-0.0003	-0.001
% Change		-0.2%	-0.2%	-0.2%	-0.2%	-0.1%	0.00%	-0.1%	-0.3%
DM	Goods	1081	284	3.3	3.1	34	190	0.3	0.4
DS		1084	285	3.3	3.1	34	190	0.3	0.4
Change		2.7	0.6	0.001	0.001	0.01	0.8	0.003	0.0004
% Change		0.2%	0.2%	0.04%	0.04%	0.03%	0.4%	1%	0.1%
DM	Urban Bus	0	0	0.2	0.1	0	0	0	0
DS		0	0	0.2	0.1	0	0	0	0
Change		0	0	-0.004	-0.004	0	0	0	0
% Change		0%	0%	-2%	-2%	0%	0%	0%	0%
DM	**Total**	**1605**	**432**	**8**	**7**	**72**	**849**	**0.6**	**0.95**
DS		**1607**	**433**	**8**	**7**	**72**	**850**	**0.6**	**0.95**
Change		**2**	**0.3**	**-0.01**	**-0.01**	**-0.1**	**0.7**	**0.003**	**-0.001**
% Change		**0.1%**	**0.1%**	**-0.1%**	**-0.1%**	**-0.1%**	**0.1%**	**0.4%**	**-0.1%**

In accordance with the EPA Guidelines (EPA 2022), the regional impacts associated with the operational phase traffic emissions pre-mitigation are considered overall neutral and long-term.

7.5 Mitigation and Monitoring Measures

In order to sufficiently ameliorate the likely air quality impact, a schedule of mitigation measures has been formulated for the Construction Phase of the Proposed Scheme.

7.5.1 Construction Phase

7.5.1.1 Construction Dust

In order to ensure that no significant dust nuisance occurs, a series of mitigation measures that are applicable to the Construction Phase of the Proposed Scheme will be implemented. In summary, the mitigation measures will include:

- Public roads outside the Proposed Scheme 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 (or similar dust suppression methods) will be used as required if particularly dusty activities associated with the construction contract are necessary during dry or windy periods;
- During movement of dust-generating materials both on and off-site, trucks will be covered with tarpaulin and before entrance onto public roads, trucks will be checked to ensure the tarpaulins are properly in place; and
- The appointed contractor will provide a site hoarding of 2.4m height along boundaries where sensitive receptors are located, at a minimum, at the Construction Compounds which will assist in minimising the potential for dust impacts off-site.

The appointed contractor will keep the effectiveness of the mitigation measures under review and revise them as necessary. In the event of dust nuisance occurring outside the works boundary associated with the Proposed

Scheme, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem.

7.5.1.2 Construction Traffic

Construction vehicles, generators etc., may give rise to some NO_2 and PM_{10}/$PM_{2.5}$ emissions. Table 7.38 summarises the construction phase impacts prior and post mitigation. In terms of construction traffic impacts, the Proposed Scheme will have a generally neutral impact on air quality, with some slight adverse impacts. Due to worst-case scenario modelling where in reality the works will be short-term and temporary in nature, the impact on air quality will not be significant. Therefore, no specific construction phase mitigation measures for construction traffic are required.

Table 7.38:Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Construction dust	Negative, Not significant, Short-term	Neutral, Short-term
Road traffic impacts on local human receptors	Neutral, Short-term	Neutral, Short-term
Road traffic impacts on local ecological receptors	Negative, Slight, Short-term	Negative, Slight, Short-term
Regional air quality	Neutral, Short-term	Neutral, Short-term

7.5.2 Operational Phase

Table 7.39 summarises the Operational Phase impacts prior to mitigation and post mitigation. As the Proposed Scheme will have a generally neutral impact on air quality, no specific Operational Phase mitigation measures are recommended. The area where moderate adverse impacts were modelled is on the N1 Church St, close to Arran Quay, and both Existing Baseline and DM NO_2 concentrations are modelled above or near the limit value of 40 $\mu g/m^3$. The impact from the Proposed Scheme derives both from these high baseline concentrations and increase in traffic flows at this location due to the Proposed Scheme. Whilst not a mitigation measure as such, it is noted that in time, vehicle emissions technology will improve and the Irish vehicle fleet will continue to evolve to the extent that vehicle emissions impacts associated with the Proposed Scheme are anticipated to be short-term. City wide traffic management measures and proactive encouragement of low emissions vehicle uptake would accelerate these improvements.

Table 7.39: Summary of Predicted Operational Phase Impacts Following the Implementation of Mitigation and Monitoring Measures

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Road traffic impacts on local human receptors	Neutral, Long-term	Neutral, Long-term
Road traffic impacts on local ecological receptors	Negative, Slight, Long-term	Negative, Slight, Long-term
Regional air quality	Neutral, Long-term	Neutral, Long-term

7.6 Residual Impacts

7.6.1 Construction Phase

When the dust minimisation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors. Thus, there will be no residual Construction Phase dust impacts.

The air dispersion modelling assessment of Construction Phase traffic emissions has found that the Proposed Scheme will be neutral overall in the study area. There are no substantial or moderate adverse effects expected as a result of the Construction Phase of the Proposed Scheme.

Therefore, overall it is considered that the residual effects as a result of the Proposed Scheme’s construction are neutral and short-term. No significant residual impacts have been identified during the Construction Phase of the Proposed Scheme, whilst meeting the scheme objectives set out in Chapter 1 (Introduction.

7.6.2 Operational Phase

The air dispersion modelling assessment has found that the majority of all modelled receptors are predicted to experience negligible impacts due to the Proposed Scheme, and beneficial impacts are also estimated along the length of the Proposed Scheme. The number of receptors where an exceedance of the NO_2 limit value is predicted decreases as a result of the Proposed Scheme.

There are localised residual moderate adverse effects predicted at human receptors on N1 Church Street as a result of the 2028 Operational Phase of the Proposed Scheme which are considered significant as NO_2 concentrations are predicted to exceed the limit value. However, NO_2 concentrations are expected to reduce to slight adverse or negligible by 2043, due to reductions in emissions between 2028 and 2043 from advancements in engine technology and the addition of a higher percentage of electric vehicles to the fleet. The localised impacts at human receptors on N1 Church Street due to the 2028 Operational Phase of the Proposed Scheme are therefore considered negative, significant and short-term.

In 2043 all receptors are expected to have ambient air quality in compliance with the ambient air quality standards for the DM and the DS scenarios. Overall, it is considered that the residual effects as a result of the Proposed Scheme’s operation are neutral and long-term.

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