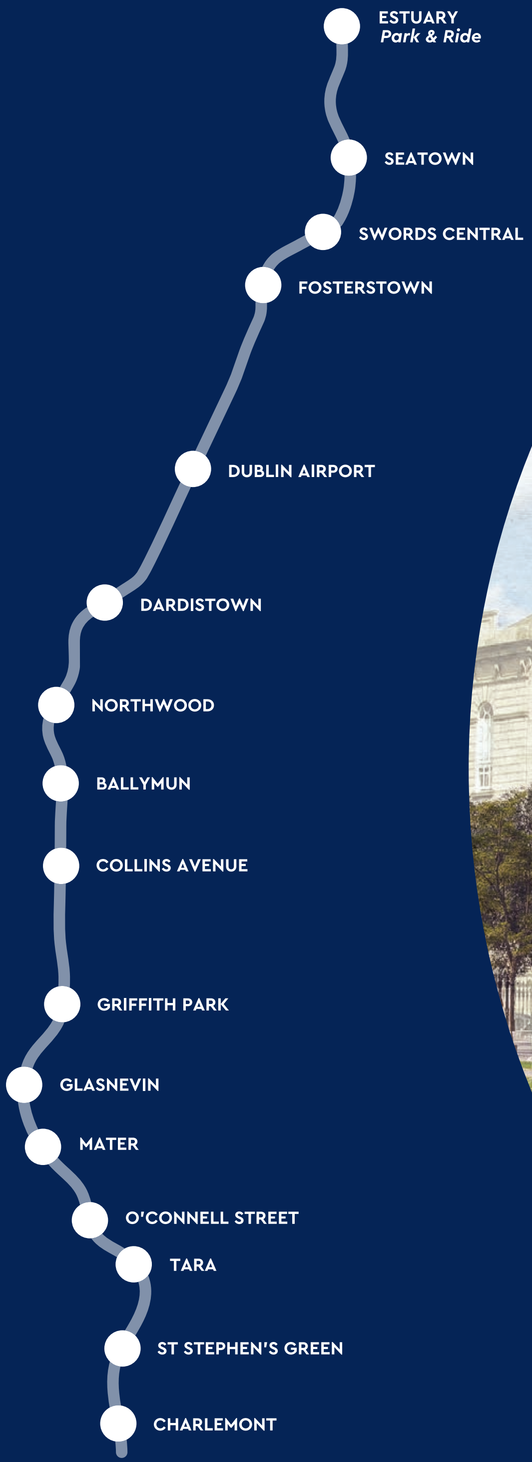

16 Air Quality

Contents

List of Abbreviations

Acronym	Meaning
AADT	Annual average daily traffic
AZ	Assessment Zone
CAFE	Clean Air for Europe
CO	Carbon Monoxide
CO_2eq	Carbon Dioxide Equivalent
COP22	22nd Conference of the Parties (2016 United Nations Climate Change Conference, Marrakech)
DANP	Dublin Airport North Portal
DASP	Dublin Airport South Portal
DART	Dublin Area Rapid Transit
DCC	Dublin City Centre
DCU	Dublin City University
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DMRB	Design Manual for Roads and Bridges
EC	European Commission
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ERM	East Regional Model
ETS	Emission Trading Scheme
FCC	Fingal County Council
GHG	Greenhouse Gas
GIS	Geographic Information System
GTC	Ground Transportation Centre
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management (UK)
INDCs	Intended Nationally Determined Contributions
JTC	Junction Turning Counts
km	Kilometre
LAQM	Local Air Quality Management
LGV	Light Goods Vehicle
LILO	Left in Left out
MMP	Mobility Management Plan
NDC	North Dublin Corporate
NECD	National Emissions Ceiling Directive
NH3	Ammonia
NHA	National Heritage Area
NMVOC	Non-methane Volatile Organic Compounds
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Dioxide and Nitric Oxide
NTA	National Transport Authority

Acronym	Meaning
O_3	Ozone
P&R	Park and Ride
P.G	Practical Guidance
PM_{10}	Particulate matter of an aerodynamic diameter of equal or less than 10 micrometres
$PM_{2.5}$	Particulate matter of an aerodynamic diameter of equal or less than 2.5 micrometres
pNHA	Proposed National Heritage Area
SAC	Special Area of Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
T.G	Technical Guidance
TII	Transport Infrastructure Ireland
TMP	Transport Modelling Plan
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compound

16. Air Quality

16.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) assesses the likely effects of the MetroLink Project (hereafter referred to as the proposed Project), on Air Quality during the Construction Phase and Operational Phase.

This Chapter describes and assesses the likely direct and indirect significant effects of the proposed Project on Air Quality in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e., the EIA Directive) (European Union 2014a). This Chapter also provides a characterisation of the receiving environment within the proposed Project and within a wider study area in the vicinity of the proposed Project.

This Chapter should be read in conjunction with the following Chapters, and their Appendices, which present related impacts arising from the proposed Project and proposed mitigation measures to ameliorate the predicted impacts:

- Chapter 9 (Traffic & Transport);
- Chapter 10 (Human Health);
- Chapter 11 (Population & Land Use);
- Chapter 15 (Biodiversity); and
- Chapter 17 (Climate).

The proposed Project is an electrified light rail system. Unlike the majority of private cars, the proposed Project will have no localised tailpipe emissions arising from the use of fossil fuels (discussed in Section 16.5.3). The exception to this is the small number of maintenance vehicles required for upkeep (discussed in Section 16.5.3). The burning of fossil fuels creates air quality emissions which can impact nearby sensitive human and ecological receptors. The proposed Project is designed to attract users to move away from the private car and instead use the MetroLink. It boosts interconnections with other major proposed public infrastructure projects such as BusConnects and the Dart+. These interconnections aim to aid in achieving the Climate Action Plans (CAP) (DECC 2021) commitment to 42-50% reduction in transport emissions and an additional 500,000 public transport and active travel journeys daily by 2030. While the CAP focuses on reductions in greenhouse gas emissions, the knock-on impact on the increased public transport and active travel and diversion from fossil fuel-based transport will aid with the improvement of localised air quality in the city.

The assessment is based on identifying and describing the likely significant effects arising from the proposed Project as described in Chapters 4 to 6 of this EIAR. The proposed Project description is based on the design prepared to inform the planning stage of the project and to allow for a robust assessment as part of the Environmental Impact Assessment (EIA) Process.

Where it is required to make assumptions as the basis of the assessment presented here, these assumptions are based on advice from competent project designers and are clearly outlined within the Chapter.

Two alternative scenarios for future traffic (depending on the implementation of the National Development Plan (2018 – 2027) and National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area (2016 – 2035)) are considered with respect to Operational Phase traffic and these are:

- 'Do Committed Minimum' scenario, which includes additional committed transport schemes; and
- 'The Likely Future' scenario, which presents an enhanced transport network scenario based on transport strategy.

An overview of these scenarios is discussed in Section 16.5, with further detail in Chapter 9.3.1 (Traffic and Transport).

Limits of deviation have been set for the proposed Project and this is addressed in the Wider Effects Report annexed at Appendix A5.19.

16.2 Outline Project Description

A full description of the proposed Project is provided in the following chapters of this EIAR:

- Chapter 4 (Description of the MetroLink Project);
- Chapter 5 (MetroLink Construction Phase); and
- Chapter 6 (MetroLink Operations and Maintenance).

Table 16.1 presents an outline description of the key proposed Project elements which are appraised in this Chapter. Diagram 16.1 presents an outline of the main elements of the proposed Construction Phase that are appraised in this Chapter and Diagram 16.2 presents an outline of the main elements of the Operational Phase of the proposed Project that are appraised in this Chapter.

Table 16.1: Outline Description of the Principal Project Elements

Project Elements	Outline Description
Permanent Project Elements	
Tunnels	It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have a 8.5m inside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows: ▪ The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and ▪ The City Tunnel: running for 9.4 km from Northwood Portal and terminating underground south of Charlemont Station.
Cut Sections	The northern section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with fences along the alignment for safety and security. While other sections are "cut and cover", whereby the alignment is covered.
Tunnel Portals	The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface. There are three proposed portals, which are: ▪ DANP; ▪ DASP; and ▪ Northwood Portal. This portal will be used during the Construction Phase to provide a launching position for the TBM. Following completion of this phase, it will be connected to Northwood Station. There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground.
Stations	There are three types of stations: surface stations, retained cut stations and underground stations: ▪ Estuary Station will be built at surface level, known as a 'surface station'. ▪ Seatown, Swords Central, Fosterstown Stations and the future Dardistown Station will be in retained cutting, known as 'retained cut stations'. ▪ Dublin Airport Station and all 10 stations along the City Tunnel would be 'underground stations'.

Project Elements	Outline Description
Intervention Shaft	An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to 'safety in railway tunnels' of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m. As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel. At other locations, emergency access will be incorporated into the stations and portals or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required (see below). At other locations, emergency access will be incorporated into the stations and portals or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required (see below).
Intervention Tunnel	In addition to the two main 'running' tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels): ▪ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands. ▪ Charlemont Intervention Tunnel: The City Tunnel will extend 360m south of Charlemont Station. A parallel evacuation and ventilation tunnel is required from the end of the City Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.
Park and Ride Facility (P&R)	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.
Broadmeadow and Ward River Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations, to cross the Broadmeadow and Ward Rivers and their floodplains.
Proposed Grid Connections	Grid Connections will be provided via cable routes and new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately, but are assessed in the EIAR).
Dardistown Depot	A maintenance depot will be located at Dardistown. It will house: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding System for rolling stock; ▪ The Operations Control Centre (OCC) for the proposed Project; ▪ A substation; and ▪ Other staff facilities and a carpark.
Operations Control Centre	The main OCC will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.
M50 Viaduct	A 100m long viaduct to carry the proposed Project across the M50 between the Dardistown Depot and Northwood Station.

Project Elements	Outline Description
Temporary Project Elements	
Construction Compounds	There will be 34 Construction Compounds including 20 main Construction Compounds. 14 satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown station) with satellite compounds located at other locations along the alignment. Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project including an easement strip along the surface sections.
Logistics Sites	The main logistics sites will be located at Estuary, near Pinnock Hill Roundabout east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound. (These areas are included within the 14 Satellite Construction Compounds).
Tunnel Boring Machine Launch Site	There will be two main tunnel boring machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

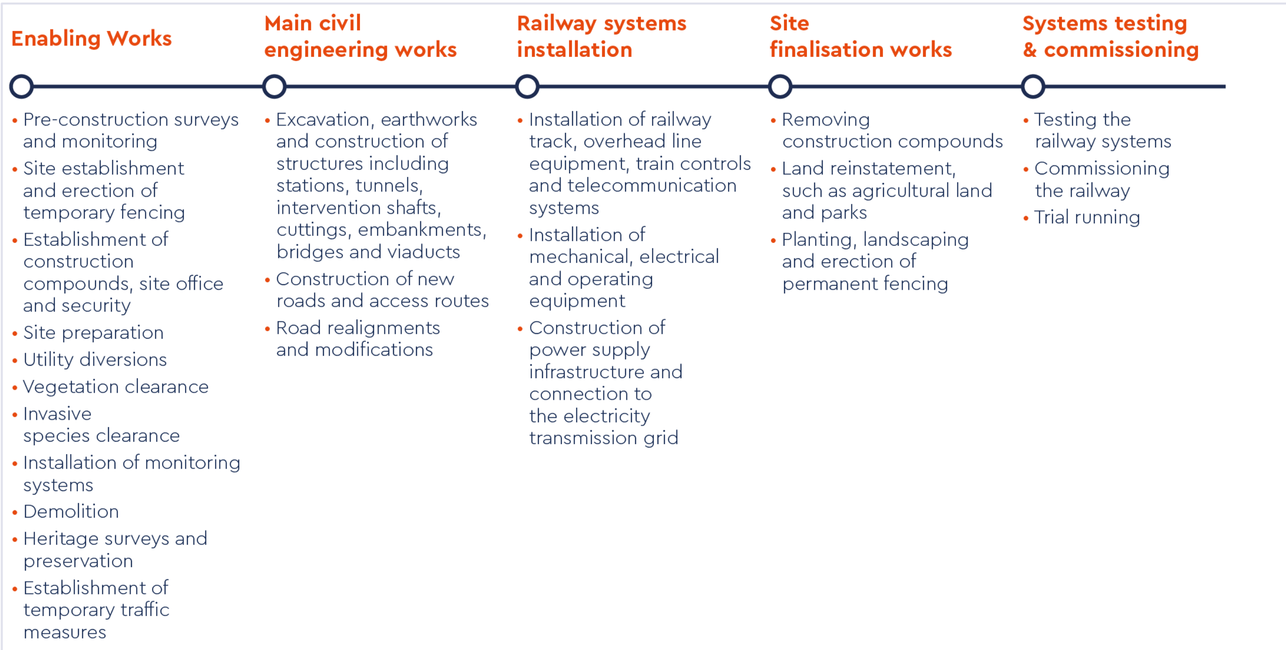

Diagram 16.1: Summary of Key Activities during the Construction Phase of the proposed Project

Diagram 16.2: Summary of Key Activities during the Operation Phase of the proposed Project

16.3 Methodology

The air quality assessment conducted for the Operational Phase of this project focuses on the change in distribution of road vehicles which is predicted to occur due to the proposed Project and the likely effects of these changes on local air quality. As the proposed Project is electrified there are no significant local emissions from it to appraise. Those local emissions, small though they are, are addressed in Section 16.5.3. During the Construction Phase the air quality impact of the redistribution of local road traffic and additional construction vehicles will also be assessed using the same methodology as the Operational Phase. In addition, potential emissions of construction related dust will be assessed.

The Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011) have been considered when assessing the likelihood and significance of effects. The TII Guidance is based on UK government assessment guidance, which has been updated since the publication of the TII Guidance. The updated guidance from Highways England (now National Highways) 'LA 105 – Air Quality (Highways England 2019) advises that the assessment of a proposed road scheme should describe the likely significant effects on the environment resulting from both the impact of a project on air quality in the Construction and Operational Phases.

While the proposed Project is not a road scheme, the guidance provides an applicable methodology for the assessment of the likely effects created by road traffic redistribution and construction vehicles.

The assessment methodology has been derived with reference to the most appropriate guidance (TII 2011) (Highways England 2019) (IAQM 2017) 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 review of the most applicable guidelines for the assessment of air quality in order to define the significance criteria for the Construction and Operational Phases of the proposed Project;
- A detailed baseline air quality review with a particular focus on NO_2, PM_{10} and $PM_{2.5}$ concentrations to characterise the baseline environment as these are the pollutants of most concern with respect to potential human health impacts (TII 2011) (Highways England 2019) (EPA 2020a). This was completed by way of a review of monitoring data collected for the proposed Project over a 1-year period supplemented by a review of available published air quality concentrations;
- Predictive qualification and impact assessments relating to the likely Construction Phase dust impacts of the proposed Project and committed mitigation measures to ensure no significant residual dust impacts;
- Predictive calculations, informed by Chapter 9: Traffic & Transport, to assess the potential air quality impacts associated with Construction and Operational Phases road traffic movements which occur due to the proposed Project, including at the Park and Ride (P&R) Facility for the Operational Phase; and
- A schedule of mitigation measures has been incorporated where required, to reduce, the identified potential air quality impacts associated with the proposed Project.

16.3.1 Study Area

The defined study area is discussed below having regard to the potential likely effects during the Construction and Operational Phases on sensitive receptors and changes to traffic are also considered beyond this extent.

The proposed Project covers an extensive linear study area between Estuary and Charlemont Station via Dublin City Centre. The assessment study area is split into four geographical zones:

- AZ1 The Northern Section: This section of the proposed Project from Estuary to north of the Dublin Airport North Portal (DANP) includes the proposed P&R at Estuary;
- AZ2 The Airport Section: This section of the proposed Project from the DANP, the tunnel underneath Dublin Airport, Dublin Airport Station and Dublin Airport South Portal (DASP);

- AZ3 Dardistown – Northwood: This section of the proposed Project from south of DASP until the Northwood portal, including the proposed Depot site at Dardistown, the M50 viaduct and the proposed Construction Compound at Northwood; and
- AZ4 Northwood – Charlemont: This section includes the City Tunnel between Northwood and Charlemont and all stations along this section.

The land use in the immediate vicinity of the proposed Project is predominantly urban but also comprises some greenfield areas in the northern part of the alignment. The study area covers a considerable area as it is not only determined by the proximity to the proposed Project. The impacted area can extend outside the four geographical zones Assessment Zones (AZs) that run along the proposed Project.

The study area for Construction and Operational Phase traffic impacts extends to the area highways network and surrounds considered to be impacted due to an altered traffic environment, including the Heavy Goods Vehicle (HGV) movements associated with the Construction Phase, as detailed in the sections below. The impacted area can extend outside the four Assessment Zones (AZs) that run along the proposed Project. It is in close proximity to both urban areas containing sensitive residential receptors as well as ecologically sensitive areas. The following sections discuss the Construction Phase and Operational Phase study areas. A summary of the study area distances is provided in Table 16.2.

16.3.1.1 Construction Phase

During the Construction Phase, the focus is on air quality sensitive receptors adjacent to dust generating activities or roads impacted due to construction activities associated with the proposed Project. Activities that have the potential to generate dust include excavations, spoil and material transport, and construction activities such as; demolition, blasting, tunnel launch, underground station boxes, intervention and ventilation shafts, construction compounds, above ground rail alignment, stations and platforms, and construction of ancillary structures (bridges, maintenance depots) and construction traffic haul 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 350m from construction works boundaries depending on the air emission sources in question and the local area under consideration. This is shown in Figure 16.1. Section 16.4.3 discusses the sensitivity classification for different receptors with respect to dust impacts.

In addition to the study area considered with respect to construction dust, additional areas must also be considered with respect to emissions from vehicles on impacted public roads. The extent of elements outside the direct proximity of the proposed Project boundary was determined using the output from the traffic models in combination with the assessment criteria for impacted road links, as set out in the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA, 2011) and Highways England Design Manual for Roads and Bridges (DMRB) LA – 105 Guidance (Highways England 2019). The study area is up to 200m from roads that experience a significant change in traffic numbers, road alignment or speed band, as per the Highways England DMRB LA - 105 Guidance (Highways England 2019), due to the Construction Phase of the proposed Project set out in Section 16.3.6. Traffic pollutants disperse with distance from the source and therefore any impact will be greatest within 200m from the impacted road. The assessment study area is focused on sensitive human receptors and designated ecological sites in proximity to the impacted routes. Highly sensitive air quality receptors include residential properties, hospitals, schools and residential care homes, whilst commercial and workplace properties are generally viewed as being of medium sensitivity (IAQM, 2014). Designated areas of conservation (either Irish or European designation) are also considered highly sensitive air quality receptors (TII, 2011). Potential impacts to air quality relate to alterations to traffic patterns (e.g., road closures), with particular attention focused on those areas where the proposed alignment is encroaching closer to air quality receptors. In addition to the geographical areas AZ1 – AZ4, additional roads included in the Construction Phase road traffic emissions model from the project include haul routes such as the M1, M50, R111, R110 and roads in proximity to the proposed spoil facility at Huntstown.

While the study areas for the modelling of the traffic impacts are defined as per the impact criteria in Section 16.3.7, some professional judgement is also necessary when defining the study area. As a result, the Construction Phase southern peak traffic study area extends over a greater area than the northern peak scenario. For some sections of the southern peak scenario the changes in Annual Average Daily Traffic (AADT), HGV flow and speed were below the scoping criteria detailed in Section 16.3.7 and therefore could be scoped out. Nevertheless, some links were included within the study area as they were close to the criteria to be scoped in, for example, impacts of 180 construction vehicles per day compared to a threshold level of 200 construction vehicles per day. The inclusion of these areas adds to the robustness of the assessment.

For the Construction Phase, this study area covers a considerable geographical area in close proximity (less than 50m) to high density sensitive residential, educational, amenity, religious and commercial receptors. Further details of sensitive receptors within the study area are provided in Section 16.4.2.

16.3.1.2 Operational Phase

The MetroLink is an electrified system and as a result is not predicted to have significant direct air quality emissions. A review of potential emissions from Operational Phase ventilation shafts, the maintenance activities such as sanding and boilers at the Dardistown Depot, diesel maintenance vehicles and P&R have been scoped out from having significant impacts. Further details on this are provided in Section 16.5.3. Therefore, the Operational Phase air quality assessment study area was determined using the output from the traffic models in combination with the assessment criteria for impacted road links as set out in the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA, 2011) and Highways England DMRB LA - 105 Guidance (Highways England 2019). The study area is up to 200m from roads that experience a significant change in traffic numbers, road alignment or speed band due to the proposed Project as set out in Section 16.3.6, as per the Highways England DMRB LA - 105 Guidance (Highways England 2019). The assessment study area is focused on sensitive human receptors and designated ecological sites in proximity to the impacted routes. The Estuary P&R facility has the capacity for 3,000 vehicles and therefore has the potential to attract additional vehicles into the local area. The study area for assessment of the Operational Phase traffic impact extends up to 45km to the north of the P&R along a 200m wide buffer either side of the M1 due to this demand.

Table 16.2 Study Area Definition for Construction and Operational Phases

Study Area	Traffic Emissions - Human Health / Ecology	Dust - Human Health/Nuisance	Dust - Ecology
	200m from "affected" road link	350m from site boundary	50m from site boundary

16.3.2 Relevant Guidelines, Policy and Legislation

The following Environmental Protection Agency (EPA) guidelines were considered and consulted in the preparation of this Chapter:

- Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2002);
- Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (EPA 2003); and
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022).

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 the sections below and Appendix A16.1 (Ambient Air Standards).

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 impact from road schemes. These are listed below:

- Guidance on the Assessment of Dust from Demolition and Construction V1. (IAQM 2016);
- A Guide to The Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1) (IAQM 2020);
- The TII 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 (Highways England) Design Manual for Roads and Bridges (DMRB) – LA 105 Air Quality (hereafter referred to as LA 105 Air Quality) (Highways England 2019); and
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide Global Update 2021 (hereafter referred to as the WHO Air Quality Guidelines) (WHO 2021).

16.3.2.1 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 16.3). These limit values are set for the protection of human health.

Table 16.3: 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
		Annual limit for protection of human health	40µg/m³ NO_2
Nitrogen Oxides (NO + NO_2)		Critical limit for the protection of vegetation and natural ecosystems	30µg/m³ NO + NO_2
Lead	S.I. 180 of 2011	Annual limit for protection of human health	0.5µg/m³
SO_2	S.I. 180 of 2011	Hourly limit for protection of human health - not to be exceeded more than 24 times / year	350µg/m³
		Daily limit for protection of human health - not to be exceeded more than 3 times / year	125µg/m³
		Critical limit for the protection of vegetation and natural ecosystems (calendar year and winter)	20µg/m³

Pollutant	Regulation*	Limit Type	Value
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	10µg/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 World Health Organization (WHO) has published Air Quality Guidelines for the protection of human health (hereafter referred to as the WHO Guideline) (WHO 2006 and 2021). The WHO Guideline values relating to NO_2, PM_{10} and $PM_{2.5}$ are shown in Table 16.4. The 2005 WHO Guideline values are more stringent than the European Union (EU) statutory limit values for PM_{10} and $PM_{2.5}$, with the 2021 updates further reducing recommended concentrations. 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. The WHO recognises that these levels are essentially unachievable in most countries and indeed also provides interim targets in the years when the full guideline values aim to be achieved. It should be noted that the targets are intended for populations rather than for individual receptors. The guidelines (WHO 2021) state:

Currently, the accumulated evidence is sufficient to justify actions to reduce population exposure to key air pollutants, not only in particular countries or regions but on a global scale.

As part of the joint WHO / United Nations Environment Program (UNEP) / World Bank *Breathe Life* campaign, in May 2020, the four Dublin local authorities signed a commitment to achieve the 2005 WHO Guidelines (WHO 2006) by a target date of 2030.

The appropriate compliance limit values for the assessment of air quality impacts of the proposed Project for the Construction and Operational phases are those outlined in the Air Quality Regulations, which incorporate the CAFE Directive. This is in line with the human health assessment (Chapter 10: Human Health).

Table 16.4: WHO Guidelines Published in 2005 and 2021*

Pollutant	Regulation	Limit Type	Value
WHO 2005 Guidelines			
NO_2	WHO 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})	WHO Guidelines	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}

Pollutant	Regulation	Limit Type	Value
PM (as $PM_{2.5}$)	WHO Guidelines	24-hour limit for protection of human health	15µg/m³ $PM_{2.5}$
		Annual limit for protection of human health	50µg/m³ $PM_{2.5}$
WHO 2021 Guidelines			
NO_2	WHO Guidelines	Hourly limit for protection of human health	200µg/m³ NO_2
		Annual limit for protection of human health	10µg/m³ NO_2
PM (as PM_{10})	WHO Guidelines	24-hour limit for protection of human health	45µg/m³ PM_{10}
		Annual limit for protection of human health	15µg/m³ PM_{10}
PM (as $PM_{2.5}$)	WHO Guidelines	24-hour limit for protection of human health	15µg/m³ $PM_{2.5}$
		Annual limit for protection of human health	5µg/m³ $PM_{2.5}$

**Air Quality Guidelines – Global Update 2005 (WHO 2006) and WHO Guidelines 2021 (WHO 2021)*

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. This guidance aims to ensure that demolition and construction work does not have an adverse impact in sensitive receptors near construction works and therefore is the local guidance for dust control appliable during the Construction Phase.

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/(m²*day) averaged over a one-year period at any receptors outside the site boundary. These standards are also applicable in Ireland and included in 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/(m²*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 German guidance continues to be used in Ireland and its guidance value will be implemented with regard to dust impacts from the construction of the proposed Project.

16.3.2.2 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 was published in December 2016. This Directive applied the 2010 National Emission Ceiling Directive (NECD) limits until 2020 and establish 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 (CH4). 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 16.5. 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 16.5.

Table 16.5: National Air Emission Targets (Ireland's Air Pollutants Emissions 2020-2030)

Pollutant	2020 - -2029 Reduction Commitments (kt) (and % reduction compared to 2005 levels)	2030 Reduction Commitments (kt) (and % reduction compared to 2005 levels)
SO_2	25.6	10.96
	-65%	-85%
NO_X	66.8	40.6
	-49%	-69%
NMVOC	56.3	51.1
	-25%	-32%
NH_3	112.1	107.5
	-1%	-5%
$PM_{2.5}$	15.6	11.2
	-18%	-41%

16.3.2.3 Regional Policy

In 2009, the Dublin Regional Air Quality Management Plan 2009 – 2012 (DCC, 2009) was published, its aims included:

- to improve co-ordination between councils, in order to build on the 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;
- prioritise the main potential threats to air quality; and
- assist measures that will reduce traffic congestion.

MetroLink is specified as one of the measures which will aid with the improvement of air quality in the city by aiding in the reduction of traffic congestion.

The Dublin Regional Air Quality Management Plan for Improvements in Levels of Nitrogen Dioxide in Ambient Air Quality (DCC 2011) is a companion document to the Dublin Regional Air Quality Management Plan. The document reviewed the measured levels of NO_2 in the 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.

In 2021 the EPA notified the four Dublin Local Authorities and informed them that an updated Air Quality Management Plan must be prepared and submitted to the European Commission by the end of 2021 due to breaches in the annual mean EU limit value for NO_2 at some Zone A monitoring stations during 2019. As a consequence, the Dublin Region Air Quality Management Plan – Air Quality Plan to improve Nitrogen Dioxide levels in Dublin Region (DCC, 2021) was published in late 2021 with an aim to remediate exceedances in the air quality limit values. The plan sets out 14 measures to be put in place to achieve these aims. These measures include:

- Integrate "15 Minute Neighbourhoods" concept in City and County Development Plans;
- Public parking controls;
- Continued delivery of the Active Travel Programme;
- Introduction of Clean Air Zones / Low Emission Zones;
- Enhanced Air Quality Monitoring and Modelling;
- Air Quality and Health Research; and
- Air Quality – Citizen Engagement.

Objective 64 of the National Policy Framework – Project Ireland 2040 (Government Ireland 2018) relates to ensuring improvements in air quality and preventing unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport. The MetroLink is specifically discussed and noted as a key priority as part of the Metropolitan Area Strategic Plan.

16.3.3 Data Collection and Collation

The baseline ambient air quality environment has been characterised through a desk study of publicly available data sources and in situ baseline ambient monitoring surveys.

16.3.3.1 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 quality assured 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 2020 (EPA 2021a), details the range and scope of monitoring undertaken throughout Ireland. The report Urban Environmental Indicators: Nitrogen Dioxide Levels in Dublin (EPA 2021b) assessed spatial variations in ambient air quality in Dublin using indicative 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 Dublin 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 16.4.3.

A review of potentially sensitive ecological areas has also been conducted using the National Parks and Wildlife Services (NPWS) online mapping services and consultation with Chapter 15: Biodiversity.

16.3.3.2 Site-Specific Baseline Surveys

A site-specific baseline monitoring study was undertaken from September 2018 to September 2019 as part of the air quality assessment for NO_2, dust deposition, PM_{10} and $PM_{2.5}$ using a chemiluminescent NO_x monitor, seventeen diffusion tube monitors, nine dust jars and three real time dust monitors, respectively (see Figure 16.2 and Table 16.6 for location details). A full year of data was captured in order to ensure that seasonal variations in the ambient air quality concentrations were captured.

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 are discussed in Section 16.4.3.

The spatial variation in NO_2 levels away from 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 sources. To assess the spatial variation in baseline NO_2 levels along the length of the proposed Project, NO_2 was monitored using passive diffusion tubes over successive one-month periods at 17 locations (refer to Table 16.6 and Figure 16.2). The passive diffusion tube results allow an indicative comparison with the annual average limit value. TII notes 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 (TII 2011).

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 has been studied in detail (UK DEFRA 2018) and diffusion tubes are considered a useful tool by national (i.e. EPA) and local bodies (i.e. DCC) for air quality studies as they allow for a wide network of results at a reasonable cost. 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 (UK DEFRA, 2021). In addition, three diffusion tubes were co-located with the continuous NO_2 monitor in order to develop a site-specific local bias adjustment factor. A site-specific bias adjustment factor of 0.76 was derived from the diffusion tube monitoring results which confirmed the applicability to Dublin of the overall laboratory bias adjustment factor of 0.77 from the UK DEFRA website. This is the slightly more conservative of the two bias adjustment factors as per UK DEFRA methodology (UK DEFRA 2018).

Dust deposition sampling was carried out using nine Bergerhoff Gauges in accordance with the requirements of the German Standard VDI 2119. The Bergerhoff Gauge consists of a collecting vessel with a protecting gauge. The collecting vessel is secured to a stand or lamppost with the opening of the collecting vessel located approximately 2m above ground level.

The PM_{10} and $PM_{2.5}$ monitoring was carried out by means of a Turnkey Instruments® Osiris Environmental Dust Monitor at each of the three locations. This instrument is currently in use by DCC as part of their own air monitoring program. Total suspended particles (TSP) are also reported however there is no ambient limit value for this parameter. The Osiris instrument is a light scattering device capable of continuous measurement of particulates. The air sample was continuously drawn into the instrument by a pump through a heated inlet at a flow rate of 600ml/minute. The incoming air passed through a laser beam in a photometer. The light scattered by the individual particles of dust was measured by the photometer and this information used to measure the size and concentration of the dust particles.

Table 16.6: Air Quality Monitoring Locations

Area	Reference	Site	East (Irish Grid)	North (Irish Grid)	NO_2 Diffusion Tube (Location Definition)	Dust Jar Co-location	Particulate Monitor Co-location	NOx Monitor Co-location
AZ1	D1, DJ1, Osiris 1	Lissenhall P&R (Triplicate Average)	318963	248681	Y (Suburban Background)	Y	Y	Y
AZ1	D2, DJ2	Foxwood Estate, Swords	318783	246316	Y (Suburban Background)	Y		
AZ1	D3	Airside, Near Premier Inn	317889	245329	Y (Roadside)			
AZ2/3	D4, DJ3, Osiris 2	Old Airport Road	315442	242222	Y (Roadside)	Y	Y	
AZ4	D5	Shangan Road / Coultry Road	315562	239867	Y (Kerbside)			
AZ4	D6, DJ4	Ballymun Road /Albert College Court	315538	238820	Y (Roadside)	Y		
AZ4	D7, DJ5	St Mobhi Road	315480	237354	Y (Kerbside)	Y		
AZ4	D8	Prospect Road /Lindsay Grove	315092	236345	Y (Kerbside)			
AZ4	D9, DJ6	Berkley Road/ Eccles Street	315237	235707	Y (Kerbside)	Y		
AZ4	D10, DJ7	35 Fedrick Street	315665	235189	Y (Kerbside)	Y		

Area	Reference	Site	East (Irish Grid)	North (Irish Grid)	NO_2 Diffusion Tube (Location Definition)	Dust Jar Co-location	Particulate Monitor Co-location	NOx Monitor Co-location
AZ4	D11	Setanta Place /Kildare Street	316297	233789	Y (Kerbside)			
AZ4	D12, DJ8	Hume Street /Stephen's Green	316230	233346	Y (Kerbside)	Y		
AZ4	D13	Adelaide Road /Hatch Lane	316125	232783	Y (Roadside)			
AZ4	D14, DJ9	Dartmouth Road	316116	232411	Y (Kerbside)	Y		
AZ4	D19, DJ12	Claremont Crescent	314408	236844	Y (Suburban Background)	Y		
AZ4	D20, DJ13, Osiris 3	Ballymun Road	315413	240504	Y (Roadside)	Y	Y	
AZ4	D21, DJ11	Attracta Road	314128	236638	Y (Suburban Background)	Y		

16.3.4 Analysis Methods

16.3.4.1 *Baseline Monitoring Analysis Methods*

Monitoring of NO_2 in proximity to the proposed Project was carried out using two sampling methods: chemiluminescent analysis and passive diffusion. Continuous monitoring of NO_2 was performed using a chemiluminescent analyser (Teledyne API, Model 200E) over a twelve-month period (12 September 2018 to 13 September 2019) at one static monitoring station (proposed Estuary P&R facility, refer to Figure 16.2). In this method, the NO_x ($NO + NO_2$) concentration is determined based on its direct relationship with the level of energy emitted by chemiluminescent NO_2, which is formed when nitric oxide (NO) is reacted with ozone (O_3) in an evacuated chamber within the analyser. The continuous monitor reported concentrations at 15-minute intervals, compared to the diffusion tubes which gave monthly averages. One of the major advantages of this monitoring method is that it provides high resolution continuous measurement of NO_2, and hence the results can be used to compare with the hourly limit value. In addition, the average NO_2 level measured over the monitoring period allows an approximate comparison with the annual limit value.

The passive diffusion tube survey was designed to assess current concentrations along the route of the proposed Project. 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 sampling, the tubes were analysed using UV spectrophotometry, at a UKAS accredited laboratory (SOCOTEC laboratories, Burton-on-Trent, England). The diffusion tube locations were strategically positioned to allow an assessment of background levels and typical exposure of the residential population along the length of the proposed Project.

Analysis of the dust deposition sampling was carried out by Environmental Laboratory Services Ltd., Blackrock, Co. Cork, based on the German Standard VDI 2119. The collecting vessel contains dustfall and liquid following sampling. The liquid is evaporated in a drying chamber and the dustfall residue weighed using a calibrated balance. The daily dust deposition rate is then calculated using information on the dustfall mass, the sampling period and the area of the collecting surface.

16.3.5 Consultations

Consultation is important in order to ensure that a sufficiently robust environmental baseline is established for the proposed Project and its surroundings. It helps to identify specific concerns and issues relating to air quality early in the assessment process. As part of the assessment, digital maps provided by the EPA, NPWS and Google Earth® have been used in determining the relevant land use within relevant study areas for the air quality assessment in question of the proposed Project. In addition, consultation with DCC and Fingal County Council (FCC) was conducted (Chapter 8: Consultation). The issues raised are outlined in Table 16.7 along with where these issues are addressed within this Chapter of the EIAR.

Table 16.7: Principal Air Quality Issues Raised During Consultation

Consultee	Phase / Date of Consultation	Issues Raised	Relevant Section of the EIAR where this is Addressed
Dublin City Council	26/05/2020	Baseline monitoring locations and other potential air quality related issues such as dust control and traffic redistribution for the proposed Project.	Sections 16.4.3, 16.5, and 16.6
Fingal County Council	14/01/2020	Potential air quality related issues such as dust control and traffic redistribution for the proposed Project Park and Ride.	Sections 16.4.3, 16.5, and 16.6

16.3.6 Identification of Potential Effects

As noted previously, the air quality assessment conducted for the Operational Phase focuses on the change in distribution of road vehicles which occurs due to the proposed Project and the potential impact of these changes on local air quality. As the proposed Project is electrified there are no significant local emissions from it to appraise. During the Construction Phase, the air quality impact of the redistribution of local road traffic and additional construction vehicles will also be assessed using the same methodology as the Operational Phase, notwithstanding that this guidance is focused primarily on the construction of road schemes, it remains the most relevant for this rail project because it is being used to assesses the impact of the proposed Project on road traffic. In addition, potential emissions of construction related dust will be assessed.

16.3.6.1 Air Quality Impact Assessment from Traffic Emissions in Construction

The air quality assessment has been carried out following procedures described in the publications by the EPA (EPA 2002; EPA 2003; EPA 2022) and using the methodology outlined in LA 105 Air Quality (Highways England 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). Ireland draws heavily on UK methods and databases, and the standards used typically mirror those from the UK, due to the UK's robust and detailed modelling methods and research. The significance criteria (TII 2011) have been adopted for the proposed Project and are detailed in Section 16.3.7. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values set for the protection of human health (40µg/m^3). However, the criteria have also been applied to the predicted annual $PM_{2.5}$ concentrations for the purpose of this assessment.

16.3.6.2 Local Air Quality Screening Assessment

In 2019 the Highways England DMRB air quality guidance was revised with the publication of LA 105 - Air Quality (Highways England 2019) replacing several 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. Historically, the DMRB air quality spreadsheet was used for the majority of assessments in Ireland with detailed modelling only required in circumstances where the screening tool indicated compliance issues with the EU air quality standards. The DMRB spreadsheet tool, however, was last revised in 2007 and thus does not include changes to vehicle emission standards in Europe over the last 14 years. In addition, the model does not account for electric, or hybrid vehicle use and thus may be viewed as a somewhat outdated assessment tool.

In acknowledgement of the DMRB air quality spreadsheet limitations, LA 105 - Air Quality (Highways England 2019) states that the DMRB spreadsheet tool may still be used for simple air quality assessments where it is deemed unlikely to lead to a breach of the air quality standards. Due to its use of an older and thus 'dirtier' fleet, vehicle emissions levels would be higher than more modern models and therefore any results will be conservative in nature and will provide a worst-case assessment of potential adverse impacts.

LA 105 Air Quality also states that modelling should be conducted for NO_2 for the base, opening and design years for both the Do Minimum and Do Something scenarios (refer to Chapter 9: 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. The guidance suggests that modelling of PM_{10} can be used to show that the project does not impact on the $PM_{2.5}$ limit value on the basis that assuming compliance with the PM_{10} limit is achieved then compliance with the $PM_{2.5}$ limit will also be achieved. Details of the modelling scenarios are provided in Section 16.5.

For the Construction Phase, two traffic impact scenarios have been modelled representing the worst-case traffic impacts. Traffic impacts occur due to construction vehicles going to and from sites as well as the redistribution of private road traffic. Traffic impacts will vary across the project and the modelled scenarios are based on a worst-case month with these emissions modelled as if the traffic continued in this state for an entire year. The resultant impacts are not representative of impacts over the entire construction period and are considered the worst-case conditions. The two construction scenarios are:

- Peak southern construction traffic impact which is predicted to occur in 2028; and
- Peak northern construction traffic impact which is predicted to occur in 2028.

The geographical extent of the scenarios is shown in Figure 16.4 for the southern peak and Figure 16.5 for the northern peak.

Whilst modelling scenarios are informed by traffic scenarios/modelling, the likely significant effects of MetroLink on air quality are identified and presented in this Chapter. These are:

- Scenario A: The 'Do Committed Minimum' scenario includes additional transport schemes that are under construction or committed to be implemented post the base-year of the East Regional Model (ERM) base (2016). 'Committed' refers to schemes that have planning permission and also have a funding commitment.
- Scenario B: The 'Likely Future' scenario, presents an enhanced transport network scenario which has been developed to understand how usage of the proposed Project may change if other planned infrastructure schemes are delivered during the appraisal period. A scheme bundle approach has been developed to examine the impacts of the enhanced network, with one bundle representing the schemes within the National Development Plan (2018-2027) and the other bundle representing the full build out of the infrastructure and initiatives contained within the NTA's Transport Strategy for the Greater Dublin Area (2016-2035).

Both the Construction and Operational Phases consider two different future year scenarios. For each of the four modelling scenarios (Construction Phase: Southern Peak and Northern peak. Operational Phase: Scenario A and Scenario B) the following three different models are assessed:

- A Do Nothing (DN) model – The DN models the baseline traffic data in 2020. This assessment is used for 2020 as a benchmark to compare future year assessments;

- Do Minimum (DM) model – The DM models the traffic data in the relevant future year without the proposed Project; and
- Do Something (DS) model – The DS models the traffic data in the relevant future year and includes the proposed Project and includes private vehicle redistribution on the road network as a consequence of the proposed Project.

The TII Project Appraisal Guidelines state the following in relation to the Do Minimum: "The Do Minimum option provides the baseline for establishing the economic, integration, safety, environmental and accessibility impacts of all options". "The Do minimum option should include those transportation facilities and services that are committed within the appraisal period". As such, all schemes which are considered to be committed have been included in the Do-Minimum Scenario. More information on the Do-Minimum Scenario is available in the Traffic and Transport Modelling Plan (Appendix A9.3).

Further details on the proposed Project that have been included within the Scenario A (Do Committed Minimum scenario), and the Scenario B (Likely Future scenario), are contained within the Traffic and Transport Modelling Plan (Appendix A9.3) and detailed in Chapter 9.3.1 (Traffic & Transport).

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 Project) compared to the Do Minimum traffic (without the proposed Project):

- Annual average daily traffic (AADT) changes by 1,000 or more;
- Heavy duty vehicle (HDV) 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 has been used in the current assessment to determine the road links required for inclusion in the modelling assessment. For roads that are scoped in, they will be included in the modelling assessment. Sensitive receptors within 200m of impacted road links were included within the modelling assessment and chosen using the methodology detailed in LA 105 – Air Quality (Highways England 2019).

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

The TII guidance states that the assessment must progress to detailed modelling if:

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

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 Project, 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 were reviewed in Section 16.4.3 and were found to be generally below 36µg/m^3 along the suburban section of the route, although as the proposed Project approached the City Centre ambient NO_2 concentrations were measured in excess of this level. The LA 105 - Air Quality guidance (Highways England 2019) states a detailed assessment should consider a representative number of receptors and all receptors with the likelihood of exceeding the air quality limit values in Construction and Operational Phases.

Vehicle-derived air emissions for areas impacted by significant changes in AADT were modelled using the detailed ADMS-Roads dispersion model (Version 5.1) for both Construction and Operational Phases. ADMS-Roads has been developed by Cambridge Environmental Research Consultants (CERC). 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 Operational Phase opening and design years of 2035 and 2050 respectively. For the Construction Phase, the proposed Project will have a peak construction year of 2028 for the northern section and southern section. The opening year is assumed to be 2035.

The modelling incorporated the following features:

- Hourly-sequenced meteorological information for Dublin Airport in 2020 has been used in the model (see Diagram 16.3) (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 an average adult breathing height. Concentrations were reported for each ASR modelled for all modelling scenarios.

Road traffic emission rates are derived using traffic data for the peak construction year of 2028, the Opening Year of 2035 and Design Year of 2050, and using emission factors from the COPERT V database (EMISIA 2020) which has been incorporated into the UK DEFRA Emission Factor Toolkit (EFT) Version 11.0 (DEFRA 2021).

The EFT Version 11.0 has been incorporated into the ADMS-Roads model. The toolkit provides emission rates from 2017 to 2030 and traffic emissions for the proposed Project were based on the following assumptions:

- EFT Version 11.0 is based on vehicle categories including petrol cars, diesel cars, electric cars, diesel Light Goods Vehicles (LGV), rigid HGVs, articulated HGVs and buses;
- Environmental Evaluation Model (ENEVAL) fleet composition data for Ireland (2016 base year) were selected to input car, LGV and HGV proportions (Table 16.8). The projections for 2020 were used for detailed modelling of the 2020 base year, 2026 projections were used as conservatively representative of the 2028 peak construction year and 2030 projections were used as conservatively representative of the 2035 opening year emissions. The use of an intermediate year to represent a future opening year is standard modelling practice, to counteract some of the fleet projection uncertainties;
- National Transport Model (NTM) fleet projections provided in UK TAG (UK Department for Transport, 2021) have been used to estimate the proportions of cars, LGV and HGV in 2050. No fleet projections currently exist, Irish or UK based, in a format that can be used in this assessment that accurately predict the proportion of electric vehicles in 2050, or which take the Department of the Environment, Climate and Communications (DECC) Climate Action Plan 2019 (DECC 2019) measures into account. A conservative approach is therefore inevitable, and on consultation from the fleet projects within ENEVAL, is based on the use of the UK NTM as the most up to date and robust alternative to the older 2016 base year ENEVAL fleet;
- The NTA provided bus fleet composition data estimates (Table 16.8);
- Emissions have been calculated using predicted emissions factors for 2020 (to represent the Base Year 2020), 2026 (to represent the peak construction year of 2028), 2030 (to represent the Opening Year 2035). 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 11.0 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. Fleet data from the ENEVAL tool were used to estimate Euro class proportions for cars and LGV, while the EFT urban Northern Ireland fleet provided more conservative proportions for HGV. The NTA provided Euro class proportions for the bus fleet;
- Scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting; and
- Technology conversion in the national fleet.

Table 16.8: Summary of Fleet Proportions

Vehicle Type		Base Year	Construction Year	Operational Year	Design Year
Car	Petrol Car	41%	34%	29%	0%
	Diesel Car	57%	64%	69%	0%
	Electric Car	2%	2%	2%	100%
LGV	LGV	99.9%	99.9%	100%	0%
	Electric LGV	0.1%	0.1%	0%	100%
HGV	Rigid HGV	86%	86%	86%	86%
	Articulated HGV	14%	14%	14%	14%
Bus	Plug-in Hybrid Bus	0%	24%	24%	0%
	Fuel Cell Electric Bus	0%	70%	70%	100%
	Diesel Bus	100%	6%	6%	0%

Detailed modelling of the design year of 2050 was scoped out for all pollutants on the basis that emissions will be lower compared to 2035 emissions. Advancements in engine technology and the addition of a higher percentage of electric vehicles to the fleet will assist in significantly reducing emissions between 2035 and 2050, even in circumstances where the number of vehicles using the road link increases. Emissions per road link using the EFT Version 11.0 were calculated for the 2050 Do Something scenario and compared to the 2035 Do Something scenario. The future fleet composition that was utilised, including the uptake rate of electric vehicles is likely a conservative approach, stemming from the inherent uncertainty associated with long-term fleet projections over 20 years into the future. An example of such uncertainty is the impact of the implementation of the 2021 Climate Action Plan (CAP) measure to cease providing National Car Test certificates for fossil fuelled cars by 2045. This measure is currently not accounted for within any Irish fleet projections and will likely drive a higher rate of electric vehicle uptake than is currently modelled (40% in the design year). The 2021 CAP aims for 845,000 with a focus on battery electric vehicles (BEVs). Across the proposed Project, emissions decreased in 2050, therefore 2035 modelled impacts can be considered worst case.

In addition, a conservative assumption regarding improvement in vehicle emission rates similar conservative assumptions are made with respect to background pollutant concentrations. Background concentrations for 2020 have been used to represent 2028 and are likely to be lower by the opening year than in 2020. Older fleet projections were used in the absence of a fleet that incorporates the effects of the 2021 Climate Action Plan measures – a larger proportion of electric vehicles is planned by the opening year than has been modelled. Construction traffic data have been modelled based on a peak construction period, while in practice the construction works will be phased. These data therefore represent a worst-case scenario. In reality, total concentrations (and magnitude of change) are likely to be lower.

16.3.6.4 Verification Study – Year 2020 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, by applying a calculated factor, 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 from the traffic model and Chapter 9 (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. These data have been used to compare model predictions of NO_2 to monitored NO_2 concentrations.

Background data were based on nitric oxide (NO) and NO_2 from Ballyfermot for 2019 and data from Rathmines 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. Due to the lack of ozone data from Ballyfermot, Rathmines was selected as a suitable substitute for ozone due to the regional nature of ozone concentration gradients. The backgrounds were also utilised in the 2028 and 2035 modelling.

The emission data for the ADMS-Roads model were based on EFT Version 11.0 and the ADMS-Roads model input parameters selected are summarised in Table 16.9. This input information is provided within the model which allows the model to best predict the future concentrations and emissions.

Table 16.9: 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 pre-set 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 applied.
Road Emission Factors	ADMS-Roads has a range of emission factors including the recent UK Emission Factor Tool (EFT) v. 11.0 dataset.	UK Emission Factor Tool (EFT) v. 11.0 (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.	2020 data from Dublin Airport Meteorological Station 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 Dublin Airport Meteorological Station. 1 is the appropriate value for a city, while 0.1 is representative of the airport setting.
Background data	The model can accept hourly background NO_X, NO_2, Ozone (O_3) and PM_{10} data.	Hourly background data for Ballyfermot (NO_2/NO_X/PM_{10}) has been used in the assessment.
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 NO_2	Model will assume that a certain percentage of NO_X emissions are NO_2 when modelling chemistry.	A representative Primary NO_2 was calculated using the EFT for each modelling scenario.

Parameter	Description	Input Value
		2020 Base – 29.7% 2028 Do Minimum – 28.2% 2028 Do Something – 28.2% 2035 Do Minimum – 27.4% 2035 Do Something – 27.4%
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. Modelled and measured road NO_X contributions are compared. Monitored data include the proposed Project specific survey and EPA diffusion tubes monitored in conjunction with DCC locations. In addition, some diffusion tube monitoring completed as part of the BusConnects Project has been shared with the proposed Project in order to assist with model verification (Table 16.10). The collection methodology was completed in the same manner as detailed in Section 16.3.3. Some of the monitoring locations were not considered suitable for model verification, due to proximity to minor road links not included in the traffic model or monitoring data, or other spatial considerations. A total of 20 monitoring sites were included in the verification exercise. The comparison is shown in Diagram 16.3, as the red points and trendline, and also in Table 16.10. This shows that on average, the unadjusted model under predicts total NO_2 concentrations by around 10.4%.

Table 16.10: Diffusion Tube Monitoring Data Used for Model Verification

Diffusion Tube No.	Monitored NO_2 concentration (µg/m³)	Modelled NO_2 concentration (µg/m³)	Difference [(modelled – monitored) / (monitored) *100]	Adjustment Factor
EPA/DCC - Clonturk Avenue	49.8	32.4	-35.0	2.28
EPA/DCC - Aulden Grange	33.2	25.1	-24.3	
Bus Connects - CBC0003DT009	34.3	26.9	-21.5	
MetroLink - D9	32.1	24.3	-24.2	
MetroLink - D8	47.8	36.0	-24.8	
Bus Connects - CBC0002DT006	33.2	24.1	-27.3	
Bus Connects - CBC0002DT005	43.0	27.9	-35.2	
Bus Connects - CBC0002DT004	37.8	24.4	-35.5	
Bus Connects - CBC0002DT003	29.4	26.2	-11.0	0.83
MetroLink - D7	26.9	27.2	1.1	
Bus Connects - CBC0003DT004	21.7	20.8	-4.0	
Bus Connects - CBC0003DT003	22.8	22.6	-1.0	
Bus Connects - CBC0003DT006	21.2	21.7	2.5	
Bus Connects - CBC0003DT005	28.5	27.2	-4.8	
EPA/DCC – Drumcondra Library	21.0	21.0	0.0	
EPA/DCC – Ballymun Library	24.2	23.0	-4.8	
MetroLink - D3	24.2	25.3	4.4	
MetroLink - D2	20.7	21.9	5.7	
MetroLink - D5	21.7	25.5	17.4	
Bus Connects - CBC0003DT007	23.3	26.7	14.4	
Average NO_2 Difference			-10.4%	

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:

- 2.28 – "More congested". Applied to modelled receptors closest to the R836 and R125 in Swords, the R104 Swords Road in Santry, the N1 from M50 junction to the city centre, the R108 Phibsborough Road, the R101 North Circular Road, the R111 South Circular Road, R110 and other busy roads. Receptors within 100m of the M50 and M1.
- 0.84 – "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 16.3 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 3.16µg/m^3. 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.

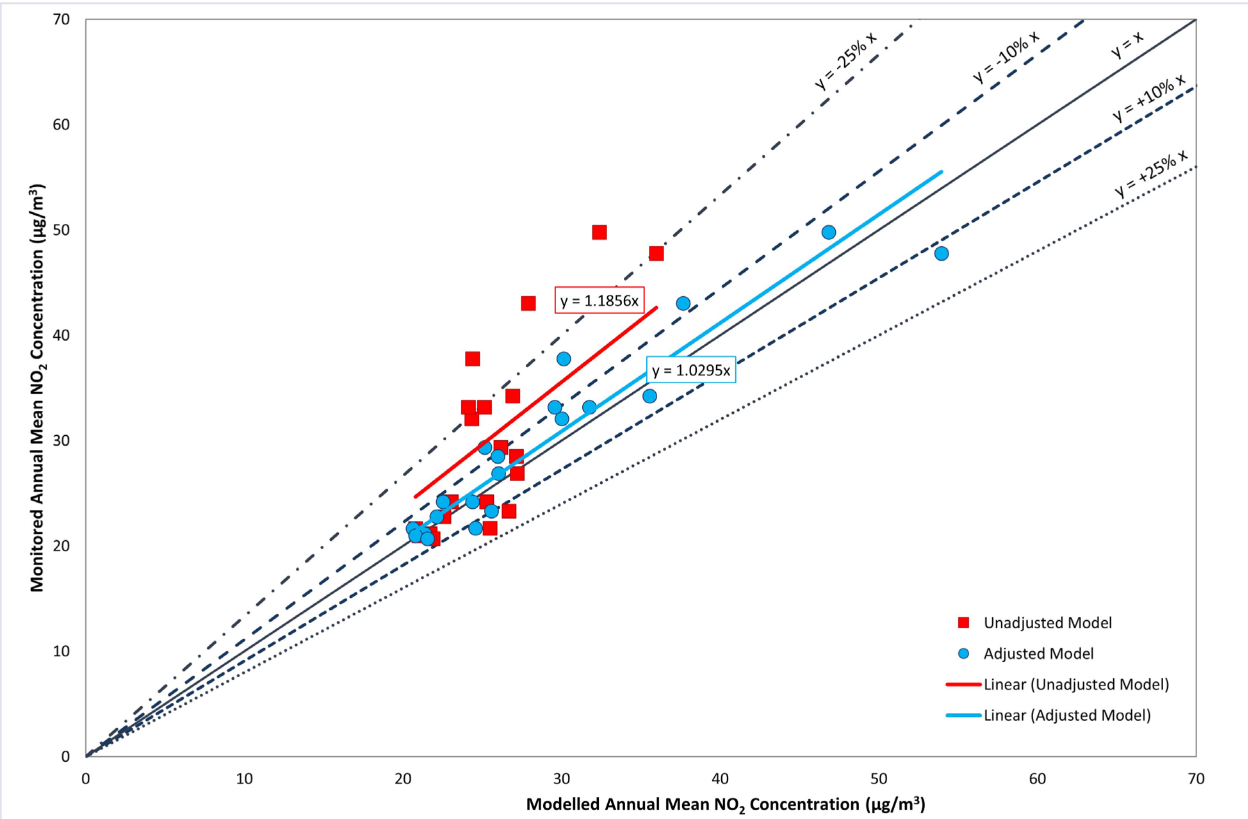

Diagram 16.3: Dispersion Model Verification - Comparison of Monitored and Modelled NO_2 Concentrations (µg/m^3)

16.3.6.5 Regional Air Quality Impact Assessment

TII (TII, 2011) recommend the use of the UK Highways Agency DMRB spreadsheet (UK Highways Agency, 2007) to assess impacts due to regional air emissions. More recent guidance (LA 114 Climate, UK Highways Agency, 2021) recommends the use of an appropriate validated traffic model to estimate regional emissions. Therefore, the potential changes in regional air emissions due to the Construction

Phase and Operational Phase traffic impacts of the proposed Project have been assessed using the National Transport Authority (NTA) Environmental Appraisal Tool, which is based on the Environmental Evaluation Model (hereafter referred to as ENEVAL). Use of ENEVAL allows for a more robust large-scale assessment of the impact of regional air impacts due to the proposed Project than the TII recommended DMRB spreadsheet. The tool allows for a better representation of potential traffic impacts at a regional level which would be otherwise left unaccounted for. These data also take into account the modal shift from private car to bus (walk or cycle). ENEVAL was developed by Systra Ltd in 2015 on behalf of the NTA. Emissions from the zonal level ENEVAL can provide information on the air emissions for the different traffic scenarios on a regional basis.

A validation study of ENEVAL was undertaken by 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 12megatonnes. The resultant figure was 8.1megatonnes 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.

ENEVAL measures pollution associated with road transport based on the various road links (as defined by traffic model, see Chapter 9 (Traffic & Transport)) and their corresponding emissions.

The change in regional air quality emissions due to Construction and Operational Phase traffic impacts of the proposed Project have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. Emissions from the zonal level ENEVAL can provide information on the emissions of pollutants including NO_2, PM_{10}, CO_2 and volatile organic compounds (VOCs) for the different traffic scenarios on a regional basis. ENEVAL was used by Codema in the publication Developing CO_2 Baselines – A Step-by-Step Guide for Your Local Authority (Codema 2017). ENEVAL also provides large-scale assessment of the impact of regional climate impacts due to the proposed Project, which are discussed in Chapter 17 (Climate).

This assessment is completed for the Construction Phase Southern Peak scenario and both the operational traffic scenarios (Scenario A and Scenario B). The Construction Phase Southern Peak scenario represents the construction period with the greatest traffic disruption and therefore it is considered worst-case with respect to the potential regional pollutants. The Northern Peak scenario was also considered for local air quality impacts due to the localised nature of pollutant impacts (i.e., within 200m of an impacted road link) in the assessment.

16.3.6.6 Ecology

The TII Air Quality Guidelines (TII 2011) requires the Air Quality Specialist to consult with the Project Ecologist for impacted roads which pass within 2km of a designated area of conservation (either Irish or European designation) However, in practice the potential for impacts on an ecological site is highest within 200m of the proposed Project and when significant changes in AADT occur (see Section 16.3.6 under Local Air Quality Screening Assessment) (CERC 2020).

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' (Highways England 2019), both of which describe NO_X emissions as the most likely source of significant impacts from road traffic. Pollutants such as CO_2, CO, SO_2, ammonia and VOCs are not considered in this guidance and 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 Project; and
- There is a significant change in AADT flows.

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 occur in proximity to the road. LA 105 notes that only sites that are sensitive to nitrogen deposition need to be included in the assessment. The ecological receptors along the 200m transect are modelled using the methodology for sensitive human receptors in Section 16.3.6. All designated areas within the modelled road network were included in the assessment. Some of these were deemed not to be significantly impacted in accordance with TII guidance (TII 2011) however they were included for the robustness of the assessment.

Designated sites (European and Irish sites of national/international importance) which are within 2km of the boundary of the proposed Project are:

- North Dublin Bay Special Area of Conservation (SAC) (Site Code: 000206);
- South Dublin Bay and River Tolka Estuary Special Protection Area (SPA) (Site Code: 004024);
- North Dublin Bay pNHA (Site Code: 000206);
- Santry Demesne proposed Natural Heritage Area (pNHA) (Site Code: 000178);
- Feltrim Hill pNHA (Site Code: 001208);
- Malahide Estuary pNHA (Site Code: 000205);
- Malahide Estuary SPA (Site Code: 004025);
- Malahide Estuary SAC (Site Code: 004025);
- Grand Canal pNHA (Site Code 002104); and
- Royal Canal pNHA (Site Code 002103).

16.3.6.7 Construction Dust Impact Assessment

Dust generation rates depend on the site activity, particle size, the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2mm (USEPA 2006) has fallen (Dublin Airport had on average 191 wet days annually over a 30-year averaging period (1981--2010)). High levels of moisture either retained in the soil or as a result of rainfall help suppress the generation of dust due to the cohesive nature of water between dust particles. Rain also assists in removing dust from the atmosphere through washout. Wind can lift particles up into the air and transport the dust downwind as well as drying out the surface. The worst dust deposition conditions typically occur, therefore, during dry conditions with strong winds.

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. Due to the scale of the proposed Project construction, sites will be in operation for extended periods and therefore detailed consideration of potential dust impacts and how to mitigate them is required.

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;
- 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;
- 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; or
- 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;
- Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.

In terms of the sensitivity of the area to dust soiling effects on people and property, the receptor sensitivity as identified above, the number of receptors and their distance from the source are considered in Table 16.11 in order to determine the sensitivity of the area to dust soiling.

Where the number of receptors is not clear i.e. for an apartment building, conservative sensitivities can be assumed.

Table 16.11: 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

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 objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); and
- 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 objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); and
- 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; and
- Indicative examples include public footpaths, playing fields, parks and shopping streets.

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 as detailed above and the number of receptors affected as per Table 16.12 and the criteria set out in 16.3.7.

Where the number of receptors is not clear i.e., for an apartment building, conservative sensitivities can be 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 area of the project is discussed in Section 16.4.3.

An additional risk for sites (Mater Hospital, Rotunda and Tara Winthrop clinic) with hospitals within the area for potential dust impacts is Aspergillus exposure. Aspergillus is a fungus that is found in soil and therefore has the potential to be made airborne during demolition or excavation. Aspergillus is of particular concern near hospital wards where immune suppressed patients are accommodated.

Table 16.12: Sensitivity of the Area to Human Health Impacts (IAQM 2014)

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

16.3.6.8 Assessment of the Sensitivity of the Receiving Environment to Dust Related Ecology Impacts

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; and
- Indicative examples include a 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; and
- Indicative example is a Natural 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; and
- Indicative example is a local Nature Reserve with dust sensitive features.

The above designations of sensitivity are taken directly from the IAQM Guidance (IAQM 2014) which is based in the UK and therefore the legal designations differ from Ireland. For the purposes of the assessment of the proposed Project, 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. SACs, pNHAs, SPAs and NHAs are included as the highest sensitivity sites. In addition, the Project Ecologist was consulted to ensure no areas of potential impact were missed.

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 route 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 (IAQM 2014). The sensitivity of the area to ecological impacts are considered using the sensitivity criteria outlined in Table 16.13.

Table 16.13: 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

An assessment of the sensitivity of the proposed Project was completed with respect to the criteria shown in Table 16.11 to Table 16.13 details the receptor sensitivity of the main construction sites. Figure 16.3 overlays a buffer of the distance criteria brackets from the project boundary to illustrate the receptors which have the potential for impacts.

Table 16.14: Summary of Sensitivity of Site Compounds to Dust Impact

Geographical Split	Site	Sensitivity Summary		
		Dust Nuisance	Human Health	Ecology Note 1
AZ1 Note 2	Estuary to Seatown – Including P&R at Estuary Station	High (>100 within 50m)	Low (10-100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Seatown to Malahide Roundabout – Including Seatown Station	High (>100 within 50m)	Low (10-100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.

Geographical Split	Site	Sensitivity Summary		
		Dust Nuisance	Human Health	Ecology Note 1
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	Medium (10-100 within 50m)	Low (10-100 within 50m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Pinnock Hill to Dublin Airport North Portal – Including Fosterstown Station	High (10-100 within 20m) including Tara Winthrop Private Clinic	Low (10-100 within 20m and background below 24 µg/m^3) including Tara Winthrop Private Clinic	No designated sensitive ecology within 50m of the project boundary.
AZ2	Dublin Airport North Portal	Medium (1-10 within 350m)	Low (1-10 within 350m below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
AZ2	Dublin Airport	High (10-100 within 20m sensitivity receptor) including permitted hotel	Medium (10-100 within 20m receptors within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
AZ3	DASP, Dardistown Station and Depot	Medium (1-10 within 20 m)	Low (1-10 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
AZ4	Northwood	High (10-100 within 20 m)	Low (10-100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Ballymun	High (>100 within 20 m)	Medium (>100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Collins Avenue	High (>100 within 50 m)	Low (>100 within 50m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Albert College	Medium (10-100 within 50 m)	Low (10-100 within 50m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Griffith Park	High (10-100 within 20 m)	Low (10-100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Glasnevin/Whitworth	High (>100 within 20 m).	Medium (>100 within 20m and background below 24 µg/m^3)	High (Royal Canal pNHA within 20m of the project boundary).
	Mater	High (>100 within 20 m) Mater Hospital	Medium (>100 within 20m and background below 24 µg/m^3) Mater Hospital	No designated sensitive ecology within 50m of the project boundary.
	O'Connell Street	Medium (<100 within 20 m)	Low (<100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Tara	High (>100 within 20 m)	Medium (>100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.

Geographical Split	Site	Sensitivity Summary		
		Dust Nuisance	Human Health	Ecology Note 1
	St. Stephen's Green	High (>1 medium sensitivity within 20 m)	Low (>10 medium sensitivity within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Charlemont	High (>100 within 20 m)	Medium (>100 within 20m and background below 24 µg/m^3)	High (Within 20m of Proposed Natural Heritage Areas: Grand Canal)
MetroLink grid connections	Dublin Airport North Portal	High (10-100 within 20 m)	Low (<100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Dardistown Depot	Medium (1-10 within 20 m)	Low (<100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	Northwood	Low (1-10 within 50 m)	Low (<100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.
	DASP MV Cable	Medium (1-10 within 20 m)	Low (<100 within 20m and background below 24 µg/m^3)	No designated sensitive ecology within 50m of the project boundary.

Note 1 - Potential for ecological impacts is only for sensitive ecological areas

Note 2 - For AZ1 the number of receptors takes account of receptors between the stations as well as in proximity of the stations.

Note 3 - Unless stated assume receptors counts are based on high sensitivity i.e. residential receptors

Note 4 - Where the final cable route option is undecided all options will be reviewed and the worst case sensitivity chosen

The criteria for appraisal of the magnitude of dust emissions is reviewed for each site compound and station box area within Table 16.15 to Table 16.18 under the headings demolition, earthworks, construction and trackout based on a series of criteria set out by the IAQM (IAQM 2014). The risk of potential for dust impacts with respect to dust nuisance, human health and ecology are a function of magnitude of the dust generation at each construction site in combination with the sensitivity of the surrounding area. Each site compound and station box have been considered individually in Appendix 16.2. The sensitivity of each of the construction compounds is established in Table 16.11, Table 16.12 and Table 16.13.

Demolition

Dust emission magnitude from demolition without mitigation in place can be classified as small, medium or large and are described as follows.

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

Table 16.15: Risk of Dust Impacts - Demolition

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

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

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Dust emission magnitude from earthworks without mitigation in place can be classified as small, medium or large and are described as follows.

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

Table 16.16: 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

Construction

Dust emission magnitudes from construction without mitigation in place can be classified as small, medium or large and are described as follows.

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

Table 16.17: 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

Trackout

Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. Dust emission magnitude from trackout without mitigation in place can be classified as small, medium or large and are described as follows.

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

Table 16.18: Risk of Dust Impacts - Trackout

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

16.3.7 Appraisal Method for the Assessment of Impacts

16.3.7.1 Local Air Quality Assessment Criteria for Construction and Operational Phases

The TII guidance document 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes' (TII 2011) details the methodology for determining air quality impact significance criteria for road schemes in Ireland. The significance criteria have been adopted for the proposed Project and are detailed in Table 16.19, Table 16.20 and Table 16.21 of the proposed Project. 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 16.19: 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

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (TII 2011)

Table 16.20: 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 Project			
Above Objective/Limit Value With Project (≥40µg/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 Project (36 - <40µg/m³ of NO_2 or PM_{10}) (22.5µg/m³ - <25µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Moderate	Large
Below Objective/Limit Value With Project (30 - <36µg/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 Project (<30µg/m³ of NO_2 or PM_{10}) (<18.75µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with proposed Project			
Above Objective/Limit Value With Project (≥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 Project (36µg/m³ - <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 Project (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 Project (<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*

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (TII 2011)

Table 16.21: Air Quality Impact Significance Criteria

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

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

Source: Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (TII 2011)

16.3.7.2 Regional Air Quality Assessment for Construction and Operational Phases

The change in regional air quality emissions due to Construction and Operational Phase traffic impacts of the proposed Project have been assessed using the NTA Environmental Appraisal Module, which is based on the ENEVAL software. The proposed Project has no tailpipe emissions contributing to regional emissions, however contribution due to construction related traffic in the Construction Phase and the redistribution of traffic in the Construction and Operational Phases, including from the Estuary P&R, requires assessment.

ENEVAL was developed by Systra Ltd in 2015 on behalf of the NTA. Emissions from the zonal level ENEVAL tool 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 Chapter 17 (Climate) (Section 17.3.4).

Impacts are assessed by comparing the percentage change against the do-minimum for each scenario.

16.3.7.3 Ecology

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 (TII 2009) 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.

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 keq ha-1 year-1, where keq 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 (Highways England 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 project ecologist should occur. Once the dry deposition flux (µg m-2 s-1) is calculated it must then be converted to nitrogen equivalent acidification flux (keq ha-1 year-1) for comparison with critical loads.

16.3.7.4 Assessment of the Magnitude of Impact from Construction Dust

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 sensitivity of the area which is established in Section 16.4.3. These major dust generating activities are divided into four types (where relevant) to reflect their different potential impacts as outlined below:

- Demolition – Any activity involved with the removal of an existing structure (or structures);
- Earthworks – The processes of soil-stripping, ground-levelling, excavation and landscaping;
- Construction – Any activity involved with the provision of a new structure (or structures), its modification or refurbishment; and
- Trackout – 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.

An assessment of the sensitivity of the proposed Project is completed in Section 16.4.3 with respect to the criteria shown in Table 16.11 to Table 16.13. Table 16.14 details the receptor sensitivity of the main construction sites.

16.4 Baseline Conditions

The following sections describe the baseline conditions in the vicinity of the proposed Project based on a review of published data and on site monitoring.

16.4.1 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 near 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.

The proposed Project runs under Dublin Airport in tunnel. The Dublin Airport meteorological station is a suitable choice for weather data, as it is located within the proposed Project and the meteorological data are collected in the correct format for the purposes of this assessment with a data collection of greater than 90%. Long-term hourly observations at Dublin Airport meteorological station provide an indication of the prevailing wind conditions for the region (see Diagram 16.4). Results indicate that the prevailing wind direction is from south to westerly in direction over the period 2017 to 2021.

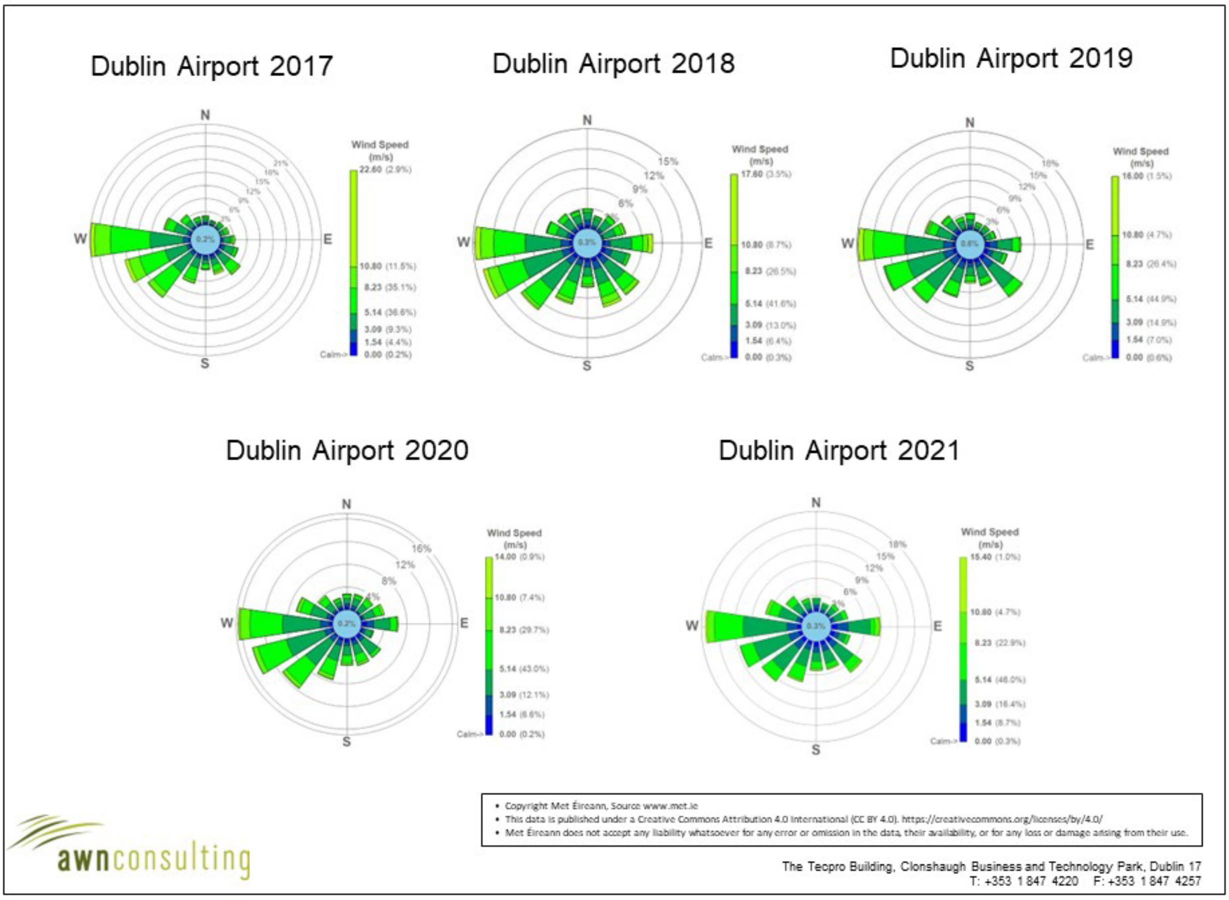

Diagram 16.4: Dublin Airport Meteorological Station Windrose 2017-2021

16.4.2 Existing Air Quality Sensitive Receptors

This section reviews the existing air quality sensitive receptors in proximity to the alignment of the proposed Project. The alignment has been split into four geographical Assessment Zones (AZs), as shown in Table 16.22. Generally, highly sensitive air quality receptors with respect to human health include residential properties, hospitals, schools and residential care homes, whilst commercial and workplace properties are generally viewed as being of medium sensitivity. Sensitive receptors for modelling have been chosen by inspection of the route, reviewing online mapping software and consultation with the wider EIAR team. They are assessed as per the appraisal methods set out in Section 16.3.6.

The land use in the immediate vicinity of the proposed Project is predominantly urban but also comprises some greenfield and brownfield sites to the north of the proposed Project. The study area covers a considerable region and is in close proximity to both urban neighbourhoods containing sensitive receptors as well as ecological sensitive areas.

Table 16.22: Geographical Split of Assessment Zones

Reference	Geographical Split	Description
AZ1	Northern Section	Estuary Station to DANP. It includes the railway crossing on a viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut, and cut and cover sections.
AZ2	Airport Section	Section AZ1 includes the Park and Ride facility at Estuary Station as well as stations at Seatown, Swords Central and Fosterstown.
AZ3	Dardistown–Northwood	Section AZ2 of the proposed Project includes the ESBN connection and new substations, the DANP, the tunnel underneath Dublin Airport, Dublin

Reference	Geographical Split	Description
		Airport Station and DASP and associated intervention and ventilation tunnels.
AZ4	Northwood–Charlemont	Section AZ3 of the proposed Project covers from south of DASP to the Northwood Portal. Section AZ3 includes Dardistown station, the Dardistown Depot, ESBN connection and substations, the M50 Crossing, Northwood station and the TBM launch site at Northwood. This section will include open, retained cut, and cut and cover sections of the alignment.

16.4.2.1 AZ1 Northern Section

The AZ1 study area includes construction of the P&R facility, rail station and ancillary infrastructure at Estuary, construction of cut and cover section between the P&R facility, demolition of a retail unit at Airside Retail Park, construction of three rail stations and platforms, construction of the DANP, and construction of ancillary structures (bridges/viaduct). Details are available in Appendix 16.2. In addition, a number of utility diversion works will be required at each of the main work areas. Air quality sensitive locations in this study area include residential dwellings to the east and west of the R132 between Estuary and Fosterstown, schools, nursing homes, pre-schools, creches, retreat centres and offices in proximity to these work areas.

16.4.2.2 AZ2 Airport Section

The AZ2 study area includes construction of the Dublin Airport Station, a surface carpark associated with the airport, and the DASP. In addition, a number of utility diversion works will be required at each of the two main work areas. Air quality sensitive locations within this study area include office and hotel buildings within Dublin Airport and Our Lady Queen of Heaven Church at Dublin Airport.

16.4.2.3 AZ3 Dardistown – Northwood

The AZ3 study area includes construction activities within the Dardistown Depot, viaduct crossing over the M50 and the construction compound at Northwood including the Northwood Station. Air quality sensitive locations in this study area include residential buildings along the Old Airport Road, at Ballymun Cross immediately south of the M50, along the R108 Ballymun Road and residential and hotels within Ballymun North. There is also one industrial receptor and some long-term outdoor carparks in this area.

16.4.2.4 AZ4 Northwood – Charlemont

The AZ4 study area includes surface works relating to station box construction at Ballymun, Collins Avenue, Griffith Park, Mater Hospital, O'Connell Street, Tara Street, St Stephen's Green and Charlemont, construction of rail interchange and rail realignment works at Glasnevin, and intervention shaft at Albert Park College Park. In addition, a number of utility diversion works will be required across the extent of the proposed Project at each of the main work areas. Air quality sensitive locations in this study area include a mix of residential dwellings, schools, churches, hospitals and other sensitive building uses adjacent to the construction work areas noted above in this study area.

16.4.3 Existing Ambient Air Quality

A full year of baseline air quality monitoring has been completed. The data collected have been included to provide site specific background concentrations of NO_2, PM_{10}, $PM_{2.5}$ and dust deposition in areas which have the potential to be impacted by the proposed Project as per the study area outlined in Section 16.3.1. In addition, a desktop review of the EPA air quality monitoring programs has been undertaken in recent years. The most recent annual report on air quality "Air Quality in Ireland 2020 – Indicators of Air Quality" (EPA 2021a), details the range and scope of monitoring undertaken throughout Ireland.

16.4.3.1 EPA Data

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 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. Zone D would be considered to have the best air quality due to low background levels of pollutants. The more populated Zones A and B would be likely to have higher air pollutant concentrations.

Long-term monitoring data have been used to determine background concentrations for the key pollutants in the area of the proposed Project. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating).

In terms of air quality monitoring, the proposed Project crosses both Zones A and D. In order to complete a conservative assessment, it is assumed that the whole assessment area is categorised as Zone A as there is only a 0.5km section, within AZ1, which is in Zone D, as shown in Figure 16.1 (EPA 2020a).

In 2020 the EPA reported (EPA 2021a) that Ireland was compliant with EU legal air quality limits at all locations, however this was largely due to the reduction in traffic due to Covid-19 restrictions. The EPA report details the effect that the Covid-19 restrictions had on stations, which included reductions of up to 50% at some monitoring stations which have traffic as a dominant source. The report also notes that CSO figures show that while traffic volumes are still slightly below 2019 levels, they have increased since 2020 levels. 2020 concentrations are therefore predicted to be an exceptional year and not consistent with long-term trends. For this reason they have not been included in the baseline section.

With regard to NO_2, continuous monitoring data from the EPA (EPA 2020a) Zone A stations was reviewed, as shown in Table 16.23. The stations representative of the proposed Project are Swords, Ballyfermot, Rathmines, Coleraine Street (closed in 2017) and Winetavern Street. Sufficient data are available for all of these stations to review long-term trends over a five-year period (2015 to 2019). Long-term annual average levels at the three suburban background sites (Swords, Ballyfermot and Rathmines) range from 13µg/m^3 to 22µg/m^3 over the period 2015 to 2019, with an average concentration of 17.2µg/m^3 in 2019 compared to the annual limit value of 40µg/m^3. Long-term annual average levels at the long-term urban traffic sites (Coleraine Street and Winetavern Street) in the City Centre range from 25µg/m^3 to 37µg/m^3 over the period 2015 to 2019, with an average concentration of 28µg/m^3 in 2019 compared to the annual limit value of 40µg/m^3. Two new urban sites St John's Road and Pearse Street were installed in 2018 and 2019 respectively. Both of these new monitoring stations showed exceedances of the annual mean limit value since they opened of 43µg/m^3 and 49µg/m^3 respectively. The monitoring locations were chosen, in part, due to the potential for exceedances of the annual mean limits at these locations. In accordance with the significance criteria set out in Section 16.3.7, the potential for significant impacts due to small increases or decreases in concentrations is higher at these locations. There were no exceedances of the one-hour limit value of 200µg/m^3 at the suburban background or urban stations over the last five years.

The ambient NO_2 monitoring results for Swords, Ballyfermot, Rathmines, Winetavern Street and Coleraine Street over the period 2015 to 2019, based on a three-year rolling average, are shown in Diagram 16.5. The data and trend line indicate that levels are reasonably constant at each location over the five-year period.

Table 16.23: Trends in Suburban and Urban NO_2 Concentration (µg/m³) 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/m³)	31	37	27	29	28	40
		99.8th%ile 1-hr NO_2 (µg/m³)	128	120	110	115	115	200
Rathmines	Urban Background	Annual Mean NO_2 (µg/m³)	18	20	17	20	22	40
		99.8th%ile 1-hr NO_2 (µg/m³)	105	88	86	87	102	200
Ballyfermot	Suburban Background	Annual Mean NO_2 (µg/m³)	16	17	17	17	20	40
		99.8th%ile 1-hr NO_2 (µg/m³)	127	90	112	101	101	200
Coleraine Street	Urban Traffic	Annual Mean NO_2 (µg/m³)	25	28	26	-	-	40
		99.8th%ile 1-hr NO_2 (µg/m³)	157	147	189	-	-	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	108	200

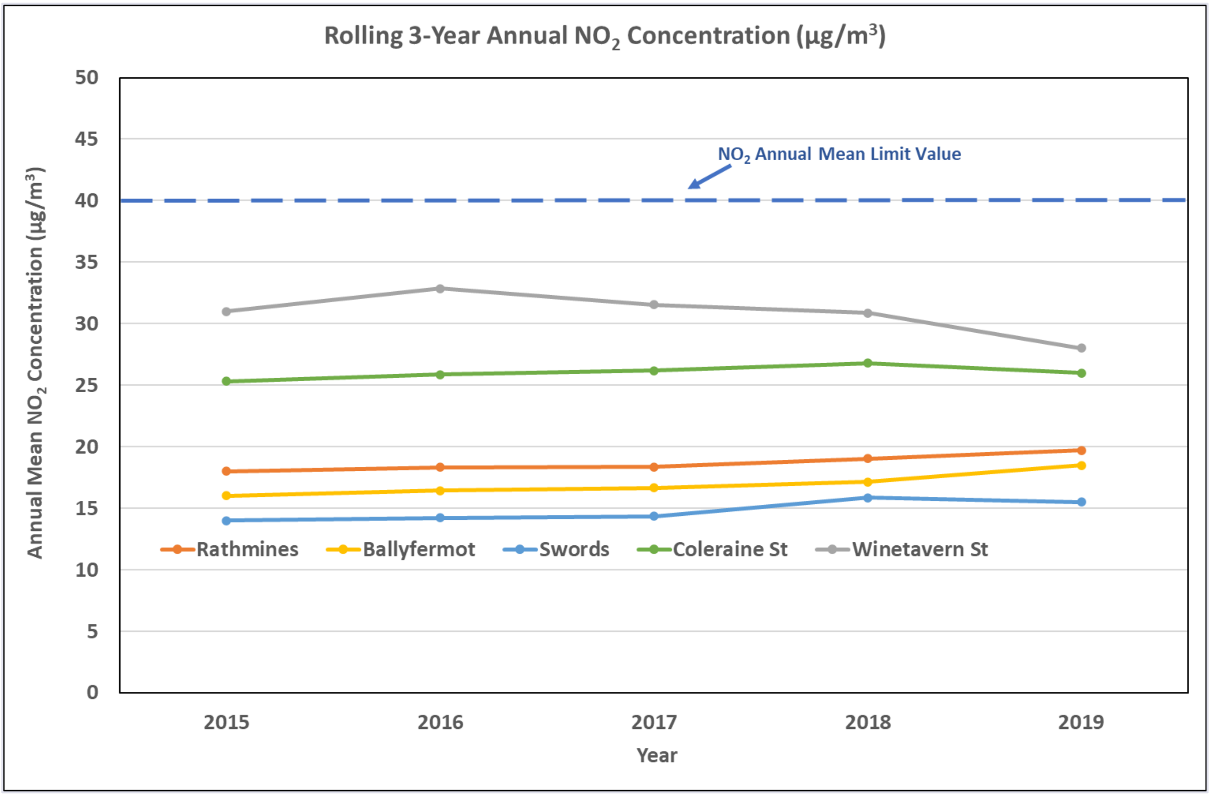

Diagram 16.5: Rolling 3-Year Annual NO_2 Concentration (µg/m³)

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 Project (EPA 2020b). The diffusion tube sampling was carried out in conjunction with DCC. 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 16.3.3 as part of the site-specific monitoring study. The roadside monitoring location at Clonturk Avenue were found to exceed the annual mean NO_2 concentration in 2019.

Table 16.24: EPA NO_2 Diffusion Tube Monitoring Data

Monitoring Site	Monitoring Year	Annual Mean NO_2 Concentration (µg/m³)
EPA/DCC – Clonturk Avenue	2019	49.8
EPA/DCC – Aulden Grange	2019	33.2
EPA/DCC – Drumcondra Library	2019	21.0
EPA/DCC – Ballymun Library	2019	24.2

A new PM_{10} monitoring station in Finglas was opened in August 2018 and the annual mean PM_{10} concentration in 2019 was 13µg/m³. In addition to the new Finglas station, two further PM_{10} and $PM_{2.5}$ monitoring stations were opened in 2020. These are located at Ballymun Library and Drumcondra Public Library; both are classified as urban stations. No EPA ratified data are available from either of these stations and therefore other stations in Zone A are reviewed with respect to long-term background concentrations. Continuous PM_{10} monitoring carried out at monitoring stations at Ballyfermot, Dun Laoghaire, Rathmines and Phoenix Park showed annual average levels ranging from 11µg/m³ to 14µg/m³ in 2019, with a maximum of five exceedances of the 24-hour limit value of 50µg/m³ (35 exceedances are permitted per year). Longer term averages from 2015 to 2019 show annual average concentrations of between 10µg/m³ and 15µg/m³ as shown in Table 16.25. These are significantly below the annual mean limit value for PM_{10} of 40µg/m³.

Average PM_{10} levels at the urban traffic monitoring location of Winetavern Street which is in the city centre have been reviewed. The annual average level in 2019 was 15µg/m³, with three exceedances of the 24-hour limit value of 50µg/m³. The City Centre monitoring location of Winetavern Street has a long-term average (2015 to 2019) of 14µg/m³.

Continuous $PM_{2.5}$ monitoring carried out at the Zone A locations of Finglas, Rathmines and Marino showed average levels of 8µg/m³ in 2019. The annual average level measured in Finglas in 2019, was 8µg/m³ compared to an annual mean limit value of 25µg/m³. Longer term averages from 2015 to 2019 show annual average concentrations of between from 7µg/m³ to 10µg/m³.

Table 16.25: Trends in Suburban and Urban PM_{10} Concentration (µg/m³) in Dublin 2015 to -2019

Station	Averaging Period	Year					Limit Value
		2015	2016	2017	2018	2019	
Winetavern Street	Annual Mean PM_{10} (µg/m³)	14	14	13	14	15	40
	90th%ile 24-hr PM_{10} (µg/m³)	25	23	21	24	24	50
Rathmines	Annual Mean PM_{10} (µg/m³)	15	15	13	15	12	40
	90th%ile 24-hr PM_{10} (µg/m³)	28	28	24	25	21	50
Phoenix Park	Annual Mean PM_{10} (µg/m³)	12	11	9	11	11	40
	90th%ile 24-hr PM_{10} (µg/m³)	20	20	16	18	18	50
Ballyfermot	Annual Mean PM_{10} (µg/m³)	12	11	12	16	14	40
	90th%ile 24-hr PM_{10} (µg/m³)	22	21	21	24	26	50

16.4.3.2 Proposed Project Monitoring Data

A baseline field survey was conducted for NO_2, dust deposition and PM_{10}/$PM_{2.5}$ (particulate matter <10µm and <2.5µm) as part of the air quality assessment for the proposed Project. Monitoring took place over an approximate 12-month period from September 2018 to September 2019. Due to an increased scope, additional monitoring locations were added in February 2019, refer to Figure 16.2.

The baseline monitoring study was carried out close to the alignment of the proposed Project, with monitoring focusing on areas of greatest potential impact due to traffic associated with the proposed Project or potential dust impacts from construction.

The results of the survey allow an indicative comparison with the annual limit values for NO_2 and PM_{10}, and the 24-hour limit value for PM_{10}. The results also provide information on the influence of road sources relative to the prevailing background level of these pollutants in the area.

16.4.3.3 NO_2

Table 16.26 shows the results of the baseline NO_2 diffusion tube monitoring at 14 locations (one location in triplicate) for the twelve months of monitoring and eight months of data at the additional three locations added in February 2019. NO_2 results are presented in Diagram 16.5, Figure 16.2 and Table 16.26 for the passive diffusion tube method. The NO_2 diffusion tube concentrations measured over the 12-month period are generally below the annual EU limit value of 40µg/m³ for the protection of human health in the majority of, but not all, locations.

The overall average bias adjusted (as detailed in Section 16.3.3) concentration was 28.1µg/m³ across all monitoring locations. The highest concentration was recorded at the roadside location of Prospect Road/Lindsay Grove, an area which experiences traffic congestion and is adjacent to the proposed Glasnevin Station. Concentrations at this location averaged 47.8µg/m³ or 120% of the annual mean limit value. The lowest concentration was recorded at the proposed Estuary P&R facility in Lissenhall (average of 12.8µg/m³).

The 99.8th%ile of the hourly concentrations from the proposed Estuary P&R in Lissenhall was 75.6µg/m³, which is 40% of the EU limit value of 200µg/m³. The average NO_2 concentration measured over the monitoring period at this location was 12.4µg/m³, which is below the annual EU limit value of 40µg/m³. Average monitored concentrations at the continuous monitor were in reasonable agreement with the concentrations monitored using diffusion tubes.

Table 16.26: NO_2 Diffusion Tube Monitoring Results (Bias adjusted)

Ref./ AZ NO.	Site	Month 1 µg/m³	Month 2 µg/m³	Month 3 µg/m³	Month 4 µg/m³	Month 5 µg/m³	Month 6 µg/m³	Month 7 µg/m³	Month 8 µg/m³	Month 9 µg/m³	Month 10 µg/m³	Month 11 µg/m³	Month 12 µg/m³	Mean	Locally Bias adjusted NO_2 Conc. (µg/m^{-3})
D1 / AZ1	Estuary Park & Ride at Lissenhall (Triplicate Average)	14.7	25.6	20.7	13.6	20.2	14.4	21.8	17.2	13.4	12.3	9.9	15.1	16.6	12.8
D2 / AZ1	Foxwood Estate, Swords	33.2	30.6	31.1	32.3	28.8	28.4	22.0	23.6	20.7	Lost	19.0	25.4	26.8	20.7
D3 / AZ1	Airside, Near Premier Inn	30.3	Lost	Lost	48.1	Lost	39.9	27.7	30.5	34.4	31.1	35.0	36.9	34.9	26.9
D4 / AZ2/3	Old Airport Road	47.3	56.1	53.4	42.9	50.9	39.6	51.4	40.4	39.6	37.3	34.9	45.7	45.0	34.6
D5 / AZ4	Shangan Road / Coultry Road	39.8	42.4	39.4	Lost	35.8	33.6	Lost	Lost	34.9	31.4	23.0	29.3	34.4	26.5
D6 / AZ4	Ballymun Road / Albert College Court	33.1	28.9	33.1	36.1	31.9	25.1	30.7	Lost	20.6	21.4	18.8	38.9	29.0	22.3
D7 / AZ4	St Mobhi Road	39.8	36.7	40.7	43.6	37.0	38.5	31.9	Lost	30.3	26.7	24.0	34.9	34.9	26.9
D8 / AZ4	Prospect Road /	70.2	Lost	71.1	63.9	67.6	59.7	74.8	37.1	63.2	61.2	48.2	66.2	62.1	47.8

	Lindsay Grove														
D9 / AZ4	Berkley Road/ Eccles Street	41.9	56.1	52.4	43.3	52.2	37.3	56.4	20.3	34.5	32.6	29.6	43.4	41.7	32.1
D10 / AZ4	35 Fedrick Street	53.3	47.3	57	55.7	50.3	Lost	55.8	47.0	42.5	39.0	40.6	42.9	48.3	37.2
D11 / AZ4	Setanta Place / Kildare Street	61.3	68.3	61.3	55.5	64.7	57.5	77.9	54.5	50.9	51.0	44.3	56.5	58.6	45.2
D12 / AZ4	Hume Street / Stephen's Green	59.2	71.2	61.9	53.0	Lost	41.7	Lost	Lost	36.7	39.4	30.0	48.3	49.0	37.8
D13 / AZ4	Adelaide Road / Hatch Lane	43	40.7	43.1	38.9	41.3	35.6	51.5	38.2	35.3	28.7	26.9	Lost	38.5	29.6
D14/ AZ1	Dartmouth Road	32.8	30.2	34.2	36.3	31.9	29.5	35.2	30.8	24.0	19.2	16.9	27.7	29.1	22.4
D19/ AZ4	Foxwood Estate, Swords	Not applicable				4.4	Lost	25.8	Lost	18.3	Lost	14.0	25.5	17.6	13.6
D20/ AZ4	Ballymun Road					20.2	24.9	44.7	37.3	31.1	26.6	20.2	38.0	30.4	23.4
D21/ AZ4	Attracta Road					29.7	22.8	Lost	28.5	19.5	18.8	15.0	26.1	22.9	17.6
Average		42.8	44.5	46.1	43.3	37.8	35.2	43.4	33.8	32.3	31.8	26.5	37.6	36.5	28.1
Max		70.2	71.2	71.1	63.9	67.6	59.7	77.9	54.5	63.2	61.2	48.2	66.2	62.1	47.8
Min		14.7	25.6	20.7	13.6	4.4	14.4	21.8	17.2	13.4	12.3	9.9	15.1	16.6	12.8

Note: Locally bias adjusted concentrations in bold exceed the 80% threshold value for screening modelling

Note: Numbering skip from D14 to D19 due to changes in the study area after work completed

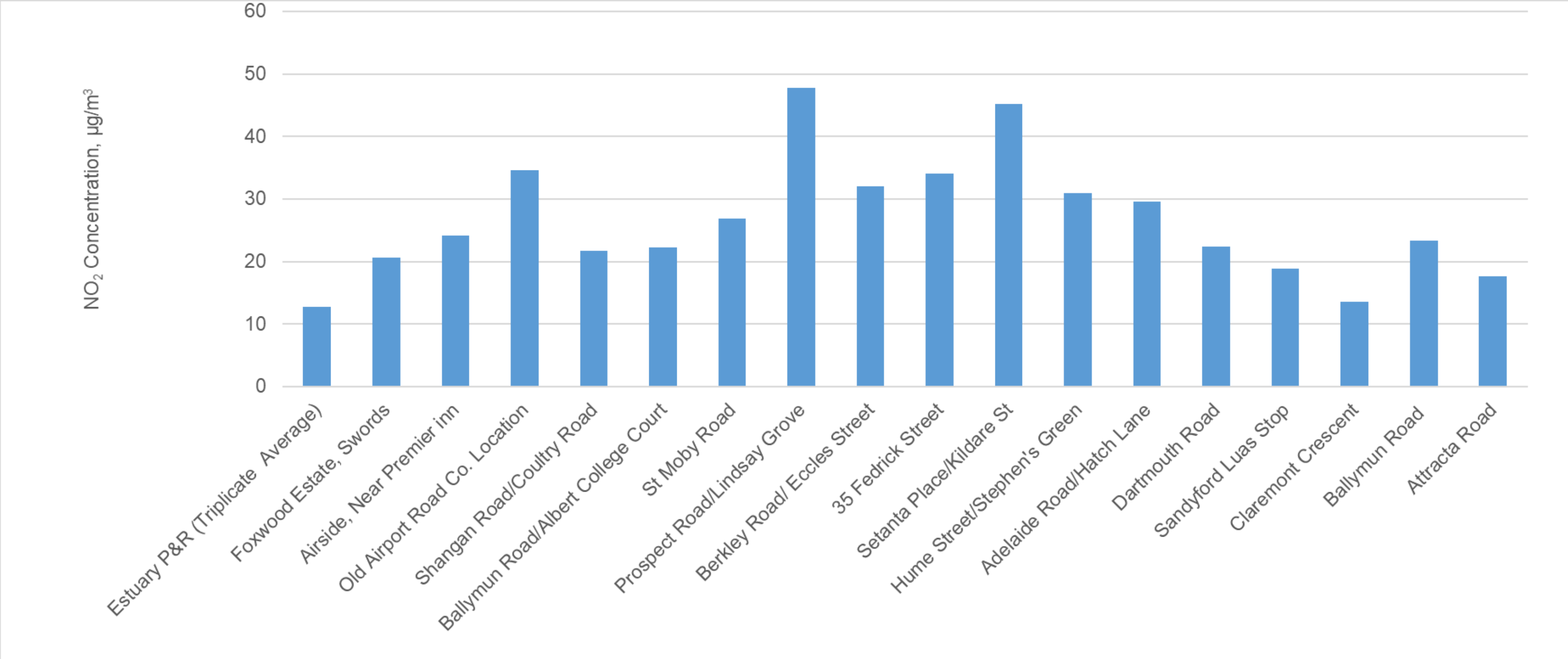

Diagram 16.5: Annual Mean NO_2 Diffusion Tube Concentrations

PM_{10} and $PM_{2.5}$

Concentrations at the Lissenhall, Old Airport Road and Ballymun Road locations are significantly below the annual mean limit value for both PM_{10} and $PM_{2.5}$. Averaged results are shown in Table 16.27. The 90.4th%ile of 24-hour averages was also below the limit value of 50µg/m³. The maximum number of daily exceedances (35 allowable exceedances per year) was 10. This was measured at the heavily trafficked roadside monitoring location on the Ballymun Road.

Table 16.27: Particulate Matter Monitoring Results (September 2018 – September 2019)

Ref.	AZ No.	Site	90.4th%ile of 24-hour Av. (No. of days above 50µg/m³) Note 1	Av. Total Suspended Particulate (TSP)	Av. PM_{10}	% of PM_{10} Limit Value (40µg/m³) Note 2	Av. $PM_{2.5}$	% of $PM_{2.5}$ Limit Value (25µg/m³) Note 3
Osiris 1	AZ1	Lissenhall P&R Location	20.0 (0)	17.8	12.0	30%	6.2	25%
Osiris 2	AZ2/3	Old Airport Road	23.3 (1)	19.7	13.5	34%	7.8	31%
Osiris 3	AZ4	Ballymun Road Note 4	43.7 (10)	28.2	19.6	49%	11.4	46%
Av.= Average								

Note 1 - 90.4th%ile of 24-hour Average, EU 2008/50/EC – Clean Air for Europe (CAFE) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 - PM_{10} Annual Average, EU 2008/50/EC – Clean Air for Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 3 - $PM_{2.5}$ Annual Average, EU 2008/50/EC states – 'Stage 2 – indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'.

Note 4 - The monitor was installed 14/02/2019

16.4.3.4 Dust Deposition

There are no statutory limits for dust deposition in Ireland. However, the German Technical Guidelines on Air Quality, known as the TA Luft standards, have set an emission level for dust deposition (non-hazardous dust). An emission level is defined in the TA Luft as a mass concentration or deposition level of an air pollutant. The maximum permissible emission level for dust deposition over a one-year period is 350mg/(m²*day) at any receptors outside the site boundary. A 2004 report from the Department of Environment Heritage and Local Government entitled "Quarries and Ancillary Activities, Guidelines for Planning Authorities" applies the TA Luft limit for dust deposition at the boundary of quarries.

The dust deposition concentrations measured at the nine initial locations are presented in Table 16.28, three additional locations were added in February 2019 and these are also included in the table. Measurements were taken using dust jars (DJ). The highest concentration occurred on St Mobhi Road with dust deposition values of 93% of the limit value. However, these annual mean concentrations were skewed by a single particularly high month (1,400mg/m²/day) in September 2019), excluding this single data point results in concentrations reducing to 66% of the limit value. The results for the monitoring period indicate that the dust depositions level vary significantly from month to month. No sites exceeded the annual TA Luft limit value of 350mg/(m²*day).

Table 16.28: Dust Deposition Monitoring Results (September 2018 – September 2019)

Sample Location	AZ NO.	Sampling Period												Av.	Av. % of Limit Value
		05/10/18 - 05/11/18	05/11/18 - 03/12/18	03/12/18 - 03/01/19	03/01/19 - 04/02/19	04/02/19 - 04/03/19	04/03/19 - 01/04/19	1/04/19 - 05/05/19	5/05/19 - 07/06/19	07/06/19 - 05/07/19	05/07/19 - 06/08/19	06/08/19 - 10/09/19	10/09/19 - 10/10/19		
Sample DJ1	AZ1	64	706	278	667	59	89	96	-	29	76	<5.0	192	225	64%
Sample DJ2	AZ1	183	-	102	26	60	89	68	59	230	46	67	113	95	27%
Sample DJ3	AZ2/3	120	165	157	193	187	122	91	247	254	160	24	264	165	47%
Sample DJ4	AZ4	66	87	66	18	63	93	295	69	32	85	66	118	88	25%
Sample DJ5	AZ4	687	212	274	8	54	27	185	608	75	113	285	1400	327	93%
Sample DJ6	AZ4	88	777	93	10	131	137	66	134	82	48	77	148	149	43%
Sample DJ7	AZ4	108	261	85	28	236	152	171	185	119	57	26	196	135	39%
Sample DJ8	AZ4	97	126	140	143	133	145	253	-	26	99	30	232	129	37%
Sample DJ9	AZ4	57	92	159	37	78	86	138	134	41	42	28	111	84	24%
Sample DJ11	AZ4	N/A				458	167	631	212	48	249	194	174	267	76%
Sample DJ12	AZ4					225	130	36	52	46	19	42	104	82	23%
Sample DJ13	AZ3					35	91	223	-	114	13	43	348	124	35%
Av. = Average															

Note: Numbering skip from DJ9 to DJ11 due to changes in the study area after work completed, DJ = Dust Jar

16.4.3.5 Existing Baseline Dust Sensitivity Assessment

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.

16.5 Predicted Impacts

The proposed Project will involve the development of a high-capacity, high-frequency rail line running from Estuary to Charlemont, linking Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services, creating fully integrated public transport in the Greater Dublin Area. When considering a development of this nature, the potential air quality impact on the surroundings must be considered for each of two distinct stages:

- Do-Nothing Scenario;
- Construction Phase; and
- Operational Phase

Details of the modelled traffic scenarios is provided in Section 16.3.6.

16.5.1 Do-Nothing Scenario

16.5.1.1 Do-Nothing Traffic Modelling

Due to the variations in traffic impacts in the two Construction Phase and two Operational Phase scenarios, four separate road networks have been modelled for the Do Nothing (DN) scenario. The four networks are shown in Figure 16.4, Figure 16.5, Figure 16.10 and Figure 16.11.

16.5.1.2 Do-Nothing Traffic Modelling of Receptors Selected for the Construction Phase Southern Peak Scenario

The DN scenario is assessed for the receptors which are modelled for Construction Phase Southern Peak Scenario using ADMS-Roads for the baseline year of 2020. 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 worst-case existing air quality sensitive receptors in the 2020 DN for the Construction Phase Southern Peak Scenario are listed in Table 16.29. Statistics for the full list of modelled receptors can be found in Table 16.3.1 of Appendix A16.3 and Figure 16.4. 'Worst-case' refers to those receptors with the higher impact rating i.e. non-negligible impacts due to the proposed Project. Receptors for this scenario are prefixed with CP_CS to denote Construction Phase southern scenario.

Table 16.29: Predicted Existing Baseline (Do Nothing Scenario) Pollutant Statistics at Worst-Case Receptor Locations for the Construction Phase Southern Peak Scenario

DN (2020) Construction Phase Southern Peak Scenario						
Receptor	Location	Receptor Location (ITM)	Annual Mean Concentration (µg/m3)			No of PM10 days > 50 µg/m3
			NO_2	PM_{10}	$PM_{2.5}$	
CP_CS229	N1 – Wardwicke Place Junction	715596,735564	53.9	17.6	10.0	1
Air Quality Objective			40	40	25	35

In the 2020 DN Construction Phase Southern Peak Scenario annual mean concentrations of NO_2 are above the relevant national air quality objective in some areas. The 56 exceedances were concentrated on the N1 between Granby Row and R802 junctions, Phibsborough to Glasnevin at the Finglas Road

Junction; some exceedances were also modelled in proximity to the M50, on the R110 Crumlin Road, R137 and R114. Concentrations for these receptors can be found in Table 16.3.1, Appendix A16.3. Not all are included in the results tables in this chapter as they experience a negligible impact due to the proposed Project and therefore are not considered worst-case receptors. Annual mean NO_2 concentrations did not exceed 60µg/m^3 at any locations indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. It should be noted that this was in proximity to the highest monitoring results recorded and traffic congestion is considered to be the source of the high concentrations. Annual mean PM_{10} concentrations are below the relevant national air quality objectives in 2020 for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicates that there is likely to be no more than one exceedance of the 50µg/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 objectives for all modelled receptors.

16.5.1.3 Do-Nothing Traffic Modelling of Receptors Selected for the Construction Phase Northern Peak Scenario

The DN for the Construction Phase Northern Peak Scenario has been modelled using ADMS-Roads for the baseline year of 2020. 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 worst-case existing air quality sensitive receptors in the 2020 DN for the Construction Phase Northern Peak Scenario are listed in Table 16.30. Statistics for the full list of modelled receptors can be found in Table 16.3.2 of Appendix A16.3 and Figure 16.5. 'Worst-case' refers to those receptors with the higher impact rating i.e. non-negligible impacts due to the proposed Project. Receptors for this scenario are prefixed with CP_NP to denote Construction Phase northern peaks.

Table 16.30: Predicted Existing Baseline (Do Nothing Scenario) Pollutant Statistics at Worst-Case Receptor Locations for the Construction Phase Northern Peak Scenario

DN (2020) Construction Phase Northern Peak Scenario						
Receptor	Location	Receptor Location (ITM)	Annual Mean Concentration (µg/m^3)			No of PM_{10} days > 50 µg/m^3
			NO_2	PM_{10}	$PM_{2.5}$	
CP_CN56	R125 North Airside Roundabout	717957,745821	28.7	15.6	11.0	1
CP_CN59	R125 North Airside Roundabout	718168,745690	28.0	15.5	10.9	<1
CP_CN79	R132 South of Airside	717705,745229	31.7	16.1	11.3	1
CP_CN552	Glasnevin R108	715079,736628	51.1	17.6	12.3	1
Air Quality Objective			40	40	25	35

In the 2020 DN Construction Phase Northern Peak Scenario annual mean concentrations of NO_2 are above the relevant national air quality objective at 40 modelled locations. Given their locations it is mostly likely that exceedances occur due to high volumes of traffic combined with some congestion, which increases emissions. It should be noted that the modelled area for the southern peak extends over a greater area than the modelled area for the northern peak. This combined with the location of the additional links from the southern peak scenario being located in more city centre locations results in a pointedly higher number of exceedances modelled for the southern scenario. Concentrations for the full list of DN northern peak receptors can be found in Table 16.3.2 of Appendix A16.3. While exceedances are modelled at these locations in the DN, they have been excluded from results tables in this chapter as these locations experience negligible impacts due to the proposed Project. They are therefore not considered a worst-case receptor. Annual mean NO_2 concentrations do not exceed 60µg/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 objectives in 2020 for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration indicates that there is likely to be no more than one exceedance of the 50µg/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 objectives for all modelled receptors.

Do-Nothing Traffic Modelling of Receptors Selected for the Operational Phase Scenario A

Under this scenario, the current air quality environment experienced within the study area will remain unchanged. The DN assumes no changes to the road infrastructure. The DN traffic has been modelled using ADMS-Roads for the baseline year of 2020 and are representative of the DN scenario. The modelled DN study area for Scenario A is based on the criteria set out in Section 16.3.6. The Operational Phase Scenario A is overall negligible in terms of the annual mean NO_2, PM_{10} and PM $_{2.5}$ concentrations (discussed in Section 16.5.3) at all modelled receptors. Worst-case refers to those receptors with the higher impact rating i.e. non-negligible impacts (as per Section 16.3.7) due to the proposed Project.

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 the selected worst-case existing air quality sensitive receptors in the 2020 DN Operational Phase Scenario A can be found in Table 16.3.3 of Appendix A16.3 and Figure 16.10. Receptors for this scenario are prefixed with OP_SA to denote Operational Phase Scenario A. There are four locations, which are residential properties in close proximity to the M50 (OP_SA _151) and close to R104 and N1 (OP_SA _31, OP_SA _32 and OP_SA _218), where the NO_2 annual mean limit value is predicted to be exceeded in the DN. The exceedances are 52.5 µg/m^3, 42.3 µg/m^3, 59.4 µg/m^3 and 41.2 µg/m^3 for OP_SA _151, OP_SA _31, OP_SA _32 and OP_SA _218 respectively.

Table 16.31: Predicted Existing Baseline (Do Nothing Scenario) Pollutant Statistics at Worst-Case Receptor Locations for the Operational Phase Scenario A

DN (2020) Operational Phase Scenario A						
Receptor	Location	Receptor Location (ITM)	Annual Mean Concentration (µg/m^3)			No of PM_{10} days > 50 µg/m^3
			NO_2	PM_{10}	$PM_{2.5}$	
OP_SA _151	M50	707825,736507	52.5	22.7	15.1	7
Air Quality Objective			40	40	25	35

16.5.1.4 Do-Nothing Traffic Modelling of Receptors Selected for the Operational Phase Scenario B

Under this scenario, the current air quality environment experienced within the study area will remain unchanged. The DN assumes no changes to the road infrastructure. The DN scenario has been modelled using ADMS-Roads for the baseline year of 2020 and are presentative of the DN scenario. The modelled DN study area for Scenario B is based on the criteria set out in Section 16.3.6. The Operational Phase Scenario B is overall negligible in terms of the annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations (discussed in Section 16.5.3) all modelled receptors, and as such there are therefore no worst-case receptors. 'Worst-case' refers to those receptors with the highest impact rating i.e. non-negligible impacts due to the proposed Project.

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 the selected worst-case existing air quality sensitive receptors in the 2020 DN for Operational Phase Scenario B can be found in Table 16.3.4 of Appendix A16.3 and Figure 16.11. Receptors for this scenario are prefixed with OP_SB to denote Operational Phase scenario B. There are two locations, both of which are residential properties in close proximity to the M50 (OP_SB _138 and OP_SB _150) which exceed the NO_2 annual mean limit value in the DN. The exceedances are 41.1µg/m^3 and 52.3µg/m^3 for OP_SB _148 and OP_SB _150 respectively.

16.5.2 Construction Phase

16.5.2.1 Construction Phase Traffic Impact Assessment

In addition to direct impacts from dust generated due to construction works, there is also the potential for air impacts from construction traffic along public roads and the redistribution of private vehicle traffic due to construction.

A detailed analysis of construction traffic volumes has been conducted to determine the expected HGV movements required to transport the materials extracted from and delivered to site. Whilst the overall construction period is forecast as 9.25 years the modelled traffic is representative of the worst-case month with respect to traffic impacts for the southern and northern sections of the proposed Project. The air quality assessment considers annual average traffic and therefore this is a conservative assessment of the Construction Phase impacts of the proposed Project.

Traffic volumes for the base scenario are based on the 2028 Do Minimum flows predicted along the local road network. The additional HGV flows per day associated with construction traffic along each road, including construction staff vehicles, deliveries and earthworks material haulage, are added to the base traffic volumes for the DS – details of which can be found in Chapter 5 (MetroLink Construction Phase). In addition, the redistribution of private vehicles due to construction works is also included in the DS. The estimated construction traffic volumes incorporate a series of worst-case assumptions including concentrated construction periods at working areas, assuming the worst-case month occurs for a full year and a conservative background concentration. 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 during for the base (Do Minimum) scenario and the Do Something (base plus construction) scenario were determined.

16.5.2.2 Do-Minimum Traffic Modelling of Receptors Selected for the Construction Phase Southern Peak Scenario

The Do Minimum (DM) Construction Phase Southern Peak scenario has been modelled using ADMS-Roads for the construction 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 worst-case existing air quality sensitive receptors in the 2028 DM scenario are listed in Table 16.32. Statistics for the full list of modelled receptors can be found in Table 16.3.5 of Appendix A16.3. 'Worst-case' refers to those receptors with the highest impact rating i.e. non-negligible impacts due to the Construction Phase of the proposed Project.

Table 16.32: Predicted Do Minimum Construction Pollutant Statistics at Worst-Case Receptor Locations Construction Phase Southern Peak Scenario

DM (2028) Construction Phase Southern Peak Scenario						
Receptor	Locations	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
			NO_2	PM_{10}	$PM_{2.5}$	
CP_CS229	N1 – Wardwicke Place Junction	715596,735564	36.2	16.5	11.4	1
Air Quality Objective			40	40	25	35

In the 2028 DM Construction Phase Southern Peak Scenario annual mean concentrations of NO_2 exceed the relevant national air quality objective for five modelled receptors (CP_CS322 (Georges Quay), CP_CS600 (Phibsborough), CP_CS609 (North Circular Road), CP_CS653 (M50), CP_CS667 (R108 Glasnevin)). This is a decrease from the DN Construction Phase Southern Peak Scenario which has 56 exceedances. Annual mean NO_2 concentrations did not exceed 60µg/m³ at any locations indicating no exceedances of the NO_2 1-hour mean are likely to occur. The exceedances of the annual mean limit value occurred at similar locations as the DN scenario. Annual mean PM_{10} concentrations are below the relevant national air quality 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 one exceedance of the 50μg/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 objectives for all modelled receptors.

16.5.2.3 Do-Something Traffic Modelling of Receptors Selected for the Construction Phase Southern Peak Scenario

The Do Something (DS) scenario has been modelled using ADMS-Roads for the construction year of 2028 in line with the methodology set out in Section 16.3.6. 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 worst-case existing air quality sensitive receptors in the 2028 DS scenario are listed in Table 16.33. Statistics for the full list of modelled receptors can be found in Table 16.3.7 of Appendix A16.3.

Table 16.33: Predicted Do Something Construction Scenario Pollutant Statistics at Worst-Case Receptor Locations Construction Phase Southern Peak Scenario

DS (2028) Construction Phase Southern Peak Scenario						
Receptor	Locations	Receptor Location (ITM)	Annual Mean Conc. (μg/m^3)			No of PM_{10} days > 50 μg/m^3
			NO_2	PM_{10}	$PM_{2.5}$	
CP_CS229	N1 – Wardwicke Place Junction	715596,735564	36.9	16.5	11.5	1
Air Quality Objective			40	40	25	35

In the 2028 DM Construction Phase Southern Peak Scenario annual mean concentrations of NO_2 exceed the relevant national air quality objective for five modelled receptors. This is a decrease from the DN which has 56 exceedances and no change from the DM. Annual mean NO_2 concentrations did not exceed 60μg/m^3 at any locations indicating that exceedances of the NO_2 1-hour mean are not likely to occur. The other exceedances of the annual mean limit value occurred at the same locations as the DN scenario (CP_CS322 (Georges Quay), CP_CS609 (North Circular Road), CP_CS653 (M50) and CP_CS667 (R108 Glasnevin)). Annual mean PM_{10} concentrations are below the relevant national air quality 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 one exceedance 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 objectives for all modelled receptors.

16.5.2.4 DS-DM – Construction Phase Southern Peak Scenario

Table 16.34 provides the predicted change in and impact on pollutant concentrations, between the DM and DS for the Construction Phase Southern Peak Scenario in 2028. Statistics for the full list of modelled receptors can be found in Table 16.3.9 of Appendix A16.3.

Table 16.34: Predicted Changes in Construction DM and DS and Impact Significance Criteria at Worst-Case Receptor Locations

Receptor	Location	Receptor Location (ITM)	Change in Annual Mean Conc. (μg/m^3)			Change in No of PM_{10} days > 50 μg/m^3	Impact on Annual Mean Concentration		
			NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
CP_CS229	N1 – Wardwicke Place Junction	715596, 735564	0.7	0.1	0.0	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 16.34 and Figure 16.5 of this EIAR the majority of modelled receptors are estimated to experience a negligible impact due to the proposed Project in terms of the annual mean NO_2 concentration during the Construction Phase. The proposed Project is predicted to have some adverse and beneficial impacts in terms of the annual mean NO_2 concentrations. There is one receptor which has slight adverse impact due to the proposed Project, with improvements due to redistribution of traffic on the N1 combined with traffic congestion or low speeds at this location. There is a slight adverse impact at five locations. These slight adverse impacts are due to redistribution of traffic and construction vehicles in areas of high background concentrations that is already exceeding the annual mean limit value. While there are a large number of construction vehicles accessing Huntstown Quarry, the worst-case impact on this road is not considered significant due to the overall concentration of air quality being significantly below the annual mean limit value in line with TII Guidance (TII 2011) and the high proportion of Euro VI engines that both the ENEVAL Systra fleet and the EFT 11.0 assume is present for HGVs during the Construction Phase. All other receptors will experience a negligible impact on annual mean NO_2 concentrations. As shown in Table 16.34 and Figure 16.7 the proposed Project is overall neutral in terms of annual mean PM_{10} and $PM_{2.5}$ concentrations, with all receptors experiencing a negligible impact.

The predictions reported are based on conservative assumptions regarding background pollutant concentrations and the improvement in vehicle emission rates. Background concentrations from 2020 have been used to represent 2028 and are likely be lower by the peak construction year than in 2020. Older fleet projections were used in the absence of a fleet that incorporates the effects of 2021 Climate Action Plan (DECC 2021) measures – a larger proportion of electric vehicles is planned by the opening year than has been modelled. Traffic data have been modelled based on a peak construction period, while in practice the construction works will be phased. These data therefore represent a worst-case scenario. In reality, total concentrations (and magnitude of change) are likely to be lower than those reported here over much of the construction period.

16.5.2.5 Ecological Assessment – Construction Phase Southern Peak Scenario

The impact of the proposed Project on the nearby ecologically sensitive areas during the Construction Phase is outlined in Table 16.35. The annual mean NO_X concentration has been compared to the critical level of 30µg/m^3 at each of the designated habitat sites (pNHAs). The predicted concentrations of mean annual NO_x at the locations below exceed the critical level for NO_X past the 200m assessment zone (TII 2011):

- Malahide Estuary SPA SAC pNHA;
- Royal Canal pNHA (Glasnevin Western Side);
- Royal Canal pNHA (Glasnevin Eastern Side);
- Royal Canal pNHA (Drumcondra Western Side);
- Royal Canal pNHA (Drumcondra Eastern Side);
- Grand Canal pNHA (M50 Viaduct Eastern Side);
- Grand Canal pNHA (M50 Viaduct Western Side);
- Liffey Valley pNHA (M50 Western Side);
- Liffey Valley pNHA (M50 Eastern Side);
- Royal Canal pNHA (M50 Western Side);
- Royal Canal pNHA (M50 Eastern Side);
- Royal Canal pNHA (Emmett Bridge Eastern Side);
- Royal Canal pNHA (Emmett Bridge Western Side);
- Royal Canal pNHA (Sallys Bridge Eastern Side);
- Royal Canal pNHA (Sallys Bridge Western Side);
- Royal Canal pNHA (Dolphins Barn Eastern Side);
- Royal Canal pNHA (Dolphins Barn Western Side);
- Grand Canal pNHA (La Touche Bridge Eastern Side);
- Santry Demesne pNHA (Swords Road Western Side); and
- Grand Canal pNHA (La Touche BridgeWestern Side).

These exceedances are mainly due to a busy road and in the case of the Grand Canal pNHA, there is a busy road running parallel with the sensitive receptor leading to contributions not decreasing with distance. There is a contribution at some intersections with Grand Canal pNHA due to the proposed Project of above 1% of the critical level therefore the Project Ecologist was consulted.

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Table 16.36. All sites are below the lower critical load for the designated habitat site with the exception of the Grand Canal pNHA and Liffey Valley pNHA intersections of the M50. At these locations nitrogen deposition is below the lower critical load for the designated habitat site within 10m from the road and the contribution due to the proposed Project is not the cause of the exceedance. In accordance with the EPA Guidelines (EPA 2022) the ecological likely effects associated with the Construction Phase traffic emissions will overall be Negative, Slight and Short-Term.

Table 16.35: Impacts at Key Ecological Receptors for the Construction Phase Southern Peak Scenario (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/m³)	Distance from road beyond which conc. is below critical level (30 µg/m³) (m)	Do Something (µg/m³)	Distance from road beyond which conc. is below critical level (30 µg/m³) (m)	Impact (DS – DM) (µg/m³)	Change as a % of critical level (30 µg/m³) (%)
Malahide Estuary SPA SAC pNHA	719323, 747668	77.1	>200m	77.3	>200m	0.18	0.58%
Royal Canal pNHA (Glasnevin Western Side)	715012, 736305	52.4	>200m	52.6	>200m	0.18	0.59%
Royal Canal pNHA (Glasnevin Eastern Side)	715031, 736295	58.7	>200m	59.0	>200m	0.24	0.80%
Royal Canal pNHA (Drumcondra Western Side)	715827, 736006	64.5	>200m	64.8	>200m	0.23	0.75%
Royal Canal pNHA (Drumcondra Eastern Side)	715851, 735995	66.9	>200m	67.2	>200m	0.25	0.83%
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	99.0	>200m	99.1	>200m	0.06	0.21%
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	85.3	>200m	85.3	>200m	0.04	0.14%
Liffey Valley pNHA (M50 Western Side)	707615,735902	54.3	>200m	54.3	>200m	0.00	0.01%
Liffey Valley pNHA (M50 Eastern Side)	707671, 735923	136.0	>200m	135.9	>200m	-0.01	-0.03%
Royal Canal pNHA (M50 Western Side)	708801, 738175	67.7	>200m	67.7	>200m	0.09	0.29%
Royal Canal pNHA (M50 Eastern Side)	709142, 738168	55.6	>200m	55.6	>200m	0.06	0.19%

Annual Mean NOx in 2028 at Closest Point Within Ecological Site to Road							
Receptor	**Receptor Location (ITM)**	**Do Minimum (µg/m³)**	**Distance from road beyond which conc. is below critical level (30 µg/m³) (m)**	**Do Something (µg/m³)**	**Distance from road beyond which conc. is below critical level (30 µg/m³) (m)**	**Impact (DS – DM) (µg/m³)**	**Change as a % of critical level (30 µg/m³) (%)**
Royal Canal pNHA (Emmett Bridge Eastern Side)	714877, 732439	67.5	>200m	67.6	>200m	0.14	0.47%
Royal Canal pNHA (Emmett Bridge Western Side)	714861, 732440	62.1	>200m	62.2	>200m	0.13	0.42%
Royal Canal pNHA (Sallys Bridge Eastern Side)	714307,732532	69.6	>200m	69.6	>200m	-0.05	-0.16%
Royal Canal pNHA (Sallys Bridge Western Side)	714292, 732536	65.6	>200m	65.6	>200m	-0.05	-0.18%
Royal Canal pNHA (Dolphins Barn Eastern Side)	713689, 732679	53.0	>200m	53.5	>200m	0.51	1.68%
Royal Canal pNHA (Dolphins Barn Western Side)	713669,732694	52.5	>200m	53.0	>200m	0.44	1.45%
Grand Canal pNHA (La Touche Bridge Eastern Side)	715625,732497	67.8	>200m	68.2	>200m	0.35	1.17%
Santry Demesne pNHA (Northwood Avenue Northern Side)	716305, 740879	34.9	80m	34.3	80m	-0.61	-2.02%
Santry Demesne pNHA(Swords Road Western Side)	716971, 740699	33.1	>200m	33.0	>200m	-0.13	-0.43%
Santry Demesne pNHA(Northwood Avenue Southern Side)	716308, 740875	34.6	50m	34.1	50m	-0.58	-1.92%
Santry Demesne pNHA (Santry Avenue)	716354, 740164	39.5	100m	39.7	100m	0.23	0.77%
Grand Canal pNHA (La Touche BridgeWestern Side)	715606, 732498	56.2	>200m	56.4	>200m	0.1	0.48%
Conc. = Concentration							

Note: Two decimal places have been provided where required in order to provide clarity of results.

Table 16.36: Impacts at Key Ecological Receptors for the Construction Phase Southern Peak Scenario (NO_2 Deposition in 2028)

Annual Mean NO_2 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 change is <1% (m)**	**Change in deposition (kgN/ha / yr)**
Malahide Estuary SPA SAC pNHA	719323, 747668	5	4.31	0m	4.32	0m	0.002	0m	0.01
Royal Canal pNHA (Glasnevin Western Side)	715012, 736305	5	3.19	0m	3.20	0m	0.002	0 m	0.01
Royal Canal pNHA (Glasnevin Eastern Side)	715031, 736295	5	3.49	0m	3.50	0 m	0.002	0 m	0.01
Royal Canal pNHA (Drumcondra Western Side)	715827, 736006	5	3.75	0 m	3.76	0 m	0.002	0 m	0.01
Royal Canal pNHA (Drumcondra Eastern Side)	715851, 735995	5	3.86	0 m	3.87	0 m	0.002	0 m	0.01
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	5	5.20	10 m	5.21	10 m	0.000	0 m	0.00
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	5	4.65	0 m	4.65	0 m	0.000	0 m	0.00
Liffey Valley pNHA (M50 Western Side)	707615, 735902	5	3.28	0 m	3.28	0 m	0.000	0 m	0.00
Liffey Valley pNHA (M50 Eastern Side)	707671, 735923	5	6.57	10 m	6.57	10 m	0.000	0 m	0.00
Royal Canal pNHA (M50 Western Side)	708801, 738175	5	3.89	0 m	3.90	0 m	0.001	0 m	0.00
Royal Canal pNHA (M50 Eastern Side)	709142,738168	5	3.34	0 m	3.34	0 m	0.001	0 m	0.00

Annual Mean NO_2 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 change is <1% (m)**	**Change in deposition (kgN/ha / yr)**
Royal Canal pNHA (Emmett Bridge Eastern Side)	714877, 732439	5	3.89	0 m	3.89	0 m	0.001	0m	0.01
Royal Canal pNHA (Emmett Bridge Western Side)	714861, 732440	5	3.64	0 m	3.65	0 m	0.001	0 m	0.00
Royal Canal pNHA (Sallys Bridge Eastern Side)	714307, 732532	5	3.98	0 m	3.98	0 m	0.000	0 m	0.00
Royal Canal pNHA (Sallys Bridge Western Side)	714292, 732536	5	3.80	0 m	3.80	0 m	0.000	0 m	0.00
Royal Canal pNHA (Dolphins Barn Eastern Side)	713689, 732679	5	3.22	10 m	3.24	10 m	0.005	0 m	0.02
Royal Canal pNHA (Dolphins Barn Western Side)	713669, 732694	5	3.20	0 m	3.22	0 m	0.004	0 m	0.02
Grand Canal pNHA (La Touche Bridge Eastern Side)	715625, 732497	5	3.90	0 m	3.92	0 m	0.003	0 m	0.01
Santry Demesne pNHA (Northwood Avenue Northern Side)	716305, 740879	5	2.33	0 m	2.29	0 m	-0.006	0 m	-0.03

Annual Mean NO_2 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 change is <1% (m)**	**Change in deposition (kgN/ha / yr)**
Santry Demesne pNHA(Swords Road Western Side)	716971, 740699	5	2.23	0 m	2.23	0 m	-0.001	0 m	-0.01
Santry Demesne pNHA(Northwood Avenue Southern Side)	716308, 740875	5	2.31	0 m	2.28	0 m	-0.006	0 m	-0.03
Santry Demesne pNHA (Santry Avenue)	716354, 740164	5	2.56	0 m	2.57	0 m	0.002	0 m	0.01
Grand Canal pNHA (La Touche BridgeWestern Side)	715606, 732498	5	3.37	0 m	3.38	0 m	0.00	0 m	0.01

Note: Three decimal places have been provided where required in order to provide clarity of results.

16.5.2.6 Regional Air Quality Assessment – Construction Phase Southern Peak Scenario

The potential changes in regional air emissions due to the traffic impacts of the proposed Project during its Construction Phase Southern Peak Scenario have been assessed using the NTA Environmental Appraisal Tool, which is based on ENEVAL. Use of ENEVAL allows for a more robust large-scale assessment of the impact of regional air impacts due to the proposed Project than the TII recommended DMRB spreadsheet.

The latest version of the NTA Eastern Regional Model Transport model incorporates ENEVAL, as part of the Appraisal Tool, in a Geographical Information System environment. ENEVAL measures the air 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 Southern Peak construction year 2028 of the Construction Phase are shown in Table 16.37. The proposed Project is overall detrimental during the Construction Phase, with increases in emissions of all pollutants modelled. The majority of these increases result from the construction vehicles making deliveries to the site and the redistribution of vehicles onto other longer routes, while construction of the proposed Project takes place. To produce these emissions estimates, the traffic model and therefore ENEVAL have applied the peak construction month in 2028 across the whole year. Emissions are therefore worst-case and likely to be lower in reality. In accordance with the EPA Guidelines (EPA 2022) the regional likely effects associated with the Construction Phase traffic emissions will overall be Negative, Slight and Short-Term.

Table 16.37: Construction Phase Southern Peak Scenario Regional Pollutant Emissions (Tonnes) – (2028)

Receptor	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	2,959	863	393	223	165	4,341	2	2
DS		2,959	863	393	223	165	4,339	2	2
Change		0.35	0.09	0.06	0.03	0.04	-2.07	0.00	0.00
% Change		0.01%	0.01%	0.01%	0.01%	0.02%	-0.05%	0.00%	0.03%
DM	Bus	17	2	10	5	1	6	0	0
DS		17	2	10	5	1	6	0	0
Change		0.072	0.007	0.008	0.004	0.001	0.015	0.000	0.000
% Change		0.42%	0.42%	0.08%	0.09%	0.15%	0.24%	0.00%	0.09%
DM	Goods (including construction vehicles)	3,242	902	245	139	96	497	1	1
DS		3,246	903	247	140	97	499	1	1
Change		4.14	0.42	1.54	0.84	0.30	1.87	0.00	0.00
% Change		0.13%	0.05%	0.63%	0.60%	0.31%	0.38%	-0.01%	0.23%
DM	Total	6,218	1,767	648	367	262	4,843	2	3
DS		6,222	1,767	650	368	263	4,843	2	3
Change		4.56	0.51	1.61	0.87	0.34	-0.19	0.00	0.00
% Change		0.07%	0.03%	0.25%	0.24%	0.13%	0.00%	0.00%	0.09%

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in concentrations is within the traffic model and ENEVAL tool margin of variability, the regional likely effects associated with the Southern Peak Construction Phase traffic emissions pre-mitigation are considered overall Neutral, Not Significant and short-term.

16.5.2.7 Do-Minimum Traffic Modelling of Receptors Selected for the Construction Phase Northern Peak Scenario

The DM scenario has been modelled using ADMS-Roads for the construction 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 worst-case existing air quality sensitive receptors in the Construction Phase Northern Peak DM scenario are listed in Table 16.38. Statistics for the full list of modelled receptors can be found in Table 16.3.6 of Appendix A16.3.

Table 16.38: Predicted Do Minimum Construction Pollutant Statistics at Worst-Case Receptor Locations Construction Phase Northern Peak Scenario

DM (2028) Construction Phase Northern Peak Scenario						
Receptor	Locations	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
			NO_2	PM_{10}	$PM_{2.5}$	
CP_CN56	R125 North Airside Roundabout	717957,745821	27.6	15.7	11.0	1
CP_CN59	R125 North Airside Roundabout	718168,745690	27.2	15.6	10.9	1

DM (2028) Construction Phase Northern Peak Scenario						
Receptor	**Locations**	**Receptor Location (ITM)**	**Annual Mean Conc. (µg/m³)**			**No of PM_{10} days > 50 µg/m³**
			NO_2	**PM_{10}**	**$PM_{2.5}$**	
CP_CN79	R132 South of Airside	717705,745229	27.9	15.9	11.1	1
CP_CN552	Glasnevin R108	715079,736628	42.3	16.9	11.7	1
Air Quality Objective			40	40	25	35

In the DM Construction Phase Northern Peak Scenario, annual mean concentrations of NO_2 exceed the relevant national air quality objective at 1 modelled receptor (CP_CN552 at Glasnevin). This is a decrease of 39 exceedances overall from the DN scenario. Annual mean NO_2 concentrations did not exceed 60µg/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 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 one exceedance of the 50µg/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 objectives for all modelled receptors.

16.5.2.8 Do-Something Traffic Modelling of Receptors Selected for the Construction Phase Northern Peak Scenario

The DS scenario has been modelled using ADMS-Roads for the construction year of 2028 in line with the methodology set out in Section 16.3.6. 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 worst-case existing air quality sensitive receptors in the 2028 DS scenario are listed in Table 16.39. Statistics for the full list of modelled receptors can be found in Table 16.3.8 of Appendix A16.3.

Table 16.39: Predicted Do Something Construction Scenario Pollutant Statistics at Worst-Case Receptor Locations Construction Phase Southern Peak Scenario

DS (2028) Construction Phase Northern Peak Scenario						
Receptor	**Locations**	**Receptor Location (ITM)**	**Annual Mean Conc. (µg/m³)**			**No of PM_{10} days > 50 µg/m³**
			NO_2	**PM_{10}**	**$PM_{2.5}$**	
CP_CN56	R125 North Airside Roundabout	717957,745821	22.6	14.6	10.3	<1
CP_CN59	R125 North Airside Roundabout	718168,745690	22.5	14.6	10.3	<1
CP_CN79	R132 South of Airside	717705,745229	30.6	16.4	11.4	1
CP_CN552	Glasnevin R108	715079,736628	42.7	16.9	11.7	1
Air Quality Objective			40	40	25	35

In the DS Construction Phase Northern Peak Scenario annual mean concentrations of NO_2 exceed the relevant national air quality objective at 1 modelled receptor (CP_CN552). This is no change from the DM scenario. Annual mean NO_2 concentrations did not exceed $60µg/m_3$, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean NO_2 concentrations did not exceed 60µg/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 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 one exceedance of the 50µg/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 objectives for all modelled receptors.

16.5.2.9 DS-DM – Construction Phase Northern Peak Scenario

Table 16.40 provides the predicted change in, and impact on, pollutant concentrations, between the DM and DS for the Construction Phase Northern Peak Scenario in 2028. Statistics for the full list of modelled receptors can be found in Table 16.3.10 of Appendix A16.3.

Table 16.40: Predicted Do Something Construction Scenario Pollutant Concentration Changes and Impacts at Worst-Case Receptor Locations

Receptor	Location	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No of PM_{10} days > 50 µg/m³	Impact on Annual Mean Concentration		
			NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
CP_CN56	R125 North Airside Roundabout	717957,745821	-5.0	-1.1	-0.6	<1	Slight Beneficial	Negligible	Negligible
CP_CN59	R125 North Airside Roundabout	718168,745690	-4.7	-1.0	-0.6	<1	Slight Beneficial	Negligible	Negligible
CP_CN79	R132 South of Airside	717705,745229	2.7	0.5	0.3	0	Slight Adverse	Negligible	Negligible
CP_CN552	Glasnevin R108	715079,736628	0.4	0.0	0.0	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 16.40 and Figure 16.4 Construction Phase of the proposed Project is adverse at some locations and beneficial at other in terms of the annual mean NO_2 concentrations. These adverse impacts are as a result of traffic redistribution and construction vehicles. There are also slightly beneficial impacts estimated at two receptors (CP_CN56 and CP_CN59) due to the closure of the R125 at Pinnockhill. There is a slight adverse impact at two sensitive residential receptors (CP_CN79 and CP_CN552) due to redistributed traffic and construction traffic. While there are a large number of construction vehicles accessing Huntstown Quarry, the worst-case impact on this road is not considered significant due to the overall concentration of air quality being well below the annual mean limit value in line with TII Guidance (TII 2011) and the high proportion of Euro VI engines that both the ENEVAL Systra fleet and the EFT 11.0 assume is present for HGVs during the Construction Phase. All other receptors will experience a negligible impact on annual mean NO_2 concentrations. As shown Table 16.34 and Figure 16.6, the proposed Project is overall neutral in terms of annual mean PM_{10} concentrations, with all receptors experiencing a negligible impact.

The predictions reported are based on conservative assumptions regarding background pollutant concentrations and the improvement in vehicle emission rates. Background concentrations from 2020 have been used to represent construction years and are likely be lower by the peak construction year than in 2020. 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. Traffic data have been modelled based on a peak construction period, while in practice the construction works will be phased. These data therefore represent a worst-case scenario. In reality, total concentrations (and magnitude of change) are likely to be lower than those reported here for much of the construction period.

16.5.2.10 Ecological Assessment – Construction Phase Northern Peak Scenario

An assessment of the impact of the proposed Project 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 predicted absolute concentration is less than 70% of the long-term critical level/load, the impact due to the project is likely to be insignificant. However, in relation to NO_X, absolute concentrations less than 70% of the critical level are rare in urban areas and thus this is unlikely to be relevant for the proposed Project. Where the process contribution is greater than 1% of the critical level/load it is recommended that the project ecologist should be consulted as per IAQM and TII Guidance.

The impact of the proposed Project on the nearby ecologically sensitive areas is outlined in Table 16.41. The annual mean NO_X concentration has been compared to the critical level of 30µg/m³ at each of the designated habitat sites. The Royal Canal pNHA at Glasnevin, Royal Canal pNHA at Drumcondra and Malahide Estuary SPA SAC pNHA M1 crossings exceed the critical level for NO_X within 200m of the proposed Project and the change was above 1% of the critical level on the eastern side therefore the Project Ecologist was consulted.

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Table 16.42. All sites are below the lower critical load for the designated habitat site. There are no exceedances of the critical level of 30µg/m³ directly linked to the proposed Project, they are associated with current traffic volumes. In accordance with the EPA Guidelines (EPA 2022) the ecological likely effects associated with the Construction Phase traffic emissions will overall be Negative, Slight and Short-Term.

Table 16.41: Impacts at Key Ecological Receptors Construction Phase Northern Peak Scenario (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/m³)	Distance from road beyond which conc. is below critical level (30 µg/m³) (m)	Do Something (µg/m³)	Distance from road beyond which conc. is below critical level (30 µg/m³) (m)	Impact (DS – DM) (µg/m³)	Change as a % of critical level (30 µg/m³) (%)
Malahide Estuary SPA SAC pNHA	719323, 747668	77.5	>200m	78.7	>200m	1.2	4%
Royal Canal pNHA (Glasnevin Western Side)	715012, 736305	50.5	>200m	50.6	>200m	0.1	0%
Royal Canal pNHA (Glasnevin Eastern Side)	715031, 736295	56.6	>200m	56.8	>200m	0.2	1%
Royal Canal pNHA (Drumcondra Western Side)	715831, 736004	81.4	>200m	81.1	>200m	-0.3	-1%
Royal Canal pNHA (Drumcondra Eastern Side)	715848, 735992	69.2	>200m	69.0	>200m	-0.2	-1%

Table 16.42: Impacts at Key Ecological Receptors Construction Phase Northern Peak Scenario (NO_2 Deposition In 2028)

Annual Mean NO_2 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 change is <1% (m)**	**Change in deposition (kgN/ha/ yr)**
Malahide Estuary SPA SAC pNHA	719323, 747668	5	2.0	0m	2.0	0m	0%	0m	0.0
Royal Canal pNHA (Glasnevin Western Side)	715012, 736305	5	3.1	10m	3.1	10m	0%	0m	0.0
Royal Canal pNHA (Glasnevin Eastern Side)	715031, 736295	5	3.4	0m	3.4	0 m	0%	0 m	0.0
Royal Canal pNHA (Drumcondra Western Side)	715831, 736004	5	4.5	0 m	4.5	0 m	0%	0 m	0.0
Royal Canal pNHA (Drumcondra Eastern Side)	715848, 735992	5	4.0	10 m	4.0	10 m	0%	0 m	0.0

Note: Conservative lower critical load from TII Guidance (Table A9.1) (TII 2011)

Note: Two decimal places have been provided where required in order to provide clarity of results.

16.5.2.11 Regional Air Quality Assessment – Construction Phase Northern Peak Scenario

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the northern peak construction year 2028 of the Construction Phase are shown in

Table 16.45. The proposed Project is overall detrimental during the Construction Phase, with increases in emissions of all pollutants modelled. The majority of these increases result from construction vehicles making deliveries to the sites and the redistribution of vehicles onto other longer routes, while construction of the proposed Project takes place. To produce these emissions estimates, the traffic model and therefore ENEVAL have applied the peak construction month in 2028 across the whole year. Emissions are therefore worst-case and likely to be lower in reality. In accordance with the EPA Guidelines (EPA 2022) the regional likely effects associated with the Construction Phase traffic emissions will overall be Negative, Slight and Short-Term.

Table 16.43: Construction Phase Northern Peak Scenario Regional Pollutant Emissions (Tonnes) – (2028)

Receptor	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	2,959	863	393	223	165	4,341	2	2
DS		2,961	863	393	223	165	4,341	2	2
Change		1.81	0.51	0.16	0.10	0.14	0.65	0.00	0.00
% Change		0.06%	0.06%	0.04%	0.04%	0.09%	0.02%	0.08%	0.09%
DM	Bus	17	2	10	5	1	6	0	0
DS		17	2	10	5	1	6	0	0
Change		0.014	0.001	0.004	0.002	0.001	0.008	0.000	0.000
% Change		0.08%	0.08%	0.04%	0.04%	0.10%	0.13%	0.00%	0.09%
DM	Goods (including construction vehicles)	3,242	902	245	139	96	497	1	1
DS		3,247	903	247	140	97	499	1	1
Change		5.53	0.68	1.73	0.94	0.36	2.50	0.00	0.00
% Change		0.17%	0.08%	0.70%	0.68%	0.38%	0.50%	0.20%	0.35%
DM	Total	6,218	1,767	648	367	262	4,843	2	3
DS		6,225	1,768	650	368	263	4,846	2	3
Change		7.36	1.19	1.89	1.04	0.51	3.16	0.00	0.01
% Change		0.12%	0.07%	0.29%	0.28%	0.19%	0.07%	0.11%	0.17%

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in concentrations is within the traffic model and ENEVAL tool margin of variability, the regional likely effects associated with the Northern Peak Construction Phase traffic emissions pre-mitigation are considered overall Neutral, Not Significant and Short-Term.

16.5.2.12 Construction Dust

The greatest potential impact on air quality during the Construction Phase is from construction dust emissions, PM_{10} and $PM_{2.5}$ emissions and the potential for nuisance dust. Dust is characterised as encompassing particulate matter with a particle size of between 1- 75µm, and therefore includes both PM_{10} and $PM_{2.5}$. Deposition typically occurs in close proximity to each site and potential impacts generally occur within 350m of the route used by construction vehicles on the public road, up to 500m from the site entrance.

Large particle sizes (greater than 75µm) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 µm are of interest as they can remain airborne for greater distances and give rise to potential dust nuisance at the sensitive receptors.

This section of the chapter provides an overview of the typical activities that have potential for dust impacts during the Construction Phase of the proposed Project. The potential for dust emissions due to construction can vary substantially day to day and are strongly influenced by the level of activity, the specific operations, and the prevailing meteorological conditions. While each individual site compound will differ, the processes that have the potential for the generation of construction dust will be similar, these processes are discussed and the individual sites are reviewed with respect to activities leading to potential dust emissions in Appendix A16.2. Further details on construction methods can be found in Chapter 5 (MetroLink Construction Phase), containing an overview of the typical activities and methods that are anticipated to be used during construction and commissioning of the proposed Project.

The following operations are the main dust generating sources or activities:

- Vegetation Clearance – removes grass and other soil covering prevented emission generation;
- Demolition – the demolition of a number of residential and commercial properties and other structures is required. A summary of the main demolition requirements is provided in Table 5.7 of Chapter 5 (MetroLink Construction Phase);
- Concrete and Bentonite Batching – large amounts of potentially dusty materials required for batching plants;
- Movement of trucks along paved public roads – potential for trackout from construction sites or resuspension of dust;
- Movement of trucks along unpaved haul roads (this will only be relevant for AZ1, Dardistown and Northwood) – potential for resuspension of dust as vehicles move around the site;
- Extraction of material – works will be broken down into different types (shallow, diaphragm wall) however all will involve the movement of potentially dusty material which has the potential to generate dust;
- Controlled Blasting – blasting has the potential to generate dust if conducted in an incorrect manner;
- Stockpiling of material – stockpiles have the potential to generate dust due to dry material movement and wind erosion; and
- TBM Spoil – large amounts of material to be removed which needs consideration with respect to potential for dust emissions.

16.5.2.12.1 Assessment of Potential Sensitivity and Potential Impact to Construction Dust

In order to determine the level of dust mitigation required during the proposed works, the likely dust emission magnitude for each dust generation at each site and the potential MetroLink grid connection routes (Appendix A16.2) needs to be taken into account in conjunction with the previously established sensitivity of the area. Using the appraisal criteria for the assessment of risk at sensitive receptors as detailed in Table 16.15 to Table 16.18, a summary of dust emission magnitudes from the main construction sites is shown in Table 16.44. The resultant requirement levels (i.e. high, medium or low levels of mitigation) for mitigation with respect to nuisance dust, health impacts and ecological impacts are shown in Table 16.45 to Table 16.47 and an overall summary provided in Table 16.48. The mitigation requirement levels take into account the sensitivity of the location and the activities conducted on site which may generate dust, the assessment finds that a high level of dust mitigation is required for the majority of sites. For scenarios where interactions with other developments, such as the proposed Dublin Central Site 2 development at O'Connell Street, are not finalised, the worst-case scenario with respect to dust impacts is considered. This ensures dust mitigation measures are appropriate for the worst-case scenario.

Aspergillus is a fungus that is found in soil and therefore has the potential to be made airborne during demolition or excavation. Aspergillus is of particular concern near hospital wards where immune suppressed patients are accommodated. Research has found that dust suppression techniques also prevent the suspension of aspergillus successfully (Fournel et al. 2010). A competent contractor will be appointed to prepare an Aspergillus Prevention Plan taking into account the National Guidelines for the Prevention of Nosocomial Aspergillosis (HSE 2018) which provides a risk assessment for aspergillus and preventative dust mitigation measures and in Appendix B of the document pre-project planning and contractor advice. Survey and prevention works with respect to Aspergillus will take place before construction commences by a competent contractor in proximity to any sensitive buildings and in particular in proximity to the Mater Hospital, Rotunda and Tara Winthrop clinic. If pre-construction surveys indicate that Aspergillus is a risk, the prevention works will include sealing the windows to the façades that are in close proximity to the hospital to prevent fugitive dust entering the hospital through windows. These works will form part of an Aspergillus Prevention Plan to be completed by a specialist and will ensure the prevention of Aspergillus spores spreading.

Dust mitigation measures will also be put in place at any auxiliary sites not listed in the table below. Given the interconnected nature of the sites it is recommended that a high level of mitigation is provided at all locations. Consistent implementation of good dust minimisation practices will ensure that the impact from construction dust is localised, reversible and not significant when considered with respect to the EPA description of effects (EPA 2022).

Table 16.44: Summary of Emission Magnitude[1]

Geographical Zones	Site	Emission Magnitude			
		Demolition	Earthworks	Construction	Trackout (Maximum Daily HGV Movements)
AZ1	Estuary to Seatown – Including P&R at Estuary Station	Medium	Large	Large	Large
	Seatown to Malahide Roundabout - Including Seatown Station	Medium	Large	Small	Large
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	N/A	Large	Small	Large
	Pinnock Hill to North Portal – Including Fosterstown Station	Medium	Large	Small	Large
AZ2	Dublin Airport	N/A	Large	Small	Large
AZ3	Dardistown (Future Station and Depot)	Small	Large	Large	Large
	Northwood	N/A	Large	Large	Large
AZ4	Ballymun	N/A	Large	Small	Large
	Collins Avenue	N/A	Large	Small	Large
	Albert College	N/A	Large	Small	Large
	Griffith Park	Small	Large	Small	Large
	Glasnevin	Large	Large	Large	Large
	Mater	N/A	Large	Small	Large
	O'Connell Street	Large	Large	Small	Large
	Tara	Large	Large	Small	Large
	St. Stephen's Green	N/A	Large	Small	Large
	Charlemont	Small	Large	Small	Large
MetroLink grid connections	DANP	N/A	Medium	Small	Medium
	Dardistown Depot	N/A	Medium	Small	Medium
	Northwood	N/A	Medium	Small	Medium
	DASP MV Cable	N/A	Medium	Small	Medium

Note 1: Potential for ecological impacts is only for sensitive ecological areas

Table 16.45: Summary Dust Nuisance Risk to Define Site-Specific Mitigation[1]

Geographical Zones	Site	Emission Risk Dust Nuisance			
		Demolition	Earthworks	Construction	Trackout
AZ 1	Estuary to Seatown – Including P&R at Estuary Station	Medium	High	High	High
	Seatown to Malahide Roundabout - Including Seatown Station	Medium	High	Low	High
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	N/A	Medium	Low	Medium
	Pinnock Hill to North Portal – Including Fosterstown Station	Medium	High	Low	High
AZ2	Dublin Airport	N/A	High	Low	High
AZ3	Dardistown (Future Station and Depot)	Low	Medium	High	Medium
	Northwood	N/A	High	High	High
AZ4	Ballymun	N/A	High	Low	High
	Collins Avenue	N/A	High	Low	High
	Albert College	N/A	High	Low	Medium
	Griffith Park	Medium	High	Low	High
	Glasnevin	High	High	High	High
	Mater	N/A	High	Low	High
	O'Connell Street	High	Medium	Low	Medium
	Tara	High	High	Low	High
	St. Stephen's Green	N/A	Medium	Low	High
	Charlemont	Medium	High	Low	High
MetroLink grid connections	DANP	N/A	Medium	Low	Medium
	Dardistown Depot	N/A	Medium	Low	Low
	Northwood	N/A	Low	Negligible	Low
	DASP MV Cable	N/A	Medium	Low	Low

Note 1: Summary of Risk defined as per IAQM Guidance (IAQM 2014)

Table 16.46: Summary Dust Health Impact Risk to Define Site-Specific Mitigation[1]

Geographical Zones	Site	Emission Risk Dust Health Impacts			
		Demolition	Earthworks	Construction,	Trackout
AZ 1	Estuary to Seatown – Including P&R at Estuary Station	Low	Low	Low	Low
	Seatown to Malahide Roundabout - Including Seatown Station	Low	Low	Negligible	Low
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	N/A	Low	Negligible	Low
	Pinnock Hill to North Portal – Including Fosterstown Station	Low	Low	Negligible	Low
AZ2	Dublin Airport	N/A	Medium	Low	Medium

[1] Assessed as per IAQM Dust Guidance (IAQM 2014)

Geographical Zones	Site	Emission Risk Dust Health Impacts			
		Demolition	Earthworks	Construction,	Trackout
AZ3	Dardistown (Future Station and Depot)	Negligible	Low	Negligible	Low
	Northwood	N/A	Low	Negligible	Low
AZ4	Ballymun	N/A	Medium	Low	Medium
	Collins Avenue	N/A	Low	Negligible	Low
	Albert College	N/A	Low	Low	Low
	Griffith Park	Negligible	Low	Negligible	Low
	Glasnevin	High	Medium	Medium	Medium
	Mater	N/A	Medium	Low	Medium
	O'Connell Street	Medium	Low	Negligible	Low
	Tara	High	Medium	Low	Medium
	St. Stephen's Green	N/A	Low	Negligible	Low
	Charlemont	Low	Medium	Low	Medium
MetroLink grid connections	DANP	N/A	Low	Negligible	Low
	Dardistown Depot	N/A	Low	Negligible	Low
	Northwood	N/A	Low	Negligible	Low
	DASP MV Cable	N/A	Low	Negligible	Low

Note: N/A indicates that demolition will not take place at this location as part of the proposed Project works.

Note: Summary of Risk defined as per IAQM Guidance (IAQM 2014)

Table 16.47: Summary Dust Ecology Impact Risk to Define Site-Specific Mitigation[1]

Geographical Zones	Site	Emission Risk Dust Ecology Impacts			
		Demolition	Earthworks	Construction	Trackout
AZ 1	Estuary to Seatown – Including P&R at Estuary Station	N/A	N/A	N/A	N/A
	Seatown to Malahide Roundabout - Including Seatown Station	N/A	N/A	N/A	N/A
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	N/A	N/A	N/A	N/A
	Pinnock Hill to North Portal – Including Fosterstown Station	N/A	N/A	N/A	N/A
AZ2	Dublin Airport	N/A	N/A	N/A	N/A
AZ3	Dardistown (Future Station and Depot)	N/A	N/A	N/A	N/A
	Northwood	N/A	N/A	N/A	N/A
AZ4	Ballymun	N/A	N/A	N/A	N/A
	Collins Avenue	N/A	N/A	N/A	N/A
	Albert College	N/A	N/A	N/A	N/A
	Griffith Park	N/A	N/A	N/A	N/A
	Glasnevin	High	High	High	High
	Mater	N/A	N/A	N/A	N/A
	O'Connell Street	N/A	N/A	N/A	N/A
	Tara	N/A	N/A	N/A	N/A
	St. Stephen's Green	N/A	N/A	N/A	N/A

Geographical Zones	Site	Emission Risk Dust Ecology Impacts			
		Demolition	Earthworks	Construction	Trackout
	Charlemont	Medium	High	Low	High
MetroLink grid connections	DANP	N/A	N/A	N/A	N/A
	Dardistown Depot	N/A	N/A	N/A	N/A
	Northwood	N/A	N/A	N/A	N/A
	DASP MV Cable	N/A	N/A	N/A	N/A

Note 1: Summary of Risk defined as per IAQM Guidance (IAQM 2014)

16.5.2.12.2 Summary of Potential Dust Impacts

The risks of dust impacts as a result of the proposed Project are summarised in Table 16.48 for each site. 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 likely effects associated with the Construction Phase dust emissions pre-mitigation are overall Negative, Not Significant and Medium-Term.

Table 16.48: Summary Overall Dust Impact Risk to Define Site-Specific Mitigation[1]

Geographical Zones	Site	Dust Risk to Define Site-Specific Mitigation
AZ 1	Estuary to Seatown – Including P&R at Estuary Station	High
	Seatown to Malahide Roundabout - Including Seatown Station	High
	Malahide Roundabout to Pinnock Hill – Including Swords Central Station	Medium
	Pinnock Hill to North Portal – Including Fosterstown Station	High
AZ2	Dublin Airport	High
AZ3	Dardistown Depot (and Future Station)	High
	Northwood	High
AZ4	Ballymun	High
	Collins Avenue	High
	Albert College	Medium
	Griffith Park	High
	Glasnevin	High
	Mater	High
	O'Connell Street	High
	Tara	High
	St. Stephen's Green	High
	Charlemont	High
MetroLink grid connections	DANP	Medium
	Dardistown Depot	Medium
	Northwood	Low
	DASP MV Cable	Medium

Note 1: Summary of Risk defined as per IAQM Guidance (IAQM 2014)

16.5.3 Operational Phase

The proposed Project is powered by electricity and therefore is not predicted to have significant tailpipe air quality emissions during its operation. The most significant potential impact of the Operational Phase of the proposed Project with respect to air quality is the alterations to DM traffic flow patterns. The only location with parking available will be the P&R facility with no other stations offering parking facilities.

16.5.3.1 Do-Minimum Traffic Modelling of Receptors Selected for the Operational Phase Scenario A

The DM is a future scenario without the project in place but with certain assumptions around future projects and projected traffic growth as outlined in Chapter 9 (Traffic & Transport). The output of this analysis and its impact on air quality has been modelled using ADMS-Roads for the opening year of 2035, see Section 16.3.6. 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 all modelled receptors can be found in Table 16.3.11 of Appendix A16.3. The proposed Project is overall Negligible in terms of the annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all modelled receptors with one exception (OP_SA _151). This is the worst-case receptor and is shown in Table 16.49. Receptor OP_SA _151 is located within 20m of the M50. All results are presented in Appendix A16.3.

In the 2035 DM Scenario A, the European AQSs are exceeded at the same receptor (OP_SA _151). However, the predicted annual mean NO_2 concentrations did not exceed 60µg/m^3 at any locations indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Predicted annual mean PM_{10} concentrations are below the relevant national air quality objectives for all modelled receptors. At all receptors, modelling of the maximum 24-hour PM_{10} concentration predicted that there is likely to be no more than three exceedances of the 50µg/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 predicted to be below the relevant national air quality objectives for all modelled receptors.

Table 16.49: Predicted Do Minimum Operational Pollutant Statistics at Worst-Case Receptor Locations Operational Phase Scenario A

DM (2035) Operational Phase Scenario A						
Receptor	Locations	Receptor Location (ITM)	Annual Mean Conc. (µg/m^3)			No of PM_{10} days > 50 µg/m^3
			NO_2	PM_{10}	$PM_{2.5}$	
OP_SA _151	M50	707825,736507	42.5	22.7	14.7	7
Air Quality Objective			40	40	25	35

16.5.3.2 Do-Something Traffic Modelling of Receptors Selected for the Operational Phase Scenario A

The DS for Scenario A is a defined scenario within the traffic modelling exercise in Chapter 9 (Traffic & Transport). The output of this analysis and its impact on air quality has been modelled using ADMS-Roads for the opening year of 2035 in line with the methodology set out in Section 16.3.6. 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 all modelled receptors can be found in Table 16.3.13 of Appendix A16.3. The proposed Project is overall Negligible in terms of the annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all modelled receptors and as such, there are therefore no worst-case receptors. All results are presented in Appendix A16.3.

In the 2035 DS Operational Phase Scenario A annual mean concentrations of NO_2 exceeded the relevant national air quality objective at a single modelled receptor (OP_SA _151). This is a reduction from the DN scenario which has four exceedances and no change from the DM scenario. Consequently, the predicted annual mean NO_2 concentrations did not exceed 60µg/m^3 at any locations indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Predicted annual mean PM_{10} concentrations are below the relevant national air quality 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 three exceedances of the 50µg/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 predicted to be below the relevant national air quality objectives for all modelled receptors.

Table 16.50: Predicted Do Something Operational Pollutant Statistics at Worst-Case Receptor Locations Operational Phase Scenario A

DM (2035) Operational Phase Scenario A						
Receptor	Locations	Receptor Location (ITM)	Annual Mean Conc. (µg/m³)			No of PM_{10} days > 50 µg/m³
			NO_2	PM_{10}	$PM_{2.5}$	
OP_SA _151	M50	707825,736507	43.3	23.0	14.8	8
Air Quality Objective			40	40	25	35

16.5.3.3 DS-DM – Operational Phase Scenario A

Table 16.55, Table 16.3.15 of Appendix A16.3 and Figure 16.10 provide the predicted change in and impact on pollutant concentrations, between the DM and DS for Scenario A in 2035. 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). The greatest impact is an increase of 0.83µg/m³ at receptor OP_SA _151 which is located in close proximity (less than 20m) to the M50 and due to the already high background concentration of above 40 µg/m³, any increase in considered more impactful as per TII significance criteria (TII 2011). As shown in Table 16.3.15 of Appendix A16.3 and Figure 16.12, the proposed Project is overall Negligible in terms of the annual mean NO_2 concentration. As shown in Table 16.3.15 (Appendix A16.3) and Figure 16.14, the proposed Project 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 Scenario A likely effects associated with the Operational Phase traffic emissions will overall be Negative, Not Significant 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 2035 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, meaning that a larger proportion of electric vehicles is planned by the opening year than has been modelled.

Table 16.51: Predicted Do Something Construction Scenario Pollutant Concentration Changes and Impacts at Worst-Case Receptor Locations

Receptor	Location	Receptor Location (ITM)	Change in Annual Mean Conc. (µg/m³)			Change in No. of PM_{10} days > 50 µg/m³	Impact on Annual Mean Concentration		
			NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$
OP_SA _151	M50	707825,736507	0.83	0.27	0.15	1	Slight Adverse	Negligible	Negligible

16.5.3.4 Ecological Assessment– Operational Phase Scenario A

An assessment of the impact of the proposed Project 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 predicted absolute concentration is less than 70% of the long-term critical level/load, the impact due to the project is likely to be insignificant. However, in relation to NO_X, absolute concentrations less than 70% of the critical level are rare in urban areas and thus this is unlikely to be relevant for the proposed Project. Where the process contribution is greater than 1% of the critical level/load it is recommended that the Project Ecologist should be consulted as per IAQM and TII Guidance.

The impact of the proposed Project on the nearby ecologically sensitive areas within 200m of roads impacted by the proposed Project, as defined in Section 16.3.6, is outlined in Table 16.52. The annual mean NO_X concentration has been compared to the critical level of 30µg/m³ at each of the designated habitat sites. The following designated habitats exceed the critical level for NO_X within 200m of the proposed Project:

- Grand Canal pNHA (M50 Western Side);
- Grand Canal pNHA (M50 Eastern Side);
- Liffey Valley pNHA (M50 Western Side);
- Royal Canal pNHA (M50 Viaduct Western Side);
- Royal Canal pNHA (M50 Viaduct Eastern Side);
- Santry Demesne (Swords Road Western Side);
- Malahide Estuary SPA SAC pNHA; and
- North Dublin Bay pNHA and South Dublin Bay and River Tolka Estuary SPA.

As there are changes in NO_x as an impact of the proposed Project above 1% of the critical level the Project Ecologist has been consulted. There are no exceedances of the critical level of 30µg/m³ directly linked to the proposed Project, they are associated with current traffic volumes.

Table 16.52: Impacts at Key Ecological Receptors Operational Phase Scenario A (NO_X Annual Mean Concentration In 2035)

Annual Mean NO_X in 2035 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) (%)**
Rogerstown Estuary SAC & pNHA	720069, 751892	41.2	80m	41.6	80m	0.4	1%
Royal Canal pNHA (M50 Viaduct Western Side)	708801, 738175	96.9	>200m	95.5	>200m	-1.4	-5%
Royal Canal pNHA (M50 Viaduct Eastern Side)	709142, 738168	83.1	>200m	83.2	>200m	0.1	0%
Liffey Valley pNHA (M50 Western Side)	707615, 735902	60.6	>200m	61.1	>200m	0.6	2%
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	102.9	>200m	103.2	>200m	0.3	1%
Santry Demesne pNHA (Swords Road Western Side)	716971, 740699	34.4	>200m	34.0	>200m	-0.4	-1%
Malahide Estuary SPA SAC pNHA	719323, 747668	90.1	>200m	89.6	>200m	-0.5	-2%
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	120.9	>200m	122.8	>200m	2.0	7%

Annual Mean NO_x in 2035 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) (%)**
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA	717719, 735687	63.5	>200m	61.4	0 m	-2.1	-7%

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Section 16.3.7 and Table 16.53. All sites are below the lower critical load for the designated habitat site with the exception of the Grand Canal pNHA. However, 10m from the road the site is below the lower critical load for the Grand Canal pNHA. Given that this location is on the M50 and the location is an elevated bridge over the canal, it is likely that dispersion of pollutant will result in NO_2 deposition which will be below the critical load at the location where the sensitive habitats are located.

Table 16.53: Significance of Impacts at Key Ecological Receptors Operational Phase Scenario A (NO_2 Deposition in 2035)

Annual Mean NO_2 in 2035 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 change is <1% (m)**	**Change in deposition (kgN/ha/yr)**
Rogerstown Estuary SAC & pNHA	720069, 751892	5	2.2	0m	2.2	0m	0%	0m	0.0
Royal Canal pNHA (M50 Viaduct Western Side)	708801, 738175	5	5.1	10m	5.0	10m	-1%	40m	-0.1
Royal Canal pNHA (M50 Viaduct Eastern Side)	709142, 738168	5	4.5	0m	4.5	0 m	0%	0 m	0.0
Liffey Valley pNHA (M50 Western Side)	707615, 735902	5	3.6	0 m	3.6	0 m	1%	0 m	0.0
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	5	5.3	10 m	5.3	10 m	0%	0 m	0.0

Annual Mean NO_2 in 2035 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 change is <1% (m)	Change in deposition (kgN/ha/yr)
Santry Demesne pNHA (Swords Road Western Side)	716971, 740699	5	2.3	0 m	2.3	0 m	0%	0 m	0.0
Malahide Estuary SPA SAC pNHA	719323, 747668	5	4.8	0 m	4.8	0 m	0%	0 m	0.0
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	5	6.0	10 m	6.0	10 m	1%	10 m	0.1
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA	717719,735687	5	3.7	0 m	3.6	0 m	-2%	20 m	-0.1

Note: Conservative lower critical load from TII Guidance (Table A9.1) (TII 2011)

In accordance with the EPA Guidelines (EPA 2022), the ecological likely effects for Scenario A associated with the Operational Phase traffic emissions will overall be Negative, Not Significant and Long-Term.

16.5.3.5 Regional Air Quality Assessment – Operational Phase Scenario A

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the Opening Year (2035) of the Operational Phase for Scenario A are shown in Table 16.54. The proposed Project will be beneficial overall, with reductions in emissions of all pollutants modelled. This also reflects the technical challenges in converting the heavy goods fleet to electric vehicles, which would reduce NO_X and NO_2 emissions. Reductions result from a predicted modal shift, with decreased private car usage in the DS compared to the DM (Chapter 9 Traffic & Transport).

Table 16.54: Operational Phase Scenario A Regional Pollutant Emissions (Tonnes) – Opening Year (2035)

Receptor	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	2,924	847	482	273	193	4,193	2	3
DS		2,912	844	480	272	192	4,175	2	3
Change		-11.45	-3.30	-1.68	-0.96	-0.88	-17.80	-0.01	-0.01
% Change		-0.39%	-0.39%	-0.35%	-0.35%	-0.46%	-0.42%	-0.43%	-0.39%
DM	Bus	18	2	10	5	1	7	0	0
DS		18	2	10	5	1	7	0	0

Receptor	Vehicle Class	NO_x (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
Change		-0.158	-0.016	-0.002	-0.001	-0.001	-0.020	0.000	0.000
% Change		-0.87%	-0.87%	-0.02%	-0.02%	-0.11%	-0.30%	0.00%	-0.08%
DM	Goods	3,501	974	274	151	103	526	1	1
DS		3,494	972	273	151	103	524	1	1
Change		-6.99	-1.32	-0.09	-0.06	-0.13	-1.70	0.00	0.00
% Change		-0.20%	-0.14%	-0.03%	-0.04%	-0.12%	-0.32%	-0.70%	-0.15%
DM	Total	6,443	1,823	766	429	297	4,725	3	4
DS		6,424	1,818	764	428	296	4,706	3	4
Change		-18.59	-4.63	-1.77	-1.02	-1.01	-19.52	-0.01	-0.01
% Change		-0.29%	-0.25%	-0.23%	-0.24%	-0.34%	-0.41%	-0.50%	-0.32%

Pollutant emissions (in tonnes) that will be produced in both the DM and DS scenarios during the Design Year (2050) of the Operational Phase are shown in Table 16.55. The impact of the proposed Project is overall positive, with small decreases in emissions of all pollutants modelled.

Table 16.55. Operational Phase Scenario A Regional Pollutant Emissions (Tonnes) – Design Year (2050)

Scenario	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	0	0	518	284	0	0	0	0
DS		0	0	497	272	0	0	0	0
Change		0	0	-21.45	-11.76	0	0	0	0
% Change		0%	0%	-4.14%	-4.14%	0%	0%	0%	0%
DM	Bus	19	2	10	5	1	7	0	0
DS		19	2	10	5	1	7	0	0
Change		-0.254	-0.025	-0.002	-0.001	-0.002	-0.040	0	0
% Change		-1.32%	-1.32%	-0.02%	-0.03%	-0.24%	-0.57%	0.00%	-0.09%
DM	Goods	535	53	233	127	41	274	0	0
DS		522	52	231	127	41	271	0	0
Change		-12.89	-1.29	-1.32	-0.73	-0.19	-2.44	0	0
% Change		-2.41%	-2.41%	-0.57%	-0.57%	-0.47%	-0.89%	0%	-0.06%
DM	Bus	554	55	761	416	42	281	0	0
DS		541	54	738	404	42	278	0	0
Change		-13.15	-1.31	-22.78	-12.49	-0.19	-2.48	0	0
% Change		-2.37%	-2.37%	-2.99%	-3.00%	-0.46%	-0.88%	#DIV/0!	-0.06%

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in concentrations is within the traffic model and ENEVAL tool margin of variability, the regional likely effects associated with the Operational Phase traffic emissions pre-mitigation are considered overall beneficial, Not Significant and Long-Term.

16.5.3.6 Do-Minimum Traffic Modelling of Receptors Selected for the Operational Phase Scenario B

The Do Minimum (DM) is a defined scenario within the traffic modelling exercise in Chapter 9 (Traffic & Transport). The output of this analysis and its impact on air quality has been modelled using ADMS-Roads for the opening year of 2035. 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 all modelled receptors can be found in Table 16.3.12 of Appendix A16.3. The proposed Project is overall Negligible in terms of the annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all modelled receptors, and as such there are therefore no worst-case receptors. All results are presented in Appendix A16.3.

In the 2035 DM Operational Phase Scenario B, annual mean concentrations of NO_2 are predicted to exceed the relevant national air quality objective at one modelled receptor. This is a reduction from the DN scenario which has two exceedances. The exceedance occurred at OP_SB_AQ150 which is located in within 20m to the M50. The annual mean NO_2 concentrations did not exceed 60 µg/m^3 at this or any other location indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are predicted to be below the relevant national air quality 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 eight 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 predicted to be below the relevant national air quality objectives for all modelled receptors.

16.5.3.7 Do-Something Traffic Modelling of Receptors Selected for the Operational Phase Scenario B

The Do Something (DS) for Scenario B is a defined scenario within the traffic modelling exercise in Chapter 9 (Traffic & Transport). The output of this analysis and its impact on air quality has been modelled using ADMS-Roads for the opening year of 2035 in line with the methodology set out in Section 16.3.6 . 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 all modelled receptors can be found in Table 16.3.14 of Appendix A16.3. The proposed Project is overall negligible in terms of the annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all modelled receptors and as such, there are therefore no worst-case receptors. All results are presented in Table 16.3.14 of Appendix A16.3.

In the 2035 DS Operational Phase Scenario B, annual mean concentrations of NO_2 are predicted to exceed the relevant national air quality objective at one modelled receptor. This is a reduction from the DN scenario which has two exceedances and no change from the DM scenario. The exceedance occurred at OP_SB_AQ150 which is located in proximity to the M50. The annual mean NO_2 concentrations were not predicted to exceed 60 µg/m^3 at this or any other location, indicating that exceedances of the NO_2 1-hour mean are unlikely to occur. Annual mean PM_{10} concentrations are predicted to be below the relevant national air quality 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 eight 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 objectives for all modelled receptors.

16.5.3.8 DS-DM – Operational Phase Scenario B

Table 16.3.16 of Appendix A16.3 and Figure 16.11 provide the predicted change in and impact on pollutant concentrations, between the DM and DS in 2035. 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). The greatest impact is an increase of 0.82 µg/m^3 at receptor OP_SB _29 which is located in close proximity to the Estuary P&R facility and is impacted by the increased traffic utilising this facility. However, due to the background air quality being significantly below the limit value, the impact is Negligible as per TII significance criteria (TII 2011). As shown in Table 16.3.16 of Appendix A16.3 and Figure 16.13, the proposed Project is overall negligible in terms of the annual mean NO_2 concentration. As shown Table 16.3.15 of Appendix A16.3 and Figure 16.15 of the EIAR, the proposed Project 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 Scenario A likely effects associated with the Operational Phase traffic emissions will overall be Negative, Not Significant 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 2035 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 2019 Climate Action Plan measures, meaning that a larger proportion of electric vehicles is planned by the opening year than has been modelled.

16.5.3.9 Ecological Assessment – Operational Phase Scenario B

An assessment of the impact of the proposed Project 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 predicted absolute concentration is less than 70% of the long-term critical level/load, the impact due to the project is likely to be insignificant. However, in relation to NO_X, absolute concentrations less than 70% of the critical level are rare in urban areas and thus this is unlikely to be relevant for the proposed Project. Where the process contribution is greater than 1% of the critical level/load it is recommended that the Project Ecologist should be consulted as per IAQM and TII Guidance.

The impact of the proposed Project on the nearby ecologically sensitive areas within 200m of roads impacted by the proposed Project, as defined in Section 16.3.6, is outlined in Table 16.56. The annual mean NO_X concentration has been compared to the critical level of 30µg/m^3 at each of the designated habitat sites. The critical level for NO_X within 200m of impacted roads was exceeded for more than 200m at the following sites:

- Royal Canal pNHA (M50 Viaduct Western Side);
- Royal Canal pNHA (M50 Viaduct Eastern Side);
- Liffey Valley pNHA (M50 Western Side);
- Grand Canal pNHA (M50 Viaduct Western Side);
- Malahide Estuary SPA SAC pNHA;
- Grand Canal pNHA (M50 Viaduct Eastern Side);
- North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA; and
- Bog of the Ring pNHA.

However, the change in NO_x as an impact of the proposed Project was only increased by above 1% of the critical level at the Bog of the Ring pNHA, therefore the Project Ecologist was consulted regarding the significance of impacts for this location. There are no exceedances of the critical level of 30 µg/m^3 directly linked to the proposed Project, the exceedances are associated with current traffic volumes.

Table 16.56: Impacts at Key Ecological Receptors Operational Phase Scenario B (NO_X Annual Mean Concentration in 2035)

Annual Mean NO_X in 2035 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) (%)
Rogerstown Estuary SAC & pNHA	720069, 751892	41.2	80m	41.9	80m	0.7	0.0
Royal Canal pNHA (M50 Viaduct Western Side)	708801, 738175	106.8	>200m	106.2	>200m	-0.6	0.0

Annual Mean NO_x in 2035 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 Viaduct Eastern Side)	709142, 738168	61.3	>200m	61.5	>200m	0.2	0.0
River Liffey pNHA (M50 Western Side)	707615, 735902	60.6	>200m	60.3	>200m	-0.3	0.0
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	103.0	>200m	102.0	>200m	-1.0	0.0
Malahide Estuary SPA SAC pNHA	719323, 747668	88.8	>200m	89.3	>200m	0.5	0.0
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	123.3	>200m	122.8	>200m	-0.5	0.0
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA	717719, 735687	62.0	>200m	60.5	>200m	-1.5	-0.1
Bog of the Ring pNHA	718473, 759911	89.1	>200m	90.8	>200m	1.7	0.1

Nitrogen deposition levels have been compared to the lower and higher critical loads for the designated habitat sites in Section 16.3.6 and Table 16.57. All sites are below the lower critical load for the designated habitat site with the exception of the Grand Canal pNHA and Royal Valley pNHA. However, these sites are below the criterial load by 10m and given that these locations are on the M50 and the location is an elevated bridge over the canal, it is likely that dispersion of pollutant will result in NO_2 deposition which will be below the critical load at the location where the sensitive habitats are location.

Table 16.57: Significance of Impacts at Key Ecological Receptors Operational Phase Scenario B (NO_2 Deposition In 2035)

Annual Mean NO_2 in 2035 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 change is <1% (m)**	**Change in deposition (kgN/ha / yr)**
Rogerstown Estuary SAC & pNHA	720069, 751892	5	2.6	0m	2.7	0m	0.0	0m	0.0

Annual Mean NO_2 in 2035 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 change is <1% (m)**	**Change in deposition (kgN/ha / yr)**
Royal Canal pNHA (M50 Viaduct Western Side)	708801, 738175	5	5.5	10m	5.4	10m	0.0	0m	0.0
Royal Canal pNHA (M50 Viaduct Eastern Side)	709142, 738168	5	3.6	20m	3.6	0 m	0.0	20 m	0.0
River Liffey pNHA (M50 Western Side)	707615, 735902	5	3.6	0 m	3.5	0m	0.0	0 m	0.0
Grand Canal pNHA (M50 Viaduct Western Side)	708039, 732131	5	5.3	10 m	5.3	10 m	0.0	0 m	0.0
Malahide Estuary SPA SAC pNHA	719323, 747668	5	4.8	0 m	4.8	0 m	0.0	0 m	0.0
Grand Canal pNHA (M50 Viaduct Eastern Side)	708084, 732140	5	6.1	10 m	6.0	10 m	0.0	0 m	0.0
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA	717719, 735687	5	3.6	0 m	3.6	0 m	0.0	0 m	-0.1
Bog of the Ring pNHA	718473, 759911	5	4.8	0 m	4.8	0 m	0.0	0 m	0.1

Note: Conservative lower critical load from TII Guidance (Table A9.1) (TII 2011)

In accordance with the EPA Guidelines (EPA 2022) the ecological likely effects for Scenario B associated with the Operational Phase traffic emissions will overall be Negative, Not Significant and Long-Term.

16.5.3.10 Regional Air Quality Assessment – Operational Phase Scenario B

Pollutant emissions (in tonnes) produced in both the DM and DS scenarios during the Opening Year (2035) of the Operational Phase for Scenario B are shown in Table 16.58. The proposed Project will be beneficial overall, with reductions in emissions of all pollutants modelled. 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. Reductions result from a predicted modal shift, with decreased private car usage in the DS compared to the DM (Chapter 9 Traffic & Transport).

Table 16.58: Operational Phase Scenario B Regional Pollutant Emissions (Tonnes) – Opening Year (2035)

Receptor	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	2,907	843	479	272	191	4,187	2	3
DS		2,894	839	477	270	190	4,169	2	3
Change		-12.85	-3.70	-1.92	-1.10	-0.95	-17.95	-0.01	-0.01
% Change		-0.44%	-0.44%	-0.40%	-0.40%	-0.50%	-0.43%	-0.51%	-0.42%
DM	Bus	16	2	9	5	1	6	0	0
DS		16	2	9	5	1	6	0	0
Change		-0.124	-0.012	-0.002	-0.001	-0.001	-0.017	0.000	0.000
% Change		-0.78%	-0.78%	-0.02%	-0.02%	-0.10%	-0.28%	0.00%	0.06%
DM	Goods	3,526	980	274	152	103	531	1	1
DS		3,522	979	274	152	103	530	1	1
Change		-3.98	-0.63	-0.02	-0.02	-0.09	-0.99	0.00	0.00
% Change		-0.11%	-0.06%	-0.01%	-0.01%	-0.09%	-0.19%	-0.39%	-0.04%
DM	Total	6,449	1,824	763	428	296	4,723	3	4
DS		6,432	1,820	761	427	295	4,704	3	4
Change		-16.95	-4.34	-1.95	-1.12	-1.05	-18.95	-0.01	-0.01
% Change		-0.26%	-0.24%	-0.25%	-0.26%	-0.35%	-0.40%	-0.48%	-0.31%

Pollutant emissions (in tonnes) that will be produced in both the DM and DS scenarios during the Design Year (2050) of the Operational Phase are shown in Table 16.59. The impact of the proposed Project is overall Positive, with small decreases in emissions of all pollutants modelled. Emissions of PM_{10} and $PM_{2.5}$ do not decrease alongside other pollutants as particulate emissions arise from tyre and break wear and tear as well as the burning of fossil fuels. The tyre and break wear and tear remains even when the vehicle fleet transitions to electric engines.

Table 16.59. Operational Phase Scenario B Regional Pollutant Emissions (Tonnes) – Design Year (2050)

Scenario	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	0	0	468	257	0	0	0	0
DS		0	0	469	257	0	0	0	0
Change		0	0	0.70	0.39	0	0	0	0
% Change		0%	0%	0.15%	0.15%	0%	0%	0%	0%
DM	Bus	16	2	9	5	1	6	0	0
DS		16	2	9	5	1	6	0	0
Change		-0.312	-0.031	-0.002	-0.001	-0.002	-0.035	0	0.000
% Change		-1.95%	-1.95%	-0.02%	-0.02%	-0.17%	-0.58%	0%	-0.18%
DM	Goods	511	51	232	127	41	272	0	0
DS		501	50	232	127	41	271	0	0
Change		-9.24	-0.92	0.00	-0.01	-0.08	-0.68	0	0.00
% Change		-1.81%	-1.81%	0.00%	-0.01%	-0.19%	-0.25%	0%	-0.38%
DM	Bus	527	53	710	389	42	278	0	0

Scenario	Vehicle Class	NO_x (tonnes)	NO_2 (tonnes)	PM_{10} (tonnes)	$PM_{2.5}$ (tonnes)	HC (tonnes)	CO (tonnes)	Benzene (tonnes)	Butadiene (tonnes)
DS		517	52	711	389	42	277	0	0
Change		-9.55	-0.96	0.70	0.37	-0.08	-0.72	0	0.00
% Change		-1.81%	-1.81%	0.10%	0.10%	-0.19%	-0.26%	0%	-0.37%

In accordance with the EPA Guidelines (EPA 2022) and considering that the change in concentrations is within the traffic model and ENEVAL tool margin of variability, the regional likely effects associated with the Operational Phase traffic emissions pre-mitigation are considered overall Neutral, Not Significant and Long-Term.

16.5.3.11 Operational Phase Ventilation Shafts

There are no substantial emissions within the tunnels as the trains or the operations do not generate significant emissions to air, therefore the main emission of ventilation shafts in normal operation is akin to warm air. The street level location of the grilles associated with the ventilation shafts is designed to minimise effects on pedestrians and near buildings. They are often situated in slightly elevated median strips (30cm) for drainage purposes or within green spaces, out of the normal transit of pedestrians or other sensitive receptors. Inlet and outlet ventilation grilles are separated in order to minimise the possibility of air recirculation. Consideration is also given to the potential for air pollution to enter from vehicles through the air intake system, in particular in more urban areas where pollutant concentrations are higher. Within the stations a system with air-quality sensors and ventilation controls can be utilised in order to ensure air quality within underground stations remains comfortable and at safe levels for human health.

With respect to the potential for emissions from the ventilation shafts during a fire, the materials for the rolling stock or other systems such as wiring are selected during the detailed design of the proposed Project to comply with strict regulations to avoid the emission of irritating or toxic products. These materials are chosen in order to ensure conditions remain tenable during evacuation however it will also minimise the potential for toxic fumes being emitted from the ventilation shaft during a fire within the tunnel.

In accordance with the EPA Guidelines (EPA 2022) and considering the potential likely effects of emissions from the ventilation shafts, the impacts are considered overall Neutral, Not Significant and Long-Term.

16.5.3.12 Operational Phase Electrical Power Emissions

The proposed Project is an electrified light rail system which will be powered by the national grid. While there are no tailpipe emissions from the proposed Project the energy to run it requires generation. The 2021 CAP has set a national target of up to 80% of electricity demand by renewables by 2030 national electricity grid. Renewables will not have any additional fossil fuel emissions associated with them. The remaining power on the national grid will be supplied by fossil fuel, the emissions of which are carefully controlled by the EPA under the suppliers Industrial Emissions Directive, which ensures that no significant impacts occur due to air quality emissions of air pollutants (including NO_2, particulates and VOCs) for nearby sensitive human or ecology receptors.

In addition, the proposed Project has set a sustainability target to achieve Net Zero Status for operational energy by the design year of (2050), with a stretch aspiration to be close (>80%) to Net Zero Status at start of operation through a combination of energy efficiency, innovation, green power purchase and offsetting residual emissions. Within the proposed Project there is the ambition to achieve net zero carbon for operational energy by the design year of (2050). As discussed in Chapter 17 (Climate) Section 17.6, TII is exploring the purchase of up to 80% of its operational demand from certified low or zero carbon electricity for operations. A Corporate Power Purchase Agreement (CPPA) is a financial contract with a renewable generator that will allow for a guaranteed source of renewable power for the operation of the proposed Project in future. In addition, up to 10% of the power requirement will come from on-site generation of power (Solar PV). Should there be a period where the on-site generation is not operating to full capacity, the shortfall to ensure 10% is met can be made through Green Tariffs. The remaining 10% of power will be required to be sourced from the National Grid. Use of non-fossil fuel related certified renewable power for 90% of the requirements from the opening year will reduce any potential air emissions associated with the electrical generation of power for the project.

In accordance with the EPA Guidelines (EPA 2022) and considering the potential likely effects of emissions from the operational power requirements, the impacts are considered overall Neutral, Not Significant and Long-Term.

16.5.3.13 Operational Phase Other Minor Emissions

In addition to the above potential emissions from the proposed Project there is the potential for some other minor emissions. These emissions have been reviewed and considered to not be significant sources of air pollutants requiring a full modelling assessment, the rational for scoping these emissions out is detailed below.

There are two proposed boilers (each 146kW) at Dardistown Depot. In addition, there are 18 x 300kW and 1 x 200kW radiant tube heaters for heating indoor spaces in buildings G, C1 and C2 also at the depot. These emissions have been considered with respect to the Directive (EU) 2015/219 which is commonly known as the Medium Combustion Directive (MCD).

In addition, Article 2 of the MCD states that the Directive shall not apply to combustion plants in which the gaseous products of combustion are used for direct gas-fired heating used to heat indoor spaces for the purpose of improving workplace conditions. As a result, the radiant tube heaters, which will be used to heat workspaces, can be scoped out.

The combined total output of the two boilers is 292kW, the MCD states that individual combustion plants with a rated thermal input less than 1MW (1,000kW) should not be considered for the purpose of calculating the total rated thermal input of a combination of combustion plants. Therefore, the impact due to combustion emissions from the depot can be considered not significant.

As part of operational maintenance of the proposed Project, diesel-powered rail maintenance vehicles (DPRMVs) will be required in order to provide rail re-profiling and other heavy-duty operations using the dedicated rail-mounted units. The infrequent use of a DPRMV is not considered a significant emission. In order to minimise emissions a "no idling" rule will be implemented when in use.

At the depot an operational maintenance activity known as sanding will be conducted to improve the vehicle-braking system. Operators at the depot will replenish the sand boxes on the vehicles, using nozzles at sand-filling stations located alongside the tracks in the depot. These filling stations will take sand via piped connections from a sand-storage silo. The sanding will be conducted at designated stations within the depot which can be carefully controlled with respect to dust emissions, in addition the sand will be stored in enclosed silos prior to use. As a consequence, potential impacts due to dust emissions from sanding at the depot can be considered not significant.

In accordance with the EPA Guidelines (EPA 2022) and considering the potential likely effects of emissions from the operational minor emissions, the impacts are considered overall Neutral, Not Significant and Long-Term.

16.6 Mitigation Measures

In order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and Operational Phases associated with the proposed Project.

16.6.1 Construction Phase

16.6.1.1 Construction Phase Dust Mitigation Measures

The potential risk from dust emissions has been reviewed for the most important activities and each of the construction areas. Further details on construction methods can be found in Chapter 5 of the EIAR (MetroLink Construction Phase) which contains an overview of the typical activities and methods that are anticipated to be used during construction and commissioning of the proposed Project. In addition, the mitigation measures document in this section should be considered in parallel with the Outline Construction Environmental Management Plan (Appendix A5.1). Before commencing relevant works, an Air Quality Management Plan shall be prepared and submitted for approval to the relevant planning authority. The plan must include all appropriate dust and emissions mitigation measures including for asbestos and aspergillus, applicable to the circumstances of the relevant site, based on the local authority requirements and industry best practices. The plan will be developed by the contractor and for each worksite shall include:

- An inventory and timetable of activities which may give rise to emissions or dust;
- Alert levels;
- Alert system to be used (including notification process);
- Details of control measures;
- Details of dust monitoring arrangements, including the location of sensitive receptors, monitoring locations, and monitoring equipment to be used; and
- Details of the air quality reporting requirements.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented, these have been detailed in Appendix A16.4. In summary, the measures which will be implemented will include:

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Any blasting will be completed by specialised contractors with a specific blasting dust management plan;
- Liaison with local authorities and community groups;
- Hoarding will be provided around the construction compounds; and
- It is anticipated that methods of collecting rainwater and recycling for general site use, will be adopted where practical. Requirements for dewatering installations at deep station and tunnel portals can also provide a valuable source of water for general site use.

Strict dust prevention will be in place at all times, to minimise any potential emissions and these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

Consistent implementation of good dust minimisation practices will ensure that the impact from construction dust is Long-Term, Localised, Reversible and not significant when considered with respect to the EPA description of effects (EPA 2022).

16.6.1.2 Construction Phase Asbestos Mitigation Measures

A Demolition Survey of all buildings to be demolished will be required prior to commencement of the demolition works. This will include a fully intrusive asbestos-containing materials survey, which will involve destructive inspection. Prior to commencement of the demolition works, all asbestos containing materials identified by the Management Asbestos Survey and Refurbishment and Demolition Survey, will be removed by a suitably trained and competent person. Asbestos-containing materials will only be removed from site by a suitably permitted/licensed waste contractor and will be brought to a suitably licensed facility. The Health and Safety Authority will be contacted where needed in relation to the handling of asbestos and material will be dealt with in accordance with the Safety, Health and Welfare at

Work (Exposure to Asbestos) Regulations 2006, as amended and associated approved Codes of Practice.

16.6.1.3 *Construction Phase Aspergillus Mitigation Measures*

In relation to aspergillus, survey and prevention works will take place before construction commences by a competent contractor in proximity to any sensitive buildings and in particular in proximity to the Mater Hospital site which utilises passive ventilation on Eccles Street. The National Guidelines for the Prevention of Nosocomial Aspergillosis (HSE 2018) provide a risk assessment for aspergillus, preventative dust mitigation measures and, in Appendix B of the document pre-project planning and contractor advice. The Guidance also provides information that should be included as part of tender documents for the construction contractors. The prevention works will involve sealing the windows to the facades that are in close proximity to the hospital; these measures will also prevent fugitive dust entering the hospital through windows. The potential risk from aspergillus is also considered in Chapter 10 (Human Health). These works will form part of an Aspergillus Prevention Plan to be complete by a specialist and will ensure the prevention of Aspergillus spores spreading. The National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities (National Disease Surveillance Centre 2002) and National Guidelines for the Prevention of Nosocomial Aspergillosis (HSE 2018) will be taken into consideration by the competent contractor as a source for the Aspergillus Prevention Plan.

The mitigation measures put in place to control construction dust will also be considered as mitigation measures with respect to aspergillus as they will minimise the potential for spread of the fungal spores.

16.6.1.4 Construction Phase Traffic Mitigation Measures

The modelling of road traffic for impacts on human and ecological receptors has found no significant impacts that require mitigation measures with respect to the modelling of emissions. However, some mitigation measures can be put in place to minimise emissions:

- Implement a policy which prevents idling of vehicles both on and off-site including HGV holding sites;
- Construction Phase traffic should be monitored to ensure construction vehicles are using the designated haul routes;
- Additional vehicular traffic will be managed through the CEMP and Temporary Traffic Management Plans for the proposed Project and stations as per Chapter 9 (Traffic & Transport);
- Efficient scheduling of deliveries to minimise number of deliveries required, and in turn their emissions; and
- Construction vehicles should conform to the current EU emissions standards and where reasonably practicable, their emissions should meet upcoming standards prior to the legal requirement date for the new standard. This will ensure emissions on haul routes are minimised.

Mitigation measures are required for the control of dust with respect of HGV moments on site and deliveries to/from the site:

- HGV traffic leaving site will pass through a wheel wash;
- Public roads outside the site will be regularly inspected for cleanliness and cleaned as necessary. If public roads are deemed to require additional cleaning where possible a suction device for road cleaning will be utilised which can access spaces around cars and other street furniture more effectively; and
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

Table 16.60: Summary of Predicted Construction Phase Impacts Following the Implementation of Mitigation

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Construction Dust impacts on human receptors	No assessment made of a non-mitigated dust impact	Medium-term, negative, localised and not significant
Construction Dust impacts on ecological receptors	No assessment made of a non-mitigated dust impact	Medium-term, negative, localised and not significant
Road traffic impacts on human receptors	Short-term, negative, localised and not significant	Short -term, negative, localised and not significant
Road traffic impacts on ecological receptors	Short -term, negative, localised and not significant	Short -term, negative, localised and not significant
Regional air quality	Neutral, not significant, short-term	Neutral, not significant, short-term

16.6.2 Operational Phase

As all ambient air pollutants will remain in compliance with the ambient air quality standards and the proposed Project has negligible impacts at all modelled receptors, no specific operation phase mitigation measures are required.

Table 16.61: Summary of Predicted Operational Phase Impacts Following the Implementation of Mitigation

Assessment Topic	Predicted Impact (Pre-Mitigation and Monitoring)	Predicted Impact (Post Mitigation and Monitoring)
Road traffic impacts on local human receptors	Neutral, not significant, long-term	Neutral, not significant, long-term
Road traffic impacts on local ecological receptors	Neutral, not significant, long-term	Neutral, not significant, long-term
Regional air quality	Neutral, not significant, long-term	Neutral, not significant, long-term

16.7 Residual Impacts

16.7.1 Construction Phase

When the dust minimisation measures detailed in the mitigation section of this chapter are implemented, fugitive emissions of dust from the site are not predicted to be significant and pose no nuisance, human health or ecological risk to nearby receptors. Thus, there will be no likely residual Construction Phase dust effects.

The air dispersion modelling assessment of Construction Phase traffic emissions has found that the proposed Project resulted in a no significant adverse effects for both construction scenarios assessed. However, some likely slight negative effects were identified as were beneficial effects.

The Construction Phase of the assessment identifies a generally negligible or beneficial effect on air quality in the vicinity of the proposed Project. Therefore, overall, it is considered that the residual effects with the EPA Guidelines (EPA 2022) and considering the likely effects of emissions from the proposed Project construction, the likely effects are considered overall Neutral, Not Significant and Medium-Term.

16.7.2 Operational Phase

The air dispersion modelling assessment has found that in 2035 no receptors will have ambient air quality exceedances of the ambient air quality standards for the Do Something (and Do Minimum) scenario as a result of the proposed Project. There is a single slight adverse effect and no moderate or substantial adverse effects expected as a result of the Operational Phase of the proposed Project.

Therefore, overall, it is considered that the residual effects with the EPA Guidelines (EPA 2022) and considering the likely effect of emissions from the Operational Phase of the proposed Project, the likely effects are considered overall Neutral, Not Significant and Long-Term.

16.8 Difficulties Encountered in Compiling Information

There were no significant difficulties encountered in compiling information for this assessment.

EPA published (EPA 2021a) baseline information for 2020 has been deemed to have been impacted by the reduction in traffic due to Covid-19 restrictions (Section 16.4.3) and therefore not consistent with long-term trends. The chapter author is satisfied that long-term data trends up to 2020 can be considered suitable for determining the baseline. Therefore, while the chapter author acknowledges this difficulty it is not deemed as a significant difficulty.

16.9 Glossary

Term	Meaning
Air Quality Exceedance	Where pollutant concentrations exceed an air quality standard.
Air Quality Management Area (AQMA)	If a local authority identifies any locations within its boundaries where the air quality objectives are not likely to be achieved, it must declare the area as an air quality management area. The local authority is subsequently required to put together a local air quality action plan
Air Quality Objective	Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set by the European Union.
Air Quality Sensitive Receptors	People, property, species or designated sites for nature conservation that may be at risk from exposure to air pollutants potentially arising as a result of a proposed development.
Air Quality Standards	Air Quality Standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The Standards are based on assessment of the effects of each pollutant on human health, including the effects on sensitive sub-groups.
Ambient Air	The air (or concentration of a pollutant) that occurs at a particular time and place outside of built structures. Often used interchangeably with "outdoor air".
Deposition	The total atmospheric deposition of acidity is determined using both wet and dry deposition measurements. Wet deposition is the portion dissolved in cloud droplets and is deposited during precipitation events. Dry deposition is the portion deposited on dry surfaces during periods of no precipitation as particles or in a gaseous form. Although the term acid rain is widely recognized, the dry deposition portion ranges from 20 to 60% of total deposition.
Diffusion Tubes	Passive diffusion tube samplers collect nitrogen dioxide and other pollutants by molecular diffusion along an inert tube to an efficient chemical absorbent. After exposure for a known time, the absorbent material is chemically analysed and the concentration calculated.
Dust	All airborne particulate matter.
Dispersion Model	A dispersion model is a means of calculating air pollution concentrations using information about the pollutant emissions and the nature of the atmosphere. In the action of operating a factory, driving a car, or heating a house, a number of pollutants are released into the atmosphere. The amount of pollutant emitted can be determined from a knowledge of the process or actual measurements. Air Quality Objectives are set in terms of concentration values, not emission rates. In order to assess whether an emission is likely to result in an exceedence of a prescribed objective it is necessary to know the ground level concentrations which may arise at distances from the source. This is the purpose of a dispersion model.
Emission Factor	An emission factor gives the relationship between the amount of a pollutant produced and the amount of raw material processed or burnt. For example, for mobile sources, the emission factor is given in terms of the relationship between the amount of a pollutant that is produced and the number of vehicle miles travelled. By using the emission factor of a pollutant and specific data regarding quantities of materials used by a given source, it is possible to compute emissions for the source. This approach is used in preparing an emissions inventory.
EU Directives	The European Union has been legislating to control emissions of air pollutants and to establish air quality objectives since the early 1970s. European Directives on ambient air quality require the UK to undertake air quality assessment, and to report the findings to the European Commission on an annual basis.
Exceedence	An exceedence defines a period of time during which the concentration of a pollutant is greater than, or equal to, the appropriate air quality criteria. For Air Quality Standards, an exceedence is a concentration greater than the Standard value. For Air Pollution Bandings, an exceedence is a concentration greater than, or equal to, the upper band threshold.

Term	Meaning
Greenhouse Gases	Greenhouse gases are atmospheric gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that slow the passage of re-radiated heat through the Earth's atmosphere.
Heavy Goods Vehicle (HGV)	A HGV is any vehicle with a gross combination mass (GCM) of over 3.5 tonnes.
Local Air Quality Management (LAQM)	The Local Air Quality Management (LAQM) process requires Local Authorities to periodically review and assess the current and future quality of air in their areas. A Local Authority must designate an Air Quality Management Area (AQMA) if any of the Air Quality Objectives set out in the regulations are not likely to be met over a relevant time period.
Light goods vehicle	A motor vehicle used to carry goods with a total mass of up to 3.5 tonnes
Nitrogen dioxide	A gas produced when fuels are burned and is often present in motor vehicle and boiler exhaust fumes. It is an irritant to the respiratory system.
Oxides of Nitrogen (NO_x)	Combustion processes emit a mixture of nitrogen oxides (NO_x), primarily nitric oxide (NO) which is quickly oxidised in the atmosphere to nitrogen dioxide (NO_2). Nitrogen dioxide has a variety of environmental and health impacts. It is a respiratory irritant which may exacerbate asthma and possibly increase susceptibility to infections. In the presence of sunlight, it reacts with hydrocarbons to produce photochemical pollutants such as ozone. NO_2 can be further oxidised in air to acidic gases, which contribute towards the generation of acid rain.
Ozone	Ozone (O_3) is not emitted directly into the atmosphere, but is a secondary pollutant generated following the reaction between nitrogen dioxide (NO_2), hydrocarbons and sunlight. Whereas nitrogen dioxide acts as a source of ozone, nitric oxide (NO) destroys ozone and acts as a local sink (NOX-titration). For this reason, O_3 concentrations are not as high in urban areas (where high levels of NO are emitted from vehicles) as in rural areas. Ambient concentrations are usually highest in rural areas, particularly in hot, still and sunny weather conditions which give rise to summer "smogs".
Particulate matter	Airborne PM includes a wide range of particle sizes and different chemical constituents. It consists of both primary components, which are emitted directly into the atmosphere, and secondary components, which are formed within the atmosphere as a result of chemical reactions. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung. Air Quality Objectives are in place for the protection of human health for PM_{10} and $PM_{2.5}$ – particles of less than 10 and 2.5 micrometres in diameter, respectively.
$PM_{2.5}$	$PM_{2.5}$ is any particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometres.
PM_{10}	PM_{10} is any particulate matter with an aerodynamic diameter equal to or less than 10 micrometres.
Receptor	A component of the natural or built environment (such as a human being, water, air, a building or a plant) affected by an impact of the construction and/or operation of a proposed development
Sulphur Dioxide (SO_2)	Sulphur dioxide is a corrosive, acidic gas which combines with water vapour in the atmosphere to produce acid rain. Both wet and dry deposition have been implicated in the damage and destruction of vegetation and in the degradation of soils, building materials and watercourses. SO_2 in ambient air is also associated with asthma and chronic bronchitis.
Tunnel boring machine	A tunnelling machine, which consists of a rotary cutting head that occupies the full face of the tunnel. A system of conveyors or pumps is used to remove the excavated material
Volatile Organic Compound	Monitoring of PMM10 levels in the UK has to date, been largely based upon the use of TEOM analysers. A principal concern with the TEOM instrument is that the filter is held at an elevated temperature (50°C) in order to minimise errors associated with

Term	Meaning
	the evaporation and condensation of water vapour. This can also lead to the loss of the more volatile species and has led to the identification of differences between TEOM and gravimetric measurements at co-located sites. In the past, a factor of 1.3 was applied to all TEOM measured concentrations to estimate the gravimetric equivalent. The Volatile Correction Method (VCM, http://www.volatile-correction-model.info/) has recently been developed. The tool uses measurements of volatile particulate matter made by nearby FDMS instruments to correct TEOM measurements for the loss of such volatile material. The corrected measurements have been demonstrated to be equivalent to the gravimetric reference equivalent.

16.10 References

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16.10.1 Directives and Legislation

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

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Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants

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

Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

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