

Plot 10a, First Street

Air Quality Assessment

Vita Ventures Ltd. & ASK Real Estate

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Executive Summary

Cundall has been commissioned to prepare an Air Quality Assessment Report for the redevelopment of Plot 10a, First Street, Manchester. Plot 10a is located in the west of the Plot 10 site, fronting onto First Street. The proposals are for a commercial-led scheme comprising a highly sustainable office building with 13 storeys.

The proposed redevelopment lies within Greater Manchester Air Quality Management Area (AQMA), which was declared in July 2001 due to exceedances of the annual mean nitrogen dioxide (NO₂) objective threshold and 24-hour particulate matter (PM₁₀) objective. Existing conditions within the study area indicate that there is potential for nitrogen dioxide (NO₂) concentrations in the wider area to exceed the National Air Quality Objective threshold levels.

In setting the scope of assessment, consideration has been made of the potential for impacts to occur during both the construction and operation phases of the development, and the exposure of future occupants of the site to air pollution.

A construction dust impact assessment was undertaken in accordance with Institute of Air Quality Management (IAQM) guidance. It was concluded that without appropriate mitigation measures, *High* risks were posed by construction, and *Medium* risks were posed by earthworks and trackout activities. During construction, receptors within 350m of the construction boundary could be susceptible to dust effects. However, with appropriate mitigation measures implemented, it was concluded that the construction effects of the Proposed Development would be not significant.

No car parking is included within the development proposals. As the anticipated number of vehicle trips associated with the Proposed Development is unlikely to increase annual average daily traffic flows by greater than 100 vehicles on any road link close to the Proposed Development, assessment of traffic-related impacts on nearby receptors was scoped out of the operation phase assessment.

Heating, cooling and hot water for the development will be provided by air source heat pumps powered by electricity. There will be a requirement for back-up diesel generators (life safety and tenant). Generators will operate for less than 50 hours per year, based on required maintenance testing. The flues will be located at roof level. Based on the current design, the location of the generator flues and roof top community terrace are >10m horizontal distance. There will also be a 6m separation screen with flues emitting just above this level. Based on the size, minimum operation hours and proposed location of the generators, they are not expected to have a significant impact on local air quality.

Although no car parking is included as part of the Proposed Development, predicted daily vehicle trips are likely to exceed the IAQM threshold criterion (of 100 vehicles per day) for when a detailed assessment of transport emissions is required. Detailed assessment of transport related emissions indicated negligible air quality impacts at all surrounding receptors, apart from one residential receptor (8 First Street) where potential impacts are predicted to range between 'slight' and 'moderate'. It should be noted that operational traffic predictions also contain potential contributions from the Plot 10b development and are considered to be very much worst-case. Mitigation measures include the exclusion of standard car parking places and a Travel Plan has been prepared to encourage future users of the building to use Public Transport modes.

The assessment has demonstrated possible exceedances of the annual mean nitrogen dioxide objective at ground floor level of facades facing Hulme Street in the worst-case future scenario. The annual mean objective does not apply to non-residential land uses. Since all modelled NO₂ values are below 60µg/m³, exceedance of national short-term NO₂ objectives is unlikely at all floors at all facades. Exceedances of fine particulate (PM₁₀) and (PM_{2.5}) objectives is unlikely at all floors at all facades.

The ventilation strategy is mixed mode. The ground floor will be fully mechanically ventilated making use of heat recovery to reduce heating demands. From first floor upwards the strategy will be mixed mode, with the ability for windows to be opened based on ambient conditions. As there are no exceedances of annual mean NO₂

concentrations at building facades, there will be no requirement for gaseous filtration. MVHR intakes should be positioned on higher floors and non-road facing facades where concentrations of ambient pollutants are expected to be lower. Openable windows can be utilised for purge or natural ventilation purposes. It should be noted that although levels of PM₁₀ and PM_{2.5} are compliant with current air quality objectives, best practice threshold values published by the World Health Organisation (WHO) are exceeded. Consideration should be given to integrating particulate filters into the MVHR design where this is practicable. Under these conditions, it is anticipated that the exposure of future occupants to poor air quality will be unlikely, and no additional mitigation measures will be required.

The Client will commit to the implementation of the best practice mitigation measures identified in this report during the construction phase of the development. It is anticipated that the generation of dust and harmful pollutants emissions from construction site activities will be reduced with the correct implementation of these measures.

Additionally, a Construction Management Plan (CMP) which conforms to the requirements of Manchester City Council's planning requirements will be submitted in support of the planning application and a suitable monitoring programme will be discussed and agreed with Manchester City Council's Environmental Health Team prior to commencement of works.

Overall, it was concluded that with the provision of appropriate mitigation measures, construction activities and operation impacts will have no significant effects on local air quality. The proposals are therefore compliant with the requirements of Manchester City Council's Planning.

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1.0

Introduction

1.0 Introduction

Cundall has been commissioned by Vita Ventures Ltd. and ASK Real Estate to prepare an Air Quality Assessment report to support a planning application for the redevelopment of Plot 10a, First Street, Manchester. The site is located within the Greater Manchester Air Quality Management Area (AQMA).

1.1 Site Location

The site known as Plot 10a covers an area of 3,100 square metres (0.31 hectares) and is located at the south-eastern edge of Manchester City Centre, within the First Street Strategic Development Framework area.

The site sits in First Street Central and is part of a wider vision to create a mixed-use neighbourhood in the area, supported by a mixture of leisure, office and residential blocks.

The site is currently mostly hardstanding, reflecting its recent use as a temporary car parking area ahead of the plot's redevelopment. There is limited vegetation on site, limited to small shrubbery to the edge of Medlock Street. There are no permanent structures on the Site.

Plot 10a is bound by:

- River Street to the north
- The vacant Plot 10b development to the east which borders River Street to the north and east;
- Hulme Street to the south, and
- The under-construction Plot 9a development to the west.

The A57(M) is located approximately 150m south of the Proposed Development.

The location of the Plot 10a site is shown in Figure 1-1. Additional context is provided by the aerial image (Figure 1-2).

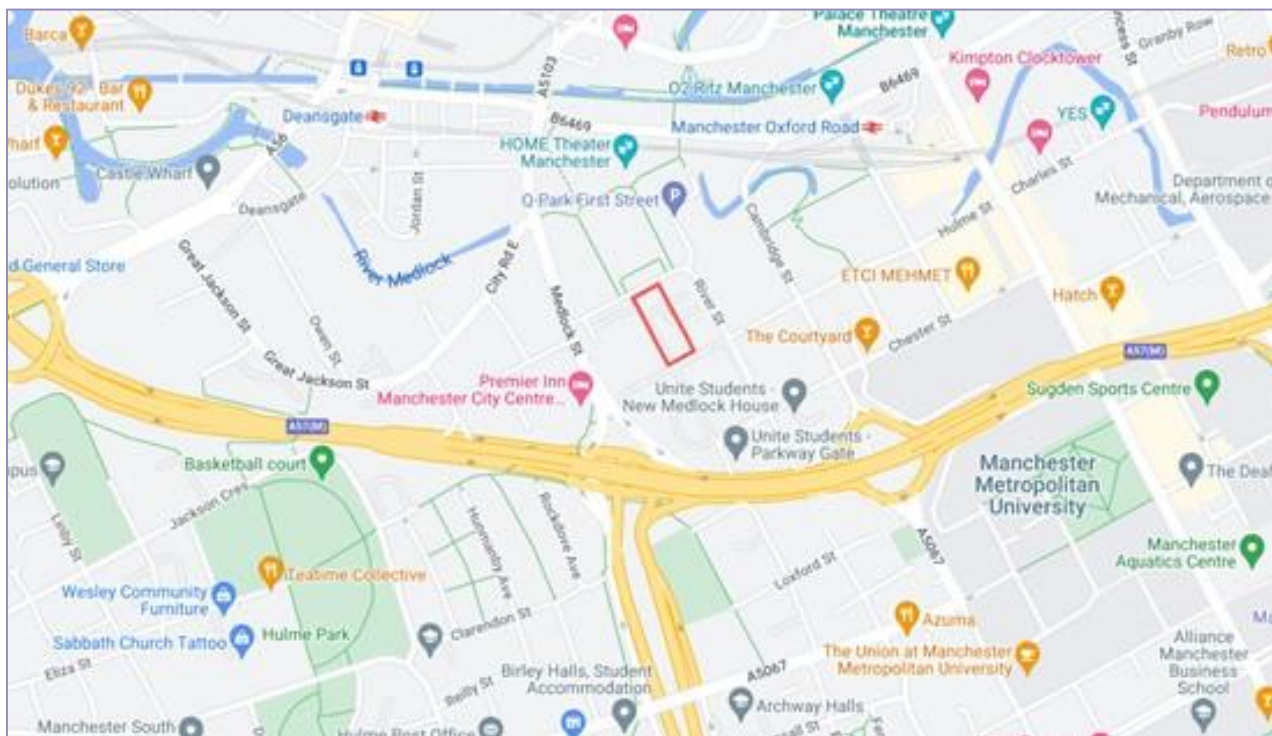


Figure 1-1: Location of the Plot 10a Development Site (Courtesy of Google Maps)



Figure 1-2: Aerial Image (Courtesy of Google Maps)

1.2 Proposed Development

The proposals are for a commercial-led scheme, comprising a highly sustainable office building, with winter gardens and roof terraces. Plot 10a is to comprise a 13-storey office building, delivering just over 20,000 sqm floorspace.

A shared servicing route will be created between the building and that proposed for Plot 10b, running between River St and Hulme St.

No car parking is included within the development proposals.

The development's heating, cooling and part of the hot water needs will be provided through efficient air-source heat pumps (ASHPs). There will be a requirement for back-up diesel generators (life safety and tenant) and operating less than 50 hours per year, based on required maintenance testing. Generator flues will be located at roof level.

The ventilation strategy is mixed mode. The ground floor will be fully mechanically ventilated making use of heat recovery to reduce heating demands. From first floor upwards the strategy will be mixed mode, with the ability for windows to be opened based on ambient conditions.

Key parameters for the Proposed Development are summarised in Table 1-1.

Parameter	Proposed Development
	Plot 10a
General Description	Plot 10a will be a 13-storey commercial office building (Use Class E) with winter gardens and roof terraces.
Quantum	c.20,175 sqm. of commercial space (Use Class E) G. + 12 storeys / c 91 m
Ancillary Space	Terrace at floors 11 and 12
Cycle Parking	204 secure cycle spaces
Vehicle Parking	No car parking. There are 28 disabled parking spaces provided in the First Street Q-Park multi-storey car park which is c.120m from the site. In addition to this, there are 6 on-street parking bays where disabled drivers can park without payment or limit almost adjacent to the site, located on the northern side of River Street between Medlock Street and James Grigor Square.

Table 1-1: Key Parameters of the Proposed Development

It is anticipated that construction will be completed at the earliest by December 2024, but more likely some time in 2025.

Layouts and elevations for the Plot 10a are provided in Figures 1-3 to 1-4, courtesy of Jon Matthews Architects^{1,2}.

¹ Jon Matthews Architects (2022), Plot 10a First Street, Proposed GA Plan Ground Floor, Ref: B1_02_2200SK, 08.12.22

² Jon Matthews Architects (2022), Plot 10a First Street, Proposed Elevation (A), Ref: B1_04_2200, Rev A, 13.09.22 Issued for final Stage 2 coordination

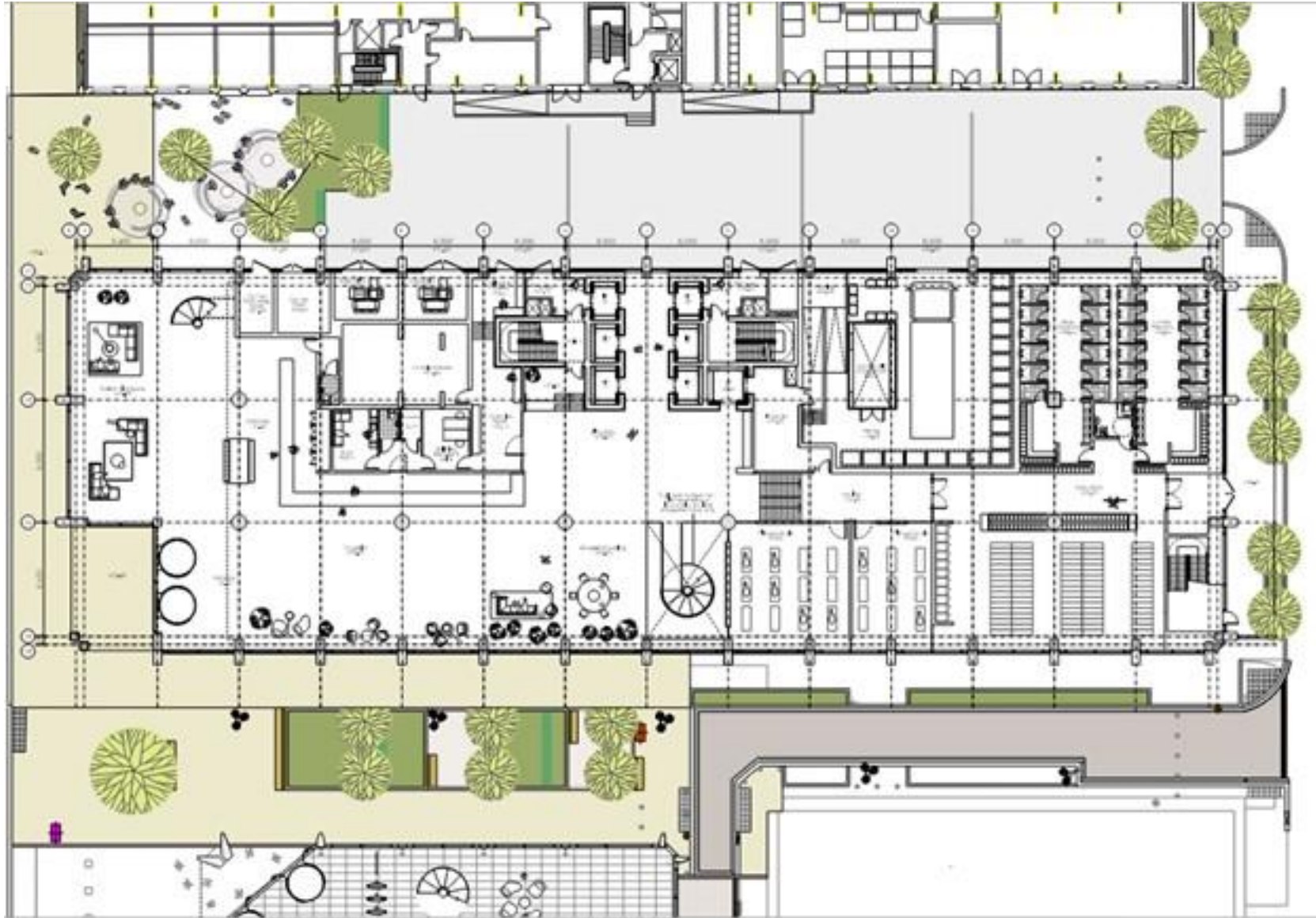


Figure 1-3: Plot 10a Proposed Ground Floor Layout (Courtesy of Jon Matthews Architects)

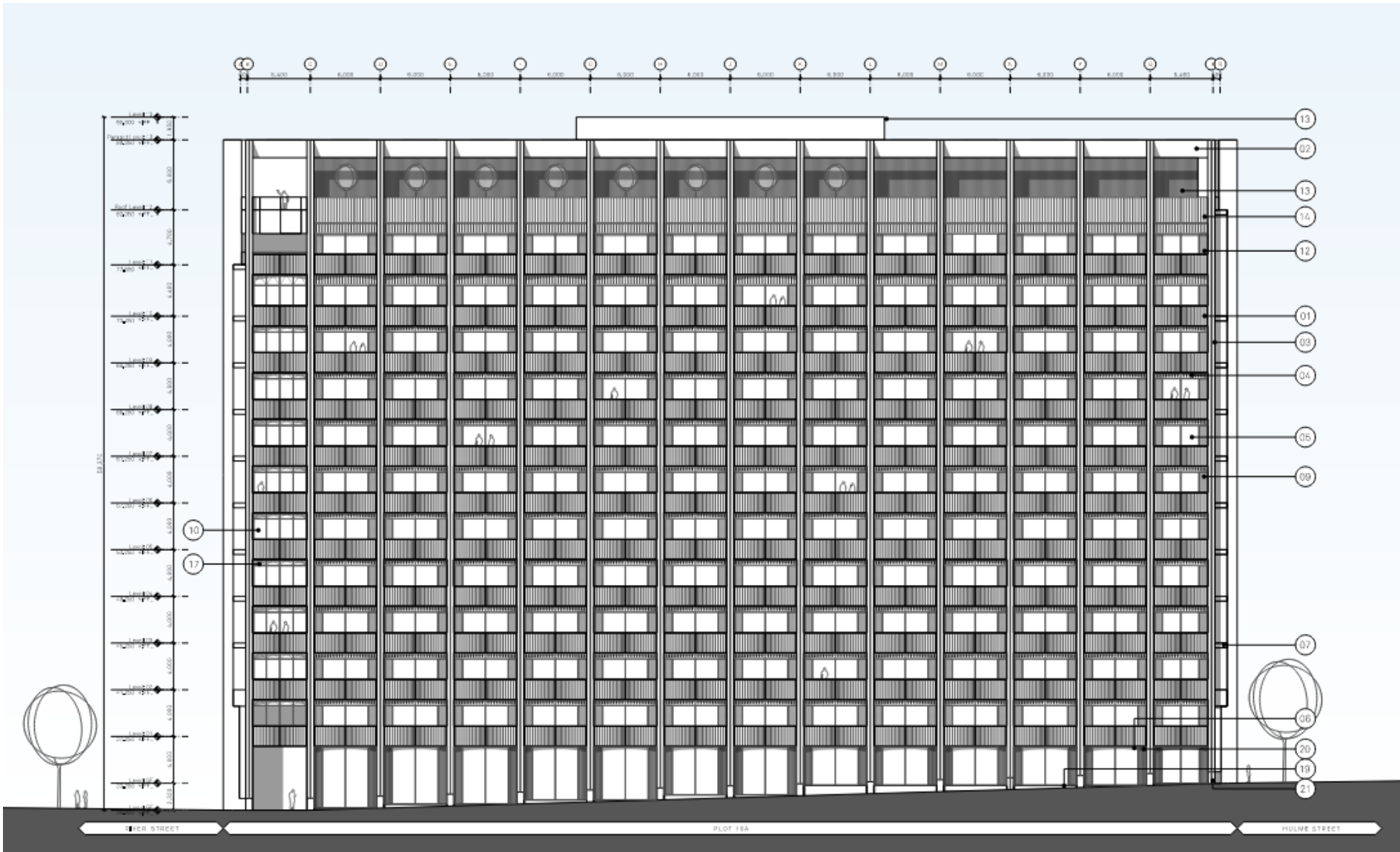


Figure 1-4: Plot 10a Proposed Elevation (A), (courtesy of Jon Matthews Architects)

1.3 Scope of Assessment

This assessment has been prepared in support of the planning application and considers the potential for effects to occur during both the construction and operation phases of the development.

This Air Quality Assessment outlines the relevant air quality legislation and policy guidance and presents the assessment methodology. The main pollutants of concern for this assessment are oxides of nitrogen (NO_x), including nitrogen dioxide (NO₂), fine and very fine particulate matter (PM₁₀ and PM_{2.5}). The existing air quality conditions are presented and the likely air quality impacts from construction and operation of the Proposed Development are considered. The effects are assessed in the context of relevant national, regional and local air quality legislation, policies and guidance. Mitigation measures are proposed, as required, to reduce the effect of the Proposed Development to negligible, as far as reasonably practicable.

The scope of the assessment is detailed further in section 3.0.

This assessment has been undertaken by Cundall's Air Quality Team, who are all Members/Associates of the Institute of Air Quality Management and managed by senior staff within the team who are also professionally chartered. Details are provided in Appendix A.

1.4 Consultation with Manchester City Council

Following the execution of an initial screening and scoping exercise, consultation with Manchester City Council's Air Quality Team was undertaken in September 2022 to discuss and agree the scope of the assessment. Further details are provided in Appendix B

2.0

Legislation, Policy and Guidance

2.0 Legislation, Policy and Guidance

2.1 Key Legislation and Policy

This assessment considers key air quality legislation, which is summarised in Table 2-1.

Legislation	Description
EU Ambient Air Quality Directive 2008/50/EC ³	Establishes the requirements of Member States in terms of improvements required to air quality. Sets standards for a variety of pollutants for human-health and the environment.
The Air Quality Standards Regulations 2010 ⁴	Transposes formalised EU Limit Values set out in directive 2008/50/EC to UK law. An Amendment was published in 2016 ⁵
The Clean Air Quality Strategy 2019 ⁶	Defra published a Clean Air Strategy in January 2019, setting out a wide range of actions for UK Government to reduce pollutant emissions and improve air quality. The actions are grouped into four main emission sources: Transport, Domestic, Farming and Industry The Clean Air Strategy sets out the case for action and demonstrates the government's determination to improve air quality. In some cases, the goals are even more ambitious than EU requirements to reduce people's exposure to toxic pollutants like nitrogen oxides, ammonia, particulate matter, non-methane volatile organic compounds and sulphur dioxide.
Environment Act 1995, Part IV ⁷ , amended by the Environment Act 2021	Defines the requirements for Local Air Quality Management (LAQM).
Environment Protection Act 1990, amended by the Pollution Prevention and Control Act 1999 ⁸ and the Environment Act 2021.	Part III provides statutory nuisance provisions for nuisance dust. Nuisance complaints about dust would need to be investigated by the Local Authority. In practice, dust deposition is generally managed appropriately by suitable on-site practices and mitigation, avoiding the determination of statutory nuisance and/or prosecution or enforcement notices.
The Non-Road Mobile Machinery (Type-Approval and Emission of Gaseous and Particulate Pollutants) Regulations 2018 ⁹	Developers and contractors are required to meet compliance with the emission standards for Non-Road Mobile Machinery (NRMM). The Regulations exercise of the powers conferred by section 2(2) of, and paragraph 1A of Schedule 2 to, the European Communities Act 1972 in relation to the type, description, construction or equipment of vehicles.
Environment Act, 2021 ¹⁰ .	The Act makes provision about targets, plans and policies with the focus of improving the natural environment. This includes air quality, as well as water, nature and biodiversity, regulation of chemicals, waste and resource efficiency and recall of products failing to meet environmental standards. The Act introduces a duty on government to bring forward at least two air quality targets by October 2022 for consultation. These are to be to reduce the annual average level of fine particulate matter (PM _{2.5}) and to set a long-term (minimum of 15 year) target for its reduction. The 2021 Act amends the Environment Act 1995 Part IV by seeking to strength local air quality a management (LAQM) through greater cooperation at local level and broadening the range of organisations that play a role in improving air quality. Responsibility for tackling air pollution is to be shared between

³ 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

⁴ HMSO (2010). Statutory Instrument 2010 No. 1001, The Air Quality Standards Regulations 2010, London: HMSO

⁵ HMSO (2016). Statutory Instrument 2016 No. 1184, Environmental Protection, England, The Air Quality Standards (Amendment) Regulations 2016, London: HMSO, <https://www.legislation.gov.uk/ukSI/2016/1184/contents/made>

⁶ Department for Environment Food and Rural Affairs (Defra) (2019) Clean Air Strategy 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf

⁷ Environment Act 1995, Chapter 25, Part IV Air Quality

⁸ Environmental Protection Act 1990, Chapter 43, Part III Statutory Nuisances and Clean Air <https://www.legislation.gov.uk/ukpga/1990/43/part/III>

⁹ HMSO (2018) The Non-Road Mobile Machinery Type-Approval and Emission of Gaseous and Particulate Pollutants) Regulations 2018, UK Statutory Instruments, 2018 No. 764, <https://www.legislation.gov.uk/ukSI/2018/764/made>

¹⁰ HMSO (2021) Environment Act 2021, November 2021, <https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted>

Legislation	Description
	designated local authorities, all tiers of local government and neighbouring authorities. The environment secretary will be required to review the Air Quality Strategy at least every five years and publish annual progress reports to parliament. The 2021 Act amends the Clean Air Act 1993 to give local authorities more power to reduce pollution in smoke control areas by replacing the criminal offence of emitting smoke from a chimney in a smoke control area with a civil penalty regime, seeking to enable simpler, quicker and more proportionate enforcement at local level. It also amends the Environmental Protection Act 1990 by extending the system of statutory nuisance to private dwellings in smoke control areas, which could result in abatement notice and issuing fines for criminal offence of breaches. The 2021 Act introduces new powers for the government to compel vehicle manufacturers to recall vehicles and non-road machinery that fails to meet legal binding standards.

Table 2-1: Key Legislation

The air quality UK Air Quality Objectives (AQOs) which apply to this assessment are shown in Table 2-2¹¹. Some pollutants have long-term (annual mean) objectives due to the chronic way they affect human health or the natural environment and others have short-term (1-hour, 24-hour mean) objectives due to the acute way they affect human health or the natural environment.

Pollutant	Averaging Period	Objective Threshold ($\mu\text{g}/\text{m}^3$)
Nitrogen Dioxide (NO_2)	Annual mean	40
	1-hour mean	200 Not to be exceeded more than 18 times per year (equivalent to the 99.79 th percentile of 1-hour mean values)
Particulate Matter (PM_{10})	Annual mean	40
	24-hour mean	50 Not to be exceeded more than 35 times per year (equivalent to the 90.4 th percentile of 24-hour mean values)
Fine Particulate Matter ($\text{PM}_{2.5}$)	Annual mean	25

Table 2-2: AQO and EU Limit Values

Previous research carried out on behalf of Defra identified that exceedances of the NO_2 1-hour mean are unlikely to occur where the annual mean is below $60 \mu\text{g}/\text{m}^3$. This assumption is still considered valid; therefore, Defra's Technical Guidance document, LAQM.TG (22)¹² confirms that this figure can be referenced where 1-hour mean monitoring data are not available (typically if monitoring NO_2 using passive diffusion tubes).

Good practice design (e.g., Building Regulations) often consider WHO guidelines, which are usually more stringent (see Table 2-3 below). Compliance with WHO recommended guidelines for residential and non-residential elements is considered 'best practice' but is non-mandatory at present, i.e., suitable control can be adopted on an 'as-required' basis. The WHO recommended guidelines were recently updated in September 2021¹³. The update includes Air Quality Guideline (AQG) levels for the pollutants of relevance to this assessment (NO_2 , PM_{10} and $\text{PM}_{2.5}$) which are significantly lower than the previous WHO guidelines, which correspond to the lower range of the interim targets for PM_{10} and $\text{PM}_{2.5}$ and the higher range for NO_2 .

¹¹ Other pollutants have been screened out of this assessment as exceedance of their respective objectives is not anticipated to be associated with the pollutant sources of relevance to this assessment.

¹² Defra (2022) Local Air Quality Management Technical Guidance TG(22) August 2022 <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

¹³ World Health Organisation (WHO) (2021) WHO global air quality guidelines, Particulate matter ($\text{PM}_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, <https://apps.who.int/iris/handle/10665/345329>.

Greater Manchester have signed up to achieve World Health Organisation (WHO) BreatheLife¹⁴ City status by 2030, which means achieving WHO targets by this date, including 20µg/m³ annual mean PM₁₀ and 10µg/m³ annual mean PM_{2.5}. It should be noted that there is no clear evidence of a safe exposure level for the air quality pollutants relative to this assessment, listed in Table 2-3. Reducing concentrations are far as feasibly possible if therefore likely to bring additional health benefits.

Pollutant	Averaging Period	Air Quality Objective (AQO) (µg/m ³)	WHO Guidelines (µg/m ³)	
			Interim Targets	AQG Level
NO ₂	Annual mean	40	40, 30, 20	10
	24-hour mean		120, 50	25
	1-hour mean	200 µg/m ³ Not to be exceeded more than 18 times per year (equivalent to the 99.79 th percentile of 1-hour mean values)		
PM ₁₀	Annual mean	40	70, 50, 30, 20	15
	24-hour mean	50 µg/m ³ Not to be exceeded more than 35 times per year (equivalent to the 90.4 th percentile of 24-hour mean values)	150, 100, 75, 50	45
PM _{2.5}	Annual mean	25	35 to 10	5
	24-hour mean		75, 50, 37.5, 25	15

Table 2-3: Comparison of WHO Guidelines with National Air Quality Objectives

2.2 Planning Policy and Guidance

Consideration of the strategic location and design of new developments is of key important in the land-use planning process and can provide a means of improving air quality. Air quality considerations as part of development applications may become material in determining planning applications. Relevant planning policy and guidance at the National, Regional, and Local levels as summarised in Table 2-4.

Policy / Guidance	Description
National Policy and Guidance	
Ministry of Housing, Communities & Local Government – National Planning Policy Framework (NPPF) (2021)¹⁵	The National Planning Policy (NPPF) published March 2012 and last updated in July 2021 with the purpose of planning achieving sustainable development. Paragraph 186 of the NPPF states that: <i>“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or National objectives for pollutants, taking into account the presence of AQMAs and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making Stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan”.</i> In addition, paragraph 105 states that:

¹⁴ BreatheLife, A global campaign for clean air, <https://breathelife2030.org/>

¹⁵ Ministry of Housing, Communities & Local Government, National Planning Policy Framework, June 2021
<https://www.gov.uk/government/publications/national-planning-policy-framework--2>

Policy / Guidance	Description
	<i>"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making."</i> Paragraph 174 discusses how planning policies and decisions should contribute to and enhance the natural and local environment. Of relevance to air quality, NPPF notes that this can be achieved by: <i>"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"</i>
Planning Policy Guidance (updated 2019)¹⁶	Planning Practice Guidance (PPG) documents have been published as part of the NPPF. PPG relating to air quality was last updated in November 2019. It provides guidance on the significance of air quality in determining the local impact of proposed developments and highlights the importance of local and neighbourhood plans with regard to air quality. A flowchart is provided to assist local authorities in determining how air quality considerations might fit into development management processes.
UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations. Detailed Plan. Defra / Department of Transport (DfT) (2017)¹⁷	This plan was produced in response to a UK Supreme Court Ruling and sets out how the UK will achieve compliance with EU Limit Values for nitrogen dioxide (NO ₂) in the shortest possible time. The plan outlined infrastructure initiatives and grants and the requirements for Local Authorities to produce local action plans, with the aim of reducing NO ₂ concentrations below the objective as soon as practically possible.
Regional Planning Policies	
Greater Manchester's Clean Air Plan¹⁸	Eight Greater Manchester authorities were identified by the Government as having roads which are expected to continue to exceed the maximum legal limits of NO₂ in 2021. They were directed by Government to undertake feasibility studies to identify measures for reducing NO₂ concentrations to compliant levels in the 'shortest possible time'. These studies must produce a series of business cases for assessing and implementing the relevant measures to address the problem. The 10 Greater Manchester local authorities, Greater Manchester Combined Authority (GMCA) and Transport for Greater Manchester (TfGM) have worked together to develop a Clean Air Plan to tackle nitrogen dioxide (NO₂) exceedances at the roadside, known as Greater Manchester (GM) Clean Air Plan (CAP). The latest GMCA report from 26th October 2022 provides an update on the GM CAP which can be summarised as follows: ▪ On 8th February 2022 The Environment Act 1995 (Greater Manchester) Air Quality Direction 2022 was issued. This new direction revoked the direction of March 2020 which required the ten GM local authorities to implement a Category C CAZ to achieve legal compliance with NO₂ limit value by 2024 latest. ▪ This new direction requires that GM local authorities: ○ Review the measures specified in the exiting Plan ○ Determine whether to propose any changes to the detailed design of those measures, or any additional measures

¹⁶ Ministry of Housing, Communities and Local Government (2019) Planning Practice Guidance: Air Quality, updated 1 November 2019
<https://www.gov.uk/guidance/air-quality--3>

¹⁷ Department for Environment, Food and Rural Affairs / Department for Transport (2017) UK plan for tackling roadside nitrogen dioxide concentrations, July 2017 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

¹⁸ Clean Air Greater Manchester, Greater Manchester Combined Authority (GMCA) reports, <https://cleanairgm.com/gmca-reports/>

Policy / Guidance	Description
	On 17th August 2022 the Air Quality Administration Committee agreed to submit the 'Case for a new Greater Manchester Clean Air Plan' to the Secretary of State as a final Case for a new Greater Manchester Clean Air Plan and Approved the Case for a New Plan – Air Quality Modelling Report for submission to the government's Joint Air Quality Unit.
Greater Manchester Air Quality Action Plan 2016-2021 (AQAP)¹⁹	The AQAP identifies a range of actions to reduce emissions and mitigate the impacts on air quality. Some Key actions regards development and transportation are: - Actions for managing new development: - Construction Management Guidance – where a key priority area is affected by a proposed scheme, a high level of mitigation control will be requested. - Development Planning Guidance - to ensure that potential local air quality effects are not overlooked and is not intended to introduce a burden on developers or local authorities to undertake unnecessary work. - Cumulative Development Database - A centralised database of significant planning applications and air quality assessments will be managed by Transport for Greater Manchester (TfGM), as a record of the cumulative effects of multiple developments and thereby facilitate combined approaches to minimising emissions. - Clean Air Zone – TfGM will undertake an appraisal of the effects of charging Clean Air Zones (CAZ) 20mph Zones - The implementation of 20mph zones in urban areas has been cited as having the potential to benefit local air quality through smoother vehicle flow through junctions and reduced acceleration and braking, as well as having potential for additional benefits from encouraging modal shift from driving to walking or cycling - Encouraging Travel Planning - Individuals and companies are encouraged to look at travel planning measures, and to investigate the potential of additional demand management measures to effect a significant mode shift and to stimulate the uptake of low-emission vehicles - Taxi and Private Hire Quality Controls to Priorities Low-Emission Vehicles - Green Infrastructure - The provision of green infrastructure in and around urban areas is now widely recognised as contributing towards creating places where people want to live and work.
Greater Manchester Low-Emission Strategy (2016)²⁰	The Low-Emission Strategy sets out a framework for policies and measures to: - Reduce air pollution as a contributor to ill-health in Greater Manchester - Support the UK government in meeting EU air quality thresholds Contribute to a reduction in Greater Manchester's carbon footprint; and encourage low-emission behaviours in the culture and lifestyles of the city region.
Greater Manchester Planning Guidance on Air Quality (2022)²¹	Greater Manchester Combined Authority (GMCA) have adopted the most recent IAQM guidance on the assessment and control of dust from demolition and construction sites, and also for air quality considerations in land-use planning and development control. Applicants, developers and consultants are advised to read the IAQM guidance prior to submitting a planning application.

¹⁹ Greater Manchester Combined Authority/ Transport for Greater Manchester, Greater Manchester Air Quality Action Plan 2016-2021, https://www.manchester.gov.uk/downloads/download/4166/air_quality_reports

²⁰ Greater Manchester Combined Authority/ Transport for Greater Manchester, (2016) Greater Manchester Low-Emission Strategy, December 2016 <https://www.greatermanchester-ca.gov.uk/media/1276/low-emission-strategy-dec-2016.pdf>

²¹ Manchester City Council (2022) Additional Planning Guidance, Environmental information for developers, August 2022 https://www.manchester.gov.uk/info/500207/planning_and_regeneration/1962/additional_planning_guidance/3

Policy / Guidance	Description
Greater Manchester's Places Everyone Plan – Submission Documents (2021/22) ²²	The plan was prepared on behalf of the 10 Greater Manchester local authorities and looks ahead to the period 2020 to 2037. The plan • sets out how Greater Manchester should develop up until 2037 • identifies the amount of new development that will come forward across the 10 districts, in terms of housing, offices, and industry and warehousing, and the main areas in which this will be focused • supports the delivery of key infrastructure, such as transport and utilities • protects the important environmental assets across the city region • allocates sites for employment and housing outside of the existing urban area; and defines a new green belt boundary for Greater Manchester
Greater Manchester Places for Everyone Joint Plan (2021) ²³	Following an announcement in December 2020, nine Greater Manchester councils (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan) will discuss proposals to work together on a joint development plan. The Places for Everyone would underpin Greater Manchester's ambitious plans for sustainable and inclusive growth, building on evidence already collected. The nine councils will continue to work closely with Stockport Council, who decided in 2020 to withdraw from the Greater Manchester Spatial Framework.
Local Planning Policies	
The Manchester Core Strategy 2012-2027 ²⁴	The strategy aims to improve air quality and detailed in Policy EN 16: <i>"The Council will seek to improve the air quality within Manchester, and particularly within AQMAs, located along Manchester's principal traffic routes and at Manchester Airport. Developers will be expected to take measures to minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself, including from CHP, and biomass plant. When assessing the appropriateness of locations for new development the Council will consider the impacts on air quality, alongside other plan objectives. These includes cumulative impacts, particularly in AQMAs."</i>
Other Relevant Policy and Guidance	
Defra Local Air Quality Management (LAQM) Policy Guidance (2022) ²⁵ and Technical Guidance (2022) ²⁶	The guidance issued under Part IV of the Environment Act 1995 is designed to help local authorities with their LAQM duties. The guidance sets out the general approach to use and detailed technical guidance to guide local authorities through the Review and Assessment process.
EPUK/IAQM Land Use Planning & Development Control (2017) ²⁷	This guidance has been produced to ensure that air quality is adequately considered in the land use planning and development control processes by relevant officers within local authorities, developers, and consultants involved in the preparation of development proposals and planning applications. This document is best practice guidance and has no formal or legal status.
IAQM Assessment of Dust from Demolition and Construction (2016) ²⁸	The document provides guidance for developers, their consultants and environmental health practitioners on how to undertake a construction impact assessment (including demolition and earthworks). The guidance provides a method for assigning a magnitude of risk (high, medium or low) and identifies appropriate mitigation measures.

²² Greater Manchester Combined Authority (2021) Greater Manchester's Plan for Homes, Jobs and the Environment: Greater Manchester Spatial Framework Publication Plan 2020, Draft for Approval October 2020, <https://www.greatermanchester-ca.gov.uk/media/3663/221020-agma-issue-opt.pdf>

²³ Greater Manchester Combined Authority (2021) Greater Manchester Places For Everyone. See: <https://www.greatermanchester-ca.gov.uk/what-we-do/planning-and-housing/places-for-everyone/submission-documents/>

²⁴ Manchester City Council (2012), Manchester's Local Development Framework, Core Strategy Development Plan Document, Adopted 11th July 2012 https://www.manchester.gov.uk/info/200074/planning/6573/core_strategy_2012-2027

²⁵ Defra (2022) Local Air Quality Management Policy Guidance PG(22) <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-Policy-Guidance-2022.pdf>

²⁶ Defra (2022) Local Air Quality Management Technical Guidance TG(22) August 2022 <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

²⁷ EPUK/IAQM, (2017) Land-Use Planning & Development Control: Planning for Air Quality <https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

²⁸ Institute of Air Quality Management (IAQM) (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1) <https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

Policy / Guidance	Description
Covid-19: Supplementary Guidance, Local Air Quality Management Reporting in 2021²⁹	The guidance had been informed by responses from an impact survey received following the release of the interim statement on Covid-19 impacts to the LAQM regime. The guidance is to be read in conjunction with LAQM.TG22
IAQM assessment of air quality impacts on designated nature conservation sites³⁰	This guidance signposts the appropriate thresholds used by local authorities, the Environment Agency and other regulators to determine the potential for air quality damage on sensitive ecological sites. Should threshold be likely to be exceeded, a suitably qualified and experienced ecologist is required to determine whether there is likely to be a significant impact on the habitat.
World Health Organisation (WHO) Global Air Quality Guidelines (2021)³¹	Since 1987, WHO has periodically issued health-based air quality guidelines to assist governments and civil society to reduce human exposure to air pollution and its adverse effects. The WHO air quality guidelines published in 2006 provided health-based guideline levels for the major health-damaging air pollutants, including particulate matter (PM),¹ ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). These guidelines had a significant impact on pollution abatement policies all over the world and led to the first universal frame of reference. Following extensive research which started in 2016 and has referred to numerous epidemiological studies, WHO have reassessed their guideline values and recently (September 2021) provided updated values.
IAQM Indoor Air Quality Guidance (2021)³²	The IAQM have provided guidance on the assessment of indoor air quality. This was published in September 2021 and covers assessment, monitoring, modelling and mitigation relating to indoor air quality.

Table 2-4: Key Policy and Guidance

²⁹ Department for Environment, Food and Rural Affairs (Defra) / Greater London Authority (2021). Covid-19: Supplementary Guidance, Local Air Quality Management Reporting in 2021, April 2021, Version 1.0, <https://iaqm.defra.gov.uk/supporting-guidance.html>

³⁰ Institute of Air Quality Management (IAQM) (2020) A guide to the assessment of air quality impacts on designated nature conservation sites, version 1.1, May 2020, <https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf>

³¹ World Health Organisation (WHO) (2021) WHO global air quality guidelines, Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, <https://apps.who.int/iris/handle/10665/345329>.

³² Institute of Air Quality Management (IAQM) (2021), Indoor Air Quality Guidance: Assessment, Monitoring, Modelling and Mitigation, version 1.0, September 2021, https://iaqm.co.uk/wp-content/uploads/2013/02/iaqm_indoorairquality.pdf

3.0

Approach and Methodology

3.0 Approach and Methodology

3.1 Overall Approach

The overall approach of this Air Quality Assessment comprises the following:

- A review of existing conditions within the study area, defined as 2km from the boundary of the Proposed Development
- An assessment of the potential to change in air quality conditions as a result of the construction and operation of the Proposed Development; and
- The formulation of appropriate mitigation measures, where required, to mitigate any adverse impacts on air quality as a result of the construction and/or operation of the Proposed Development.

The Environmental Health Officer at Manchester City Council has been contacted to agree the scope and methodology of this assessment. The email correspondence is included as Appendix B.

3.2 Existing Conditions

Existing ambient air quality conditions relates to relevant pollution that is already present in the environment from various sources such as industrial processes, commercial and domestic activities, road traffic emissions and natural resources.

Existing sources of emissions within the study area (2km) have been defined using several approaches, as follows:

- Industrial and waste management sources that may affect the area have been identified using the Environment Agency's Pollution Inventory Data³³.
- Local sources have also been reviewed through examination of the latest Annual Status Report (ASR) for Greater Manchester Combined Authority³⁴
- Background concentrations have been defined using the national pollution maps published by Defra³⁵. These cover the whole country on a 1x1 km grid.

3.3 Construction Phase

No demolition is required to enable the site redevelopment for Plot 10a. The development proposals comprise the construction of a 13-storey office building

Machinery used during construction can generate new sources of emissions, as well as traffic movements to/from the site and the works themselves. When assessing the effect of dust emissions generated during construction works, receptors include those nearest to the construction boundary of the site in each direction. These receptors have the potential to experience effects of greater magnitude due to emissions of dust generated by the works, when compared with more distant receptors.

Without appropriate mitigation controls in place, there is the potential for adverse effects to occur during to the construction of the Proposed Development. The implementation of best practice mitigation controls can ensure any potential adverse effects would be not significant.

The impact of anticipated construction activities has been assessed in accordance with IAQM Guidance on the Assessment of Dust from Demolition and Construction v1.1 (2016). The construction phase assessment considers the anticipated physical activities occurring on-site that are likely to result in the generation of dust which gives rise to impacts on dust soiling and human health, especially through the generation of PM₁₀ and PM_{2.5}.

³³ Environment Agency, Pollution Inventory <https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory>

³⁴ Greater Manchester Combined Authority (2021) 2021 Air Quality Annual Status Report (ASR), June 2021, https://www.manchester.gov.uk/downloads/download/4166/air_quality_reports

³⁵ Department for Environment, Food and Rural Affairs (Defra) (2019). Background Mapping data for local authorities, <https://uk-air.defra.gov.uk/data/laqm-background-home>

The assessment involves the identification of whether each phase of on-site activity (demolition, earthworks, construction, and trackout) represents a low, medium, or high risk of causing a significant effect and then identifies suitable mitigation measures for the relevant level of risk assigned. Details of the IAQM construction impact assessment procedure are presented in Appendix C.

Best practice mitigation controls have been identified in accordance with IAQM guidance.

3.4 Operation Phase

IAQM's guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' (updated in January 2017) was issued to ensure that air quality is adequately considered in the land-use planning and developmental control process. Full details are provided in Appendix D. To determine the need for operational assessment, a screening assessment has been undertaken using the criteria outlined in the IAQM guidance note (Appendix E).

3.4.1 Combustion Plant Impact

Any on-site combustion plant such as boilers and combined heat and power (CHP) has the potential to impact air quality receptors both on and off-site. Emissions from combustion plant would include NO₂ and possibly also PM₁₀ and PM_{2.5} if diesel is used as a source.

Heating, cooling and hot water provision for the buildings will be provided by air source heat pumps (ASHPs) powered by electricity.

There will be a requirement for back-up diesel generators (life safety and tenant). Generators are to operate less than 50 hours per year, based on required maintenance testing. The generator flues will be located at roof level. Based on the current design, the location of the generator flues and roof top community terrace are >10m horizontal distance. There will also be a 6m separation screen with flues emitting just above this level. Based on the size, minimum operation hours and proposed location of the generators, emissions from the generators are not expected to have a significant impact on local air quality.

3.4.2 Road Traffic Impacts

The Proposed Development has the potential to impact existing air quality as a result of pollutants from road traffic exhaust emissions, such as NO₂, PM₁₀ and PM_{2.5}, associated with traffic travelling to and from the development during the operation phase.

The guidance includes a method for screening the requirement for an air quality assessment, the undertaking of an air quality assessment, the determination of the air quality impact associated with a development proposal and whether this impact is significant. Interpretation of this guidance was used to develop a methodology for the assessment of road impact emissions.

As the site is located within an AQMA, the EPUK/IAQM guidance states the following criteria to establish where an air quality assessment is likely to be considered necessary:

- A change of Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) movements; and
- A change of Heavy-Duty Vehicle (HDV) flows of more than 25 AADT movements.

Traffic data provided by Vectos includes traffic flows from Plot 10a and the neighbouring Plot 10b, located to the east. Allowing for the cumulative impact of both Plot 10a and 10b is considered to be a robust worst-case assessment. As the anticipated number of vehicle trips associated with the Proposed Plot 10a and 10b development is predicted to increase annual average daily traffic flows by greater than 100 vehicles, assessment of traffic-related impacts on nearby receptors has therefore been scoped into the operation phase assessment.

3.4.3 Human Exposure

Potential exposure of future occupants of the site was considered in accordance with the Defra Technical Guidance and EPUK/IAQM Planning Guidance. This assessment evaluated the exposure that future occupants or visitors might experience associated with existing baseline conditions, considering the following:

- The background and future baseline air quality, and whether this will be likely to approach, or exceed, the threshold values set by the air quality objectives
- The presence and location of air quality focus areas as an indicator of local hotspots where the air quality objective thresholds may be exceeded
- The presence of any heavily trafficked roads, with emissions that could give rise to significantly higher concentrations of pollutants (e.g., NO₂), that would cause unacceptably high exposure for users of the new development; and
- The presence of non-road transport sources that may be significant, such as nearby airports, railway lines with high traffic usage of diesel locomotives³⁶ or coal-fired steam locomotive railway lines.

The current/baseline conditions were established qualitatively by reviewing relevant air quality information that is readily available from the Local Authority, including Review and Assessment Reports and historic monitoring data. These data were used to understand current/baseline pollutant concentrations at receptors within the study area, and the risk that any changes in air quality may cause exceedance of AQOs at these locations.

The exposure that future site users might experience was considered in accordance with EPUK/IAQM Planning Guidance and Defra technical guidance Local Air Quality Management Technical Guidance (LAQM.TG22).

Detailed dispersion modelling has been used to undertake an assessment of human exposure at the development site.

3.4.4 Dispersion Model

Detailed dispersion modelling of NO_x, PM₁₀ and PM_{2.5} emissions from operational traffic was used to undertake assessment of human exposure at the development. This has been carried out using the latest version of ADMS-Roads Extra (version 5.0.1.3), which is an internationally recognised new generation dispersion model developed by CERC. ADMS uses advanced algorithms to describe the boundary layer structure, turbulence and stability.

The inputs required for the modelling are outlined in the following sections.

3.4.4.1 Meteorological Data

Hourly sequential meteorological data is required as an input to the model. Data from Manchester Airport meteorological station for 2019 has been obtained for use in this assessment. Manchester Airport is located approximately 14km to the south-west of the Proposed Development and due to its location and elevation, is considered to be the most representative meteorological station for the Proposed Development. Both the location of the Proposed Development and Manchester Airport are inland sites, without significant terrain influence.

Defra's LAQM.TG22 guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably greater than 90%. Unusable hours include missing hours and calm hours³⁷. The 2019 dataset has been checked for usability. There are 8,469 lines of usable hourly data for 2019, which equates to 96.7% of the hourly in a year. As this is well above the 75% threshold, the data is considered to be adequate for dispersion modelling, in accordance with LAQM TG22 guidance.

The 2019 wind rose for Manchester Airport is presented in Figure 3-1. It can be seen that the predominant wind direction is south/south-westerly.

³⁶ Defra (2021), Local Air Quality Management Technical Guidance (TG21) - which lists rail lines with a heavy traffic of diesel passenger trains

³⁷ Wind speeds <0.75m/s would be classed as calm. ADMS Roads sets the speed to 0.75m/s for speeds <0.75m/s and uses the wind direction from the previous hour.

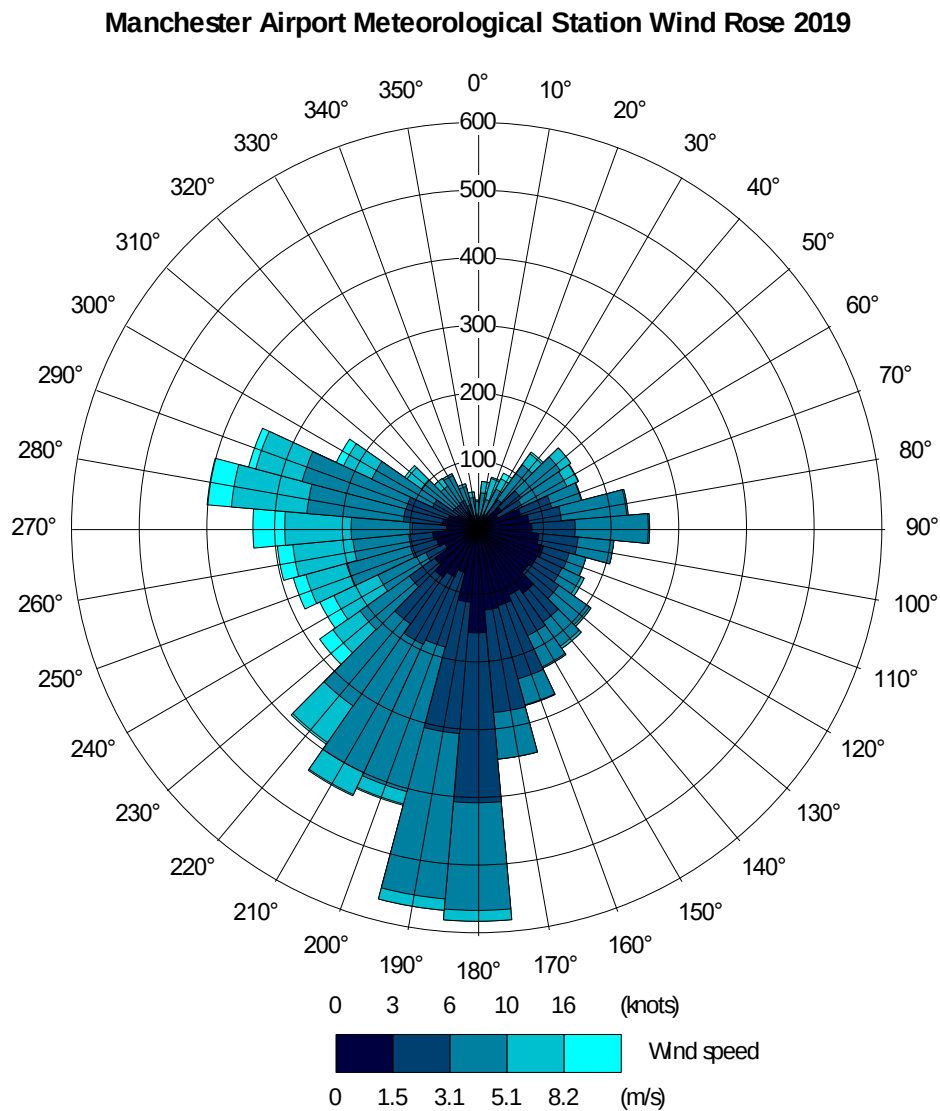


Figure 3-1: 2019 Wind Rose for Manchester Airport

Surface roughness is a component of surface texture. Air travelling over the surface is affected by the surface roughness, rough surface would result in higher roughness to smoother surfaces. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). The future setting of the Proposed Development has been considered in the modelling by setting the surface roughness length to 1.0m. This is the value recommended by the model developers for cities and woodlands. A surface roughness length 0.2m was used for the meteorological station, which is stated within ADMS-Roads as being suitable for 'agricultural' areas.

The Monin-Obukhov length is used to describe the effects of buoyancy on turbulence kinetic energy, particular in the lowest atmospheric boundary layer. This relates to the urban heat island effect, and its effects on turbulence due to surface topology and the effects from heated and shaded building surfaces. Monin-Obukhov values typically range from 2m to 10m in rural settings but can be higher in urban area where buildings and traffic results in more heat generation. In this assessment, the minimum Monin-Obukhov length scale was set to 30 m (the recommended model setting for cities and large towns). A value of 10m was used for the land around Manchester Airport meteorological station.

3.4.4.2 Traffic Data

Air quality at the Proposed Development is likely to be affected during operation by emissions from local traffic flows. For each road link for each scenario, the following data has been included in the model:

- 24-hour Annual Average Daily Traffic (AADT) flows based on historic data from DfT³⁸ factored from 2019 to the development opening year (2024) using the appropriate growth factor derived from the government's Trip End Model Presentation Program (TEMPRO v7.2)
- 24-hour AADT flows for the Proposed Development, allowing for the cumulative impact of Plot 10a and 10b, which have been provided by Vectos
- % Heavy Goods Vehicles (HGVs)
- Estimated vehicle speeds. These were based on posted speed limits, local knowledge, evaluation of Google Traffic data and professional judgement. Speeds were reduced to 20kph at junctions within 25m of junctions, in accordance with TG22 guidance.
- Elevated road heights were included for sections of the A57 (M). Heights were calculated using data provided by Defra LIDAR survey data download³⁹

The latest full year of ratified monitoring data available at the time of writing was 2020. However, during 2020, Covid-19 lockdown travel restrictions are likely to have suppressed air quality pollutant levels, i.e., conditions were atypical. To enable verification with local monitoring data, 2019 was therefore selected as a more conservative and representative dataset and modelled as the baseline year.

The assessment scenarios modelled are as follows:

- 2019 baseline scenario obtained from 2019 DfT traffic counts
- 2027 opening year for the Proposed Development with emissions kept at 2022 (worst case scenario); and,
- 2027 opening year for the Proposed Development with 2027 emissions (best case scenario)
- A summary of the road links used within the model inputs is provided in Appendix F.

3.4.4.3 Vehicle Emission Rates

Vehicle emission rates for NO_x, PM₁₀ and PM_{2.5} were obtained from the latest version of Defra's Emission Factor Toolkit (EFT11.0)⁴⁰, for the 'England (Not London)' area, with a 'Basic Split' traffic split format.

Vehicle emission rates are expected to decrease in the future due to increasingly stringent Euro emission standards, but there is uncertainty as to the rate of improvement for NO_x emissions from diesel vehicles, considering recent measurements of exhaust emissions and ambient air quality. Vehicle emissions for 2022 have also been used in modelling for the future year scenarios. This is a conservative assumption, as some improvements are likely by the Proposed Development opening year of 2027. Future scenarios have also been modelled using 2027 emissions, but retaining background concentrations from 2019, to provide an indication of the range of predicted results.

³⁸ Department of Transport (DfT) Traffic Count Data. See: <https://roadtraffic.dft.gov.uk/local-authorities/85>.

³⁹ LIDAR Defra Surveys Data Download. See: <https://environment.data.gov.uk/DefraDataDownload/?Mode=survey>.

⁴⁰ <https://lagm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>.

3.4.4.4 Receptors

Detailed dispersion modelling of NO_x, PM₁₀ and PM_{2.5} emissions from operational traffic was used to undertake assessment of human exposure at the development site and existing receptors close to the modelled road network.

Worst-case existing sensitive receptor locations were selected, such as those close to junctions and closest to the roads impacted by the Proposed Development, see Figure 3-2 and Table 3-1. A height of 1.5m corresponds to a ground floor property, a height of 4.5m corresponds to a first-floor property, and subsequent floors have been represented by 3.0m increases.

Future proposed on-site receptors have also been modelled and also include worst case locations, such as those closest to roads and junctions. The modelled receptors are shown in Figure 3-3 and listed in Table 3-2. The proposed receptor locations include various facades of the Proposed Development at various heights within the development.

Receptor ID	Location		Floors	Heights (m)
	Easting	Northing		
1	383793.0	397353.8	Vita Student First St	1.5
2	383854.0	397269.4	Macintosh Mills Apartments	1.5
3	383965.2	397129.2	New Medlock House - Student Halls	1.5
3a	383965.2	397129.2	New Medlock House - Student Halls	4.5
3b	383965.2	397129.2	New Medlock House - Student Halls	7.5
3c	383965.2	397129.2	New Medlock House - Student Halls	10.5
3d	383965.2	397129.2	New Medlock House - Student Halls	13.5
3e	383965.2	397129.2	New Medlock House - Student Halls	16.5
3f	383965.2	397129.2	New Medlock House - Student Halls	19.5
3g	383965.2	397129.2	New Medlock House - Student Halls	22.5
4	383886.2	397102.4	Parkway Gate - Student Halls	1.5
4a	383886.2	397102.4	Parkway Gate - Student Halls	4.5
4b	383886.2	397102.4	Parkway Gate - Student Halls	7.5
4c	383886.2	397102.4	Parkway Gate - Student Halls	10.5
4d	383886.2	397102.4	Parkway Gate - Student Halls	13.5
4e	383886.2	397102.4	Parkway Gate - Student Halls	16.5
4f	383886.2	397102.4	Parkway Gate - Student Halls	19.5
4g	383886.2	397102.4	Parkway Gate - Student Halls	22.5
4h	383886.2	397102.4	Parkway Gate - Student Halls	46.5
5	383683.1	397294.8	8 First Street	1.5
6	383740.9	397355.5	Tony Wilson Place	1.5
7	383799.7	397245.2	Plot 10b	1.5
8	383838.8	397264.8	Plot 10a	1.5
9	383699.6	397254.7	Plot9a First Street	1.5
10	383765.8	397155.5	First Street South	1.5
11	383587.1	397372.9	Flats on Medlock St	1.5

Receptor ID	Location		Floors	Heights (m)
	Easting	Northing		
12	383556.9	397212.3	Flats on River St	1.5
13	383592.7	397264.2	Flats on Shortcroft St	1.5
14	383683.6	397191.8	Premier Inn Manchester City Centre	1.5
15	384026.5	397250.2	MSV Student Living	1.5
16	383983.8	397228.4	Cambridge Mill Flat Complex	1.5
17	384005.9	397070.1	53 Conmere Square	1.5
17a	384005.9	397070.1	53 Conmere Square	4.5
17b	384005.9	397070.1	53 Conmere Square	7.5
18	383990.2	397071.7	45 Conmere Square	1.5
18a	383990.2	397071.7	45 Conmere Square	4.5
18b	383990.2	397071.7	45 Conmere Square	7.5
19	383626.8	397333.2	One City Road	1.5

Table 3-1 Modelled Existing Receptors

The proposed receptor locations include various facades of the proposed buildings at various heights, which are representative of each of the floors. The modelled receptors are shown in Figure 3-3 and listed in Table 3-2.

Receptor ID	Location		Floors	Heights (m)
	Easting	Northing		
1	383737.0	397308.0	Ground, 1-12	1.5, 7.8, 11.8, 15.8, 19.8, 22.3, 27.8, 31.8, 35.8, 39.8, 43.8, 48.1 and 52.7
2	383769.1	397327.2	Ground, 1-12	1.5, 7.8, 11.8, 15.8, 19.8, 22.3, 27.8, 31.8, 35.8, 39.8, 43.8, 48.1 and 52.7
3	383813.1	397244.2	Ground, 1-12	1.5, 7.8, 11.8, 15.8, 19.8, 22.3, 27.8, 31.8, 35.8, 39.8, 43.8, 48.1 and 52.7
4	383780.1	397230.8	Ground, 1-12	1.5, 7.8, 11.8, 15.8, 19.8, 22.3, 27.8, 31.8, 35.8, 39.8, 43.8, 48.1 and 52.7

Table 3-2: Modelled Future Receptors

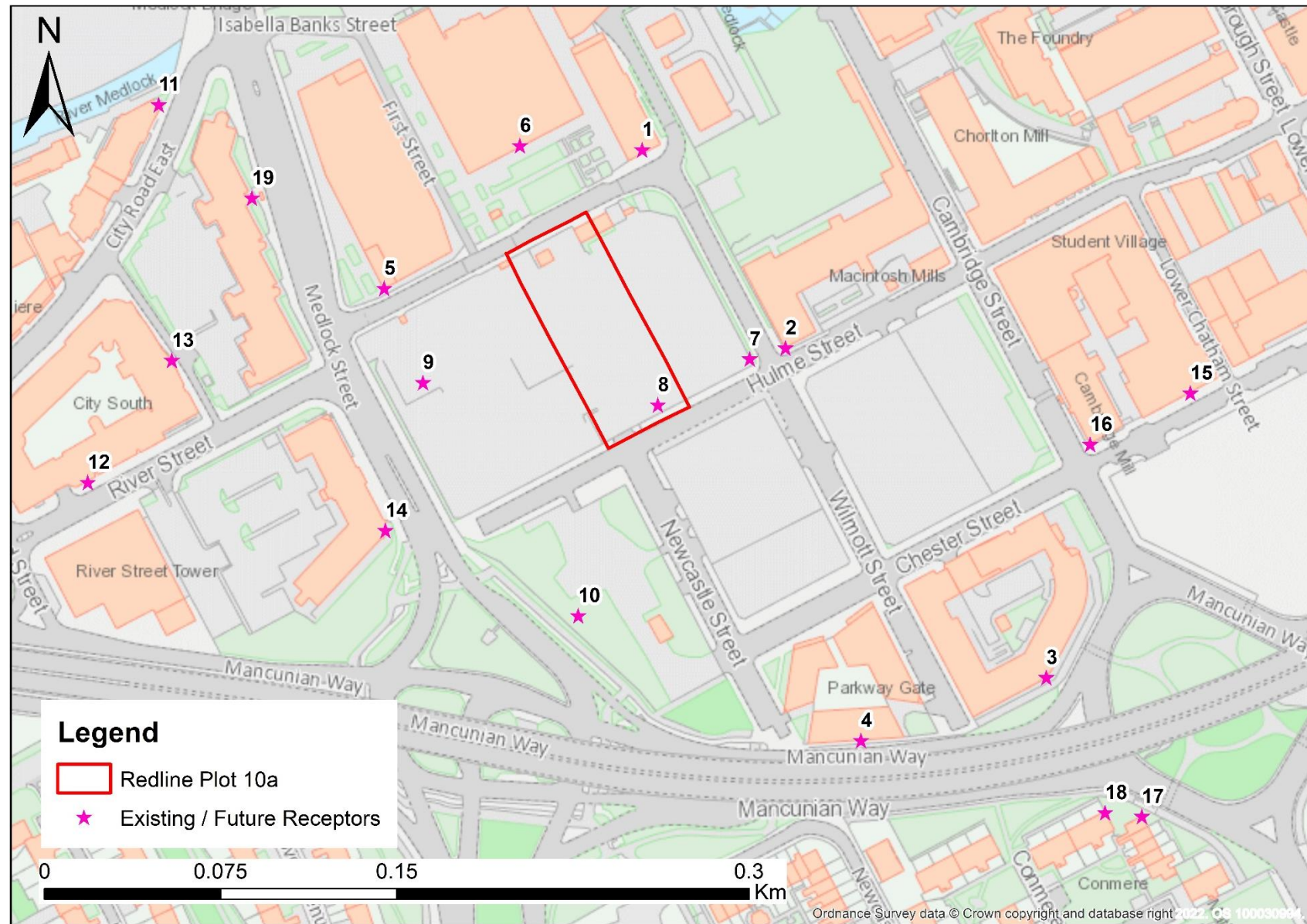


Figure 3-2: Existing Receptors

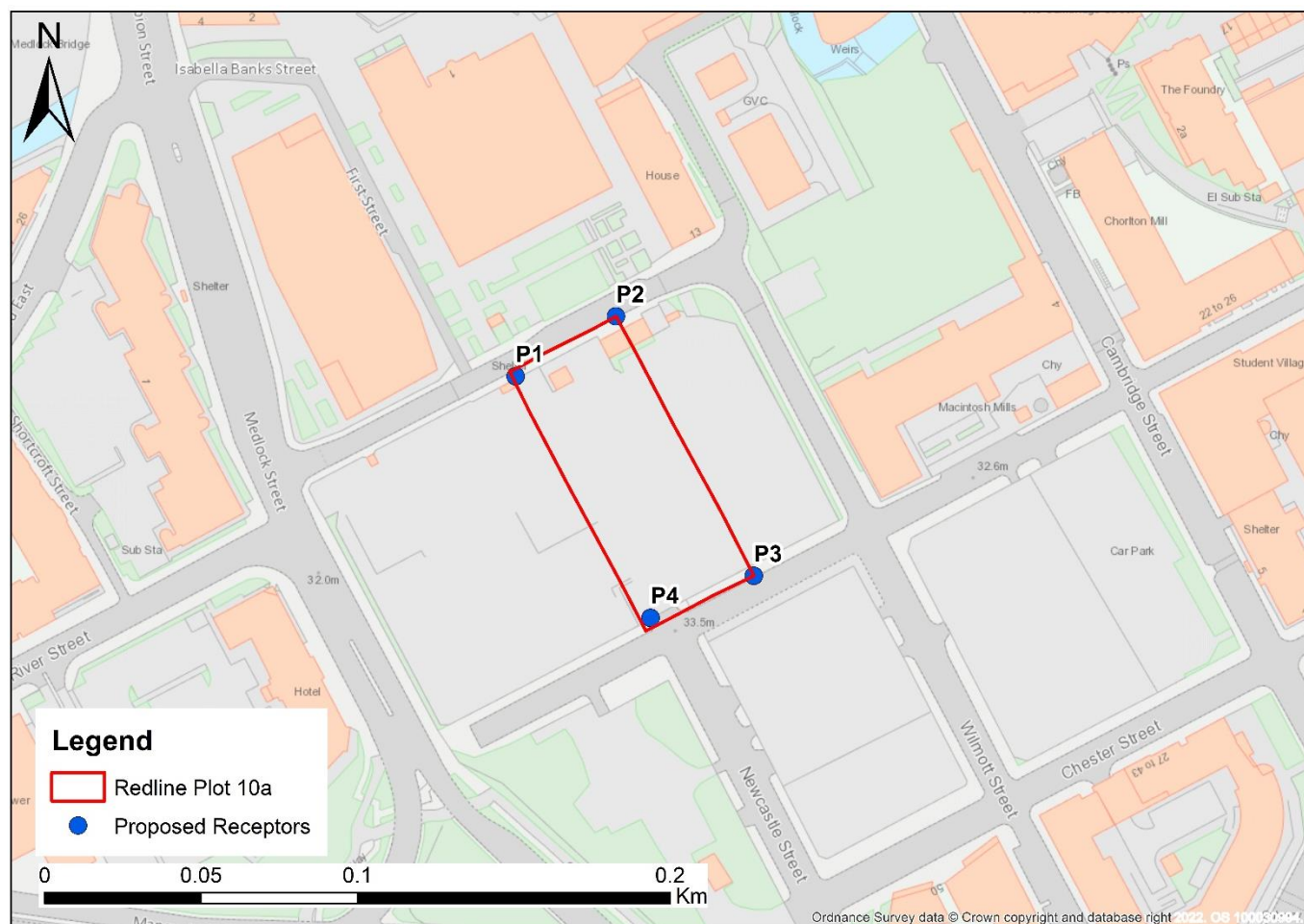


Figure 3-3: Modelled Receptors

3.4.4.5 Results Processing

3.4.4.6 Atmospheric Chemistry

NO₂ is associated with effects on human health and therefore the air quality standards for the protection of human health are based on NO₂ rather than total NO_x or NO. The model predicts NO_x concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO₂). NO_x is emitted from combustion processes primarily as NO with a small percentage (usually <5%) of NO₂. The emitted NO reacts with oxidants in the air (mainly ozone) to form secondary NO₂. Factors affecting the rate of this oxidation occurs include the concentration of oxidants in the air, wind speed and temperature.

Predicted NO_x concentrations have been processed to determine annual mean nitrogen dioxide (NO₂) concentrations for comparison with the annual mean NO₂ objectives. A NO_x:NO₂ conversion has been applied to the modelled NO_x concentrations, in order to determine the impact of the NO_x emissions on ambient concentrations of NO₂.

NO₂ concentrations were estimated from the modelled NO_x concentrations. For roads, Defra's NO_x to NO₂ calculator⁴² was used with the 'All Other urban UK Traffic' mix assumed.

The annual mean background and modelled roads contribution from ADMS-Roads were added together to give total concentrations and enable a comparison to be made with the air quality criteria for annual mean concentrations.

3.4.4.7 Background Pollutant Concentrations

Adjusted Defra background concentrations were used in the NO₂ PM₁₀ and PM_{2.5}. Justification of background concentrations used is discussed further in section 4.3.

⁴² <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>.

The modelling has assumed that there will be no reduction in background NO₂ concentrations with the background value for the base year used in the 2022 and 2027 modelling scenarios to match that used in the model verification.

3.4.4.8 Comparison with Air Quality Standards

The results of dispersion modelling at sensitive residential receptors have been compared to relevant air quality objectives for the protection of human health listed in Table 2-2.

3.4.4.9 Model Verification

Using the guidance provided in Chapter 7 of LAQM.TG (22), the modelled output has been verified against local monitoring data obtained from diffusion tube surveys operated by Manchester City Council. Full details are provided in Appendix H.

The performance of the dispersion model was assessed by comparing the modelled concentrations with measured concentrations. Meteorological data, monitored concentrations, vehicle emission rates and traffic data for 2019 were all used in the model verification process.

The model adjustment was undertaken using methodology which requires the determination of the ratio between the measured and modelled road contributed NO_x at each comparison site. The ratio between them, referred to as the adjustment factor, is applied to the modelled road contributed NO_x. The modelled NO₂ is then determined using the Defra NO_x/NO₂ calculator⁴³.

The modelled road contributed NO_x was adjusted by the factor 2.926 and then converted to total NO₂ using the Defra NO_x/NO₂ calculator. The results, in comparison with the measured total NO₂ concentrations, are shown in Appendix H.

The final adjusted total NO₂ concentration predicted at the two diffusion tubes is within ±25% of the measured values and is therefore considered satisfactory.

In accordance with Defra guidance LAQM.TG (22), the road contributed NO_x adjustment factor was also applied to the road contributed PM concentration. The total PM₁₀ and PM_{2.5} concentrations are derived by adding the adjusted road contribution value to the Defra background concentrations.

⁴³ <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

4.0

Site Description and Baseline Conditions

4.0 Site Description and Baseline Conditions

To assess the significance of any new development proposal (in terms of air quality), it is necessary to identify and understand the baseline air quality conditions in and around the study area. This provides a reference against which any potential changes in air quality can be assessed. Since air quality is predicted to change in the future (mainly because of changes to vehicle emissions), the baseline situation is extrapolated forward to the opening year. The future baseline scenario is the predicted baseline for the opening year.

To identify the existing air quality conditions, a review of publicly available information has been undertaken, including the latest local authority air quality reports, monitoring data, and background concentration maps. This section presents the results of the review.

4.1 Local Sources of Pollution

Industrial air pollution sources are regulated through operating permits or authorisations, which list stringent emission requirements. Regulated industrial processes are classified as either Part A or Part B processes and are regulated through the Pollution Prevention and Control (PPC) system⁴⁴ which has been transposed into National legislation⁴⁵. The larger, more polluting, Part A processes are regulated by the Environment Agency for emissions to air, water and land. The smaller, less polluting processes are regulated by the local authority for emission to air.

A review of the Environment Agency Pollutant Inventory for 2020 indicated that there is one Part A permit site located within 2km of the Proposed Development. This is Heineken UK Ltd, located 1.3km South of the Proposed Development and is regulated for emissions to air and waste transfer. The location of this site in relation to the Proposed Development is shown in Figure 4-1.

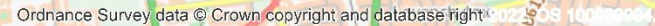
The Part B processes are regulated and reviewed by the Local Authorities and given the nature of these processes, are unlikely to significantly affect ambient air quality in the vicinity of the Proposed Development. The Part B processes within 2km of the Proposed Development are shown in Figure 4-2. The nearest sites to the Proposed Development are Johnsons Dry Cleaners UK Ltd, approximately 0.9km to the north and Asda supermarket, approximately 1.0km to the south.

Any emissions from these installations are assumed to be represented in the Defra background concentrations.

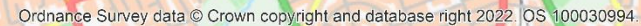
The most recent 2021 ASR also confirmed that there were no new industrial and other sources identified.

⁴⁴ Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

⁴⁵ The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390



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Document Ref. PLOT10--CDL-XX-XX-RP-Y-40200

4.2 Local Air Quality Management

The Environment Act 1995 requires local authorities to review and assess air quality with respect to the objectives for seven pollutants specified in the National Air Quality Strategy. Local authorities are required to carry out an assessment and provide an Annual Status Report (ASR) of their area every year. If the ASR identifies any potential hotspot areas likely to exceed air quality objectives, a detailed assessment of those areas is required. If objectives are not predicted to be met, the local authority must declare the area as an Air Quality Management Area (AQMA). If an AQMA has been declared, the Local Authority will also need to produce an Air Quality Action Plan (AQAP), to include measures to improve air quality in the AQMA.

The Proposed Development is located in Manchester city centre. The baseline assessment includes a brief review and summary of the Greater Manchester Combined Authority's latest available Annual Status Report for 2021 (ASR) and the data available from Clean Air Greater Manchester⁴⁶.

A single AQMA was designated on the 1st May 2016 for the whole of Greater Manchester and reflects the location of the motorways, major roads and urban areas, for exceedances of the annual mean NO₂ objective threshold. The AQMA was declared due to concerns regarding annual mean NO₂ and 24-hour mean PM₁₀ concentrations. The AQAP was published in 2016⁴⁷ and sets out measures to improve air quality in the AQMA. The latest ASR reports that Defra have responded positively to Greater Manchester's suggestion that update of the AQAP should be postponed until the impact of the proposed Greater Manchester wide Clean Air Zone (CAZ) is understood. The location of the AQMA boundary with respect to the Proposed Development is shown in Figure 4-3.

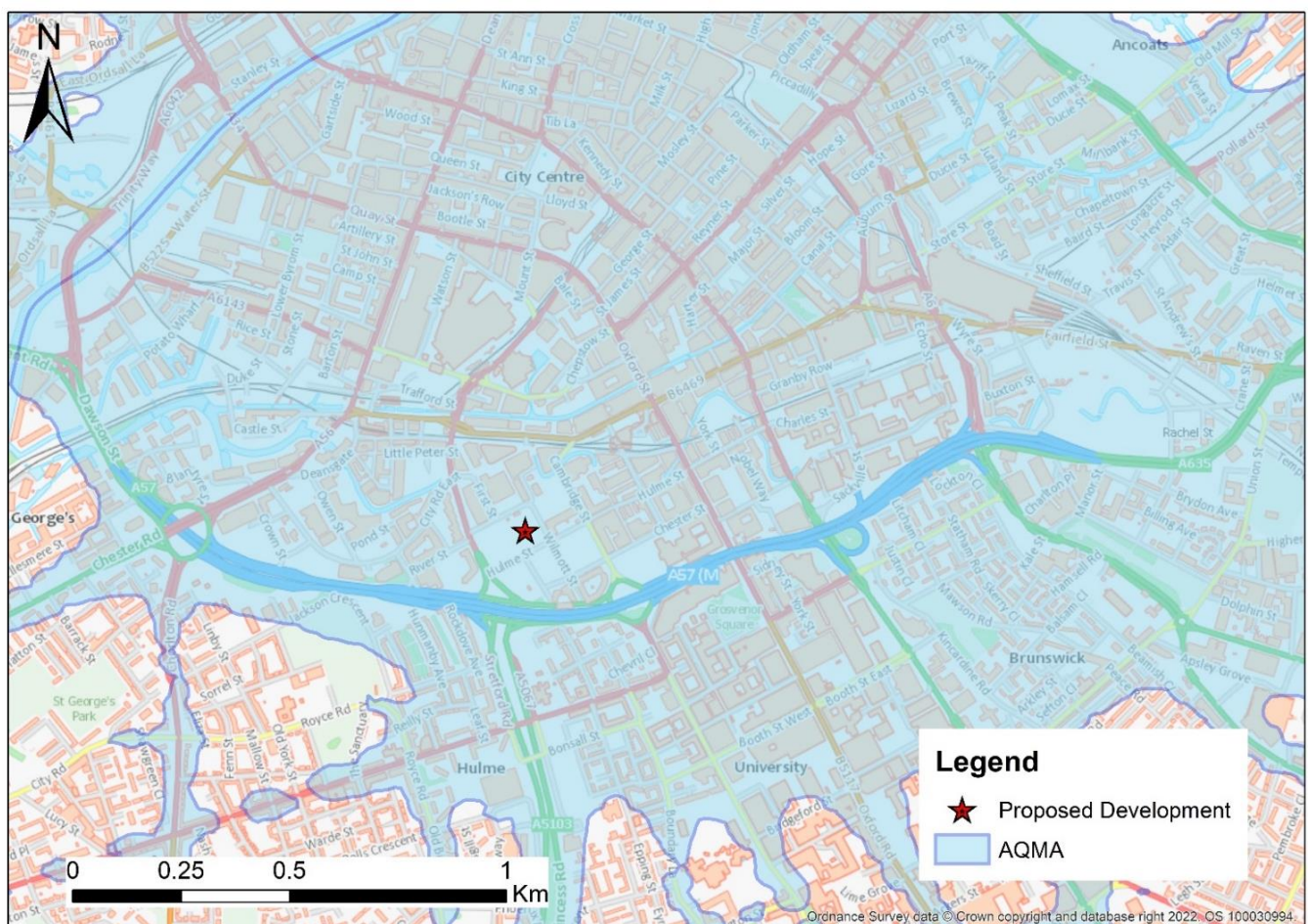


Figure 4-3: Air Quality Management Area

⁴⁶ Clean Air Greater Manchester, <https://cleanairgm.com/>

⁴⁷ Greater Manchester Combined Authority / Transport for Greater Manchester (2016) Greater Manchester Air Quality Action Plan 2016-2021, https://www.manchester.gov.uk/downloads/download/4166/air_quality_reports

4.2.1 Local Air Quality Monitoring

A review of existing local air quality conditions in the vicinity of the Proposed Development has been undertaken. Automatic and diffusion tube monitors within 2km of the proposed development have been evaluated as part of this assessment.

4.2.1.1 Automatic Monitoring

Automatic or continuous monitoring involves drawing air through an analyser continuously to obtain near real-time pollutant concentration data. A review of the most recent ASR for Greater Manchester Combined Authority showed that Manchester City Council operates two automatic monitoring stations with 2km of the Proposed Development. These are an urban traffic (MAN1) and an urban centre site (MAN3) located approximately 0.4km to the east and 1.2km to the north-east, respectively. The location of these automatic monitors is shown in Figure 4-4 and details about these are provided in Table 4-1.

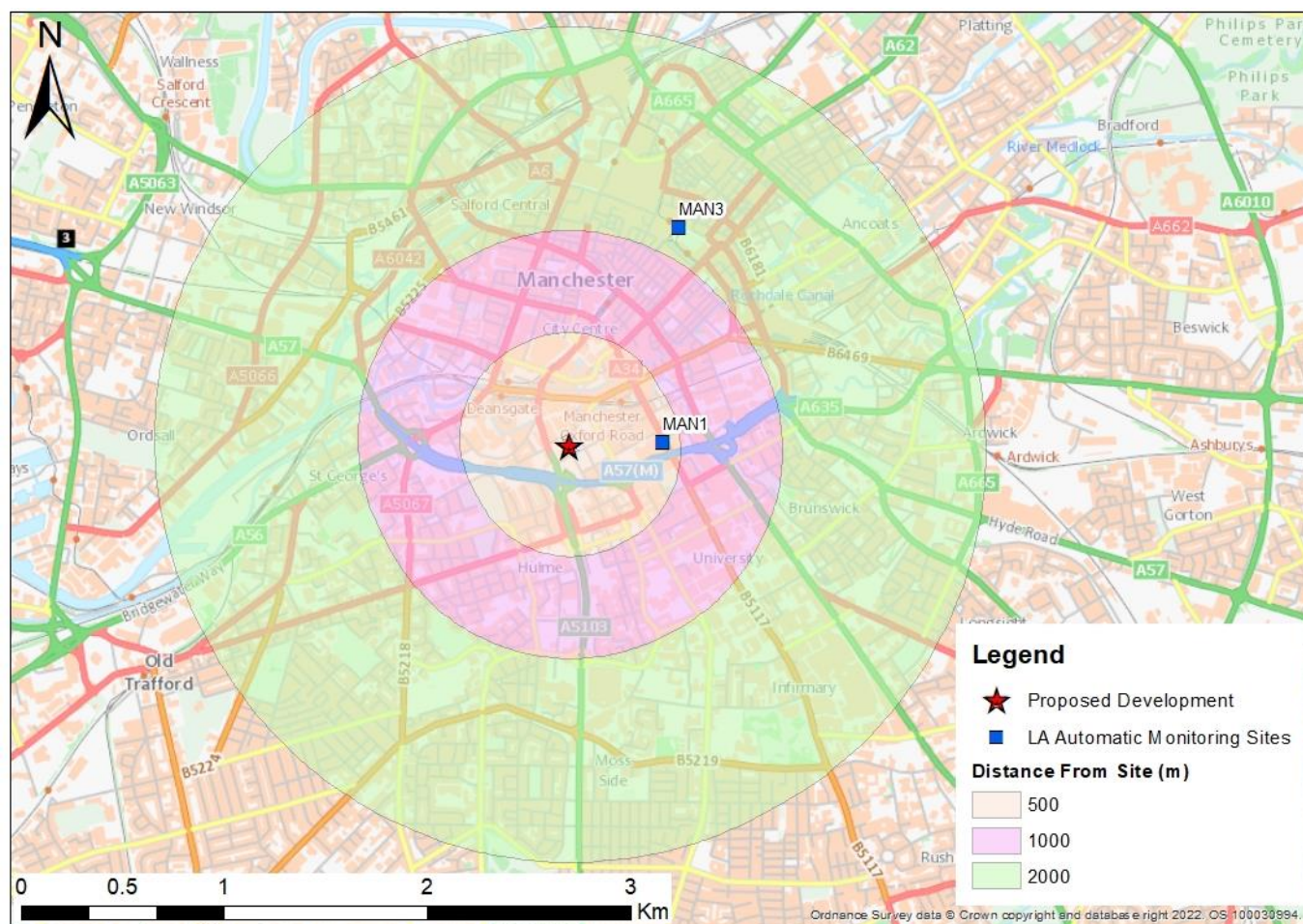


Figure 4-4: Local Automatic Monitoring Sites

Site ID	Site Location	OS Grid Reference		Site Type	Pollutants Monitored	Distance to kerb of nearest road (m)
		x	y			
MAN1	Manchester Oxford Road	384233	397287	Urban Traffic	NO ₂ , PM ₁₀	1
MAN3	Manchester Piccadilly	384310	398337	Urban Centre	NO ₂ , O ₃ , PM ₁₀ , PM _{2.5} , SO ₂	30

Table 4-1: Details of Automatic Monitoring Sites within 2km

Recent NO₂ monitoring results from 2015 to 2021 are shown in Table 4-2, with numbers of hourly exceedances of 200µg/m³ indicated in brackets. An exceedance is defined as an annual mean greater than 40µg/m³ for NO₂, or

when the hourly value exceeds $200\mu\text{g}/\text{m}^3$ more than 18 times within a calendar year. All exceedances of the objective thresholds are indicated in bold. Annual mean concentrations that also exceed $60\mu\text{g}/\text{m}^3$ have also been underlined.

Site ID	Site Type	Distance from Site (km)	Annual Mean NO ₂ Concentration ($\mu\text{g}/\text{m}^3$)						
			2015	2016	2017	2018	2019	2020	2021 ⁴⁸
MAN1	Urban Traffic	0.5 km E	<u>66</u> (60)	<u>66</u> (90)	<u>65</u> (6)	<u>62</u> (2)	<u>59</u> (1)	36 (0)	n.d.
MAN3	Urban Centre	1.2 km NE	39 (1)	40 (0)	36 (1)	35 (0)	36 (0)	27 (0)	27(0)

Notes: Exceedances of the annual mean air quality objective are indicated in **bold**. Underlined values exceed $60\mu\text{g}/\text{m}^3$, the value at which exceedances of the short-term objective are likely to occur.
n.d. no data

Table 4-2: Results of Local Air Quality Monitoring at Automatic Sites – Nitrogen Dioxide (NO₂)

These results show that the NO₂ annual mean air quality objective was exceeded all years in the period 2015 to 2019 at the urban traffic site (MAN1). Excluding an annual mean concentration of $40\mu\text{g}/\text{m}^3$ recorded in 2016, concentrations recorded at the urban centre site (MAN3) were below the objective.

The number of hourly exceedances of $200\mu\text{g}/\text{m}^3$ have been well below the permissible 18 times per year at both sites since 2017.

The latest provisional data from 2020 to 2021 supports the general decreasing trend in urban background concentrations, this is most likely due to the impacts of COVID-19 lockdown measures but may also be due to a combination of national decreases in vehicle emissions due to technology improvements.

Annual mean concentrations of NO₂ recorded at both automatic monitoring sites within 2km between 2015 and 2021 remained above the new WHO Air Quality interim target range ($20\mu\text{g}/\text{m}^3$ to $40\mu\text{g}/\text{m}^3$) and well above the new WHO guidance level of $10\mu\text{g}/\text{m}^3$.

Greater Manchester had previously made a commitment to achieving WHO guideline levels by 2030 as part of the Breathe-Life Initiative⁴⁹. However, the recommended guidelines were recently updated in September 2021⁵⁰. The update includes Air Quality Guideline (AQG) levels for the pollutants of relevance to this assessment (NO₂, PM₁₀ and PM_{2.5}) which are significantly lower than the previous WHO guidelines, which correspond to the lower range of the interim targets for PM₁₀ and PM_{2.5} and the higher range for NO₂. Greater Manchester has not yet issued any statement regarding the latest WHO recommendations.

Annual mean concentrations of PM₁₀ recorded at the monitoring sites within 2km are listed in Table 4-3, with number of days exceedance shown in brackets. An exceedance is defined as a PM₁₀ annual mean greater than $40\mu\text{g}/\text{m}^3$, or when the daily value exceeds $50\mu\text{g}/\text{m}^3$ more than 35 days within a calendar year.

Site ID	Site Type	Distance from Site (km)	Annual Mean PM ₁₀ Concentration ($\mu\text{g}/\text{m}^3$)						
			2015	2016	2017	2018	2019	2020	2021
MAN1	Urban Traffic	0.5 km E	28 (25)	27 (16)	27 (15)	30 (15)	26 (18)	<u>n.d.</u>	<u>n.d.</u>
MAN3	Urban Centre	1.2 km NE	20 (3)	20 (3)	20 (3)	21 (2)	20 (7)	15 (n.d.)	15 (n.d.)

Notes: n.d. no data

Table 4-3: Results of Local Air Quality Monitoring at Automatic Sites- PM₁₀

Annual mean concentrations of PM₁₀ met the air quality objective at both sites in all years monitored between 2015 and 2021. Concentrations at the urban traffic site on Oxford Road (MAN1) showed a maximum of $30\mu\text{g}/\text{m}^3$ recorded in 2018. The maximum concentration recorded at the urban centre site MAN3 was $21\mu\text{g}/\text{m}^3$ recorded in

⁴⁸ Data contains some unratiied (provisional) values and covers the period January-October 2021.

⁴⁹ <https://www.businessgrowthhub.com/green-technologies-and-services/green-intelligence/resource-library/greater-manchester-becomes-uk-s-first-breathelife-region>. Accessed December 2021.

⁵⁰ World Health Organisation (WHO) (2021) WHO global air quality guidelines, Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, <https://apps.who.int/iris/handle/10665/345329>.

2018.

Annual mean concentrations recorded at both sites between 2015 and 2019 were above the new WHO Air Quality guidance level for annual mean PM₁₀ of 15µg/m³ and at MAN3 in 2020 and 2021 at the WHO Air Quality guidance level for annual mean PM₁₀ of 15µg/m³.

Trends remained broadly static at both sites between 2015 and 2019. Lower figures in 2020 and 2021 are most likely due to a combination of the impacts of COVID-19 lockdown measures and national decreases in vehicle emissions due to technology improvements.

The number of times daily averages have been recorded above 50µg/m³ have been below the permissible 35 days at both sites during this monitoring period. Trends have remained broadly static at both sites since 2015.

PM_{2.5} is also monitored at the urban centre site (MAN3). Annual mean PM_{2.5} concentrations recorded between 2015 and 2021 are listed in Table 4-4. An exceedance is defined as an annual mean greater than 25µg/m³ for PM_{2.5}.

Site ID	Site Type	Distance from Site (km)	Annual Mean PM _{2.5} Concentration (µg/m ³)						
			2015	2016	2017	2018	2019	2020	2021
MAN3	Urban Centre	1.2 km NE	10	10	8	11	12	8	9

Table 4-4: Results of Local Air Quality Monitoring at Automatic Sites – PM_{2.5}

Annual mean concentrations of PM_{2.5} have been below the air quality objective at MAN3 between 2015 and 2021, with a maximum of 12µg/m³ recorded in 2019. Concentrations remain above the new WHO guidance level of 5µg/m³ in all years.

4.2.1.2 Non-Automatic Monitoring

The Clean Air Greater Manchester Website⁵¹ shows that GMCA has over 400 diffusion tubes monitoring NO₂ in Greater Manchester, 17 of which are within 2km of the Proposed Development. Of the locations within 2km of the Proposed Development, eleven of these are “Roadside” sites, two are “Kerbside” and the remaining four are “Urban background”. The locations of the sites within 2km are shown in Figure 4-5.

Details of the diffusion tubes are listed in Table 4-5 and the latest monitoring results are provided in Table 4-6. All exceedances of the annual mean objective are indicated (40µg/m³) in bold. Annual mean concentrations that also exceed 60µg/m³ have also been underlined.

⁵¹ <https://cleanairgm.com/air-quality-data/diffusion-tubes>.

Site ID	Site Location	OS Grid Reference		Site type	Distance to kerb of nearest road (m)
		x	y		
MAN09AB	Newton Street	384601	398303	Kerbside	0.5
MAN24	Princess Street /Cooper Street	383954	398060	Kerbside	0.5
MAN26AB	Long Millgate	383971	398876	Urban background	59
MAN29A	Oxford Street	384117	397505	Roadside	2.0
MAN59/ 60/61	Piccadilly Gardens	384310	398337	Urban background	56
MAN71	Great Ancoats Street	385161	398290	Roadside	2.0
MAN72	Lockton Close	384761	397384	Urban background	46
MAN77	Hewitt Street	383602	397488	Urban background	2.0
MAN82/83/84	Oxford Road	384233	397287	Roadside	0.5
MAN 96	Ardwick Green	385189	397167	Roadside	2.0
MAN 97	Chester Road	382886	397215	Roadside	11.0
SA27	Frederick Street	383076	398738	Roadside	1.5
SA39	Trinity Way	383040	398563	Roadside	8.0
SA59	West Crown Avenue	381822	397895	Roadside	11.0
SA60	Regent Road	382445	397724	Roadside	4.0
SA79	Chapel Street	382602	398519	Roadside	10.0
SA81	Regent Road 2	382561	397722	Roadside	1.5

Table 4-5: Details of Diffusion Tube Monitoring Sites within 2km

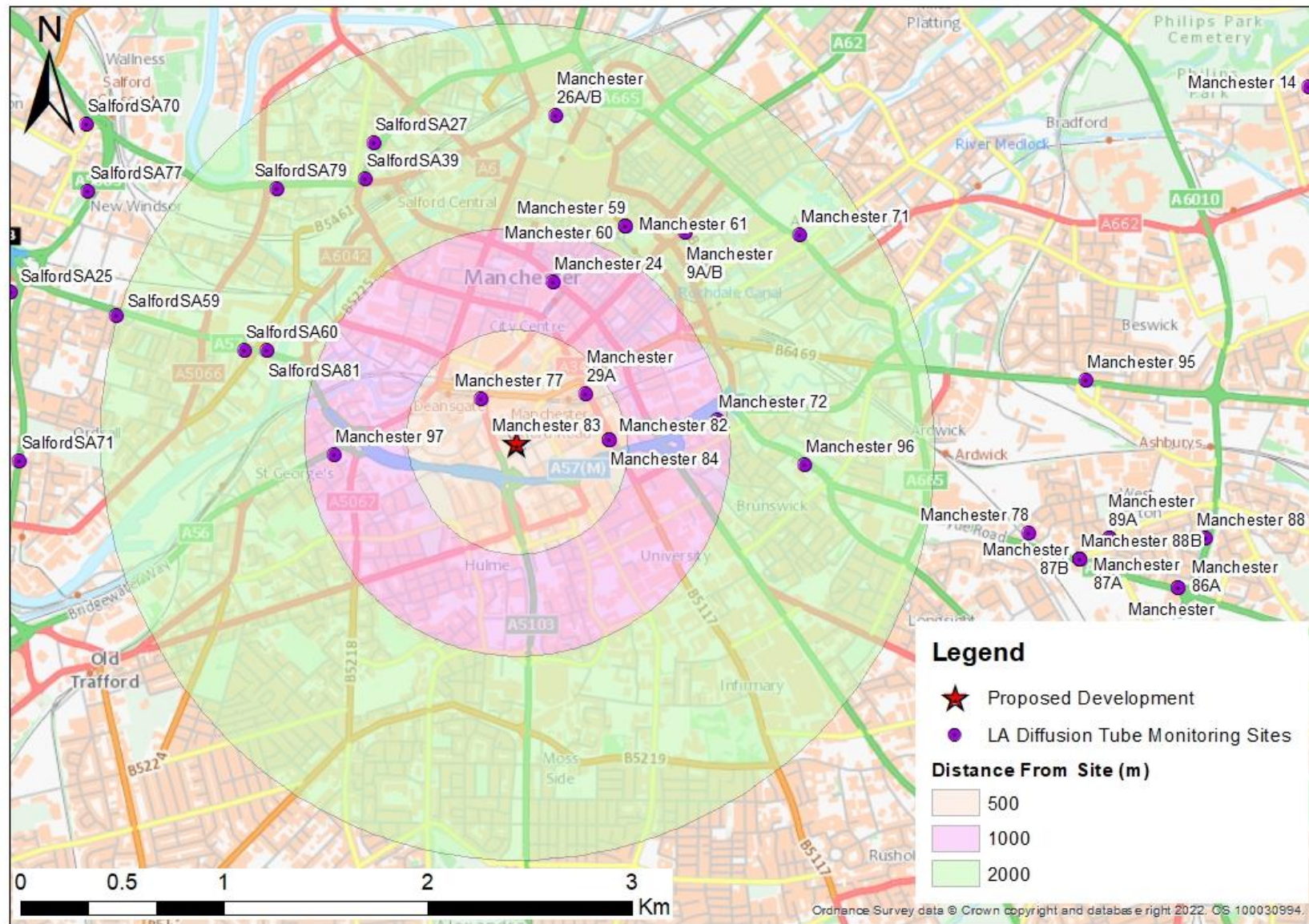


Figure 4-5: Local Authority (LA) Diffusion Tube Sites within 2km

Site ID	Distance to Site	Site Type	Annual Mean NO ₂ Concentration (µg/m ³)				
			2016	2017	2018	2019	2020
MAN09AB	1.3 km NE	Kerbside	51.9	51.1	45.8	44.9	32.5
MAN24	0.8 km NE	Kerbside	45.3	44.7	40.3	40.8	26.8
MAN26AB	1.6 km NE	Urban background	37.1	35.5	33.4	33.0	22.9
MAN29A	0.4 km NE	Roadside	<u>66.2</u>	57.7	58.8	55.4	39.0
MAN59/ 60/61	1.2 km NE	Urban background	40.8	35.7	31.6	33.1	22.3
MAN71	1.7 km NE	Roadside	51.2	50.4	46.1	45.3	31.4
MAN72	1.0 km E	Urban background	40.0	34.6	33.4	32.8	24.5
MAN77	0.2 km NW	Urban background	44.2	38.8	41.0	43.7	26.9
MAN82/83/84	0.5 km E	Roadside	<u>60.2</u>	56.2	54.0	52.0	33.9
MAN 96	1.4 km E	Roadside	-	-	-	46.0	36.4
MAN 97	0.8 km W	Roadside	-	-	-	32.3	23.4
SA27	1.6 km NW	Roadside	39.8	36.8	34.1	37.2	26.7
SA39	1.4 km NW	Roadside	46.8	41.6	39.1	41.7	30.4
SA59	1.9 km NW	Roadside	-	36.7	33.3	32.4	23.0
SA60	1.3 km NW	Roadside	-	40.7	40.2	36.7	27.0
SA79	1.6 km NW	Roadside	-	-	-	41.1	27.3
SA81	1.2 km NW	Roadside	-	-	-	46.4	34.8
Notes: Exceedances of the annual mean air quality objective are indicated in bold . Values greater than 60µg/m ³ are <u>underlined</u> . - no data available							

Table 4-6: Diffusion Tube Monitoring Results 2016 to 2020

Of the 17 diffusion tube monitoring locations, all but 3 of the roadside/kerbside sites exceeded the NO₂ objective (40µg/m³) at some point during the period between 2016 and 2019. The maximum concentration recorded at a roadside/kerbside site in 2019 was 55.4µg/m³, recorded at MAN29A. Exceedances of the NO₂ annual mean objective were also recorded at one of the urban background sites, with a maximum of 43.7µg/m³, recorded at MAN77 in 2019. MAN77 is located nearest to the Proposed Development next to an A-road. As Plot 10a is set back from the A-road, it is anticipated that concentrations the Plot 10A Proposed Development would be lower.

2020 data has not been specifically interpreted due to atypical conditions created by COVID-19 lockdown.

Since 2017, the annual mean NO₂ concentrations recorded at all of the 17 sites within 2km have been below 60µg/m³. Exceedances of the short-term objective are therefore considered to be unlikely.

4.3 Defra's Background Pollutant Concentration Mapping

Background concentrations refer to existing levels of pollution in the atmosphere, as a result of emission from a variety of sources, such as traffic, industrial and agricultural processes. Defra publishes background pollutant mapping⁵³ for every 1km x 1km OS grid square across the UK for NO_x, NO₂, PM₁₀ and PM_{2.5}. Background pollutant mapping has been reviewed for the grid square in which the Proposed Development lies and surrounding grid squares. The 2019 background concentrations (which are based on 2018 monitoring data) are presented in Table 4-7.

OS Grid Square		Annual Mean Concentration (µg/m ³)			
X	Y	NO _x	NO ₂	PM ₁₀	PM _{2.5}
383500	397500	39.9	26.1	13.5	8.7
383500	398500	44.6	28.2	13.1	8.5
384500	397500	44.5	28.2	14.4	9.1
384500	398500	47.0	29.3	13.6	8.8
384500	399500	32.8	22.2	12.5	8.2
385500	398500	35.2	23.4	12.6	8.3
Average		40.7	26.2	13.3	8.6

Table 4-7: Defra's 2019 background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5}

Defra background concentrations are all below the air quality objectives for annual mean NO₂ and PM₁₀ and PM_{2.5}.

Table 4-8 shows the comparison between the measured 2019 concentrations at the nearest urban background continuous monitor (MAN3) along with the estimated 2019 Defra background concentrations at the corresponding OS grid square.

Comparison of the 2019 measured and Defra backgrounds at MAN3 indicate that the use of monitored data is more conservative, presumably incorporating additional local sources. There are significant differences of 17.9%, 15.2%, 34.0% and 25.2% in NO_x, NO₂, PM₁₀ and PM_{2.5} concentrations, respectively.

Pollutant	Estimated Defra background concentration (µg/m ³)	Measured concentration at MAN3 (µg/m ³)	Difference	Difference (%)
NO _x	51.8	63.1	-11.3	-17.9
NO ₂	30.8	36.3	-5.5	-15.2
PM ₁₀	13.2	20	-6.8	-34.0
PM _{2.5}	8.6	11.5	-2.9	-25.2

Table 4-8: Comparison between monitored (MAN3) and Defra background concentrations

A further investigation has been carried out to compare the other urban background monitoring sites with the estimated Defra background concentration at other locations within the wider Greater Manchester Area.

Table 4-9 which shows this further comparison indicates that there is a difference in annual mean NO₂ of between 10.5% and 29.6% at the other urban background sites, however it should be noted that values are much lower, and less typical of the study area.

⁵³ Defra, Air Quality Assessment, Background Maps, <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

Table 4-9: Comparison between monitored NO₂ and Defra background NO₂ concentrations

Site	Estimated Defra background concentration (µg/m ³)	Measured NO ₂ concentration (µg/m ³)	Difference	Difference (%)
TRAFF	17.0	19	-2.0	-10.5
WIG5	13.4	19	-5.6	-29.5

Accordingly, it was decided to adjust the predicted Defra background concentrations using the most conservative ratios derived from the MAN 3 automatic monitor. These are described below:

- The adjustment factor for background NO_x is 1.22
- The adjustment factor for background NO₂ is 1.18
- The adjustment factor for background PM₁₀ is 1.51
- The adjustment factor for background PM_{2.5} is 1.33

The worst-case adjusted background concentrations for 2019 have been applied to the 2022 and 2027 scenarios. This is considered to be a conservative approach as the background concentration is likely to decrease in future years.

4.4 Local Traffic Data

The presence of any heavily trafficked roads, with emissions that could give rise to significantly higher concentrations of pollutants (e.g., NO₂), may cause unacceptably high exposure for users of the new development.

Traffic count data for the area is reported in Appendix F.

The emissions from roads in the area not included in the modelled are assumed to be represented in the background concentration listed in section 4.3.

4.5 Future Baseline

The UK Government has previously directed Greater Manchester to introduce a Category C Clean Air Zone (CAZ), with an aim of achieving statutory NO₂ Limit Values. In response, Greater Manchester has developed a Clean Air Plan to tackle harmful and illegally high levels of roadside air pollution across the city-region.

Review of the Clean Air Greater Manchester website⁵⁴ in September 2022 indicated that the original Clean Air Plan was unworkable and would not have met the obligations to achieve compliance with the legal limit for harmful nitrogen dioxide air pollution by 2024 and could have caused significant financial hardship for people affected. Government agreed that the Greater Manchester charging Clean Air Zone would not go ahead on 30th May 2022. A public consultation on the new Clean Air Plan proposals will then take place in early 2023, subject to government feedback.

⁵⁴ Clean Air Greater Manchester, Clean Air Plans <https://cleanairgm.com/clean-air-plans>

4.6 Sensitive Receptors

Sensitive receptors include, but are not limited to, residential housing, hospitals, schools, day-care and convalescent facilities and include those who are at a heightened risk of negative health outcomes due to exposure to air pollution.

Sensitive receptors near the development were identified with reference to mapping data provided by Ordnance Survey.

The site is located within a densely urbanised area. There are several properties surrounding the site, identified in the Address Base Plus geographical data set. These include several receptors considered to be of high sensitivity, such as residential properties and hotels. Sensitive residential receptors within 350m are illustrated in Figure 4-6 and include receptors within 20m of the red line boundary.

Defra MAGIC mapping⁵⁵ has been reviewed to determine the presence of any sensitive ecological sites⁵⁶. There are no designated ecological receptors within 1km of the site boundary.

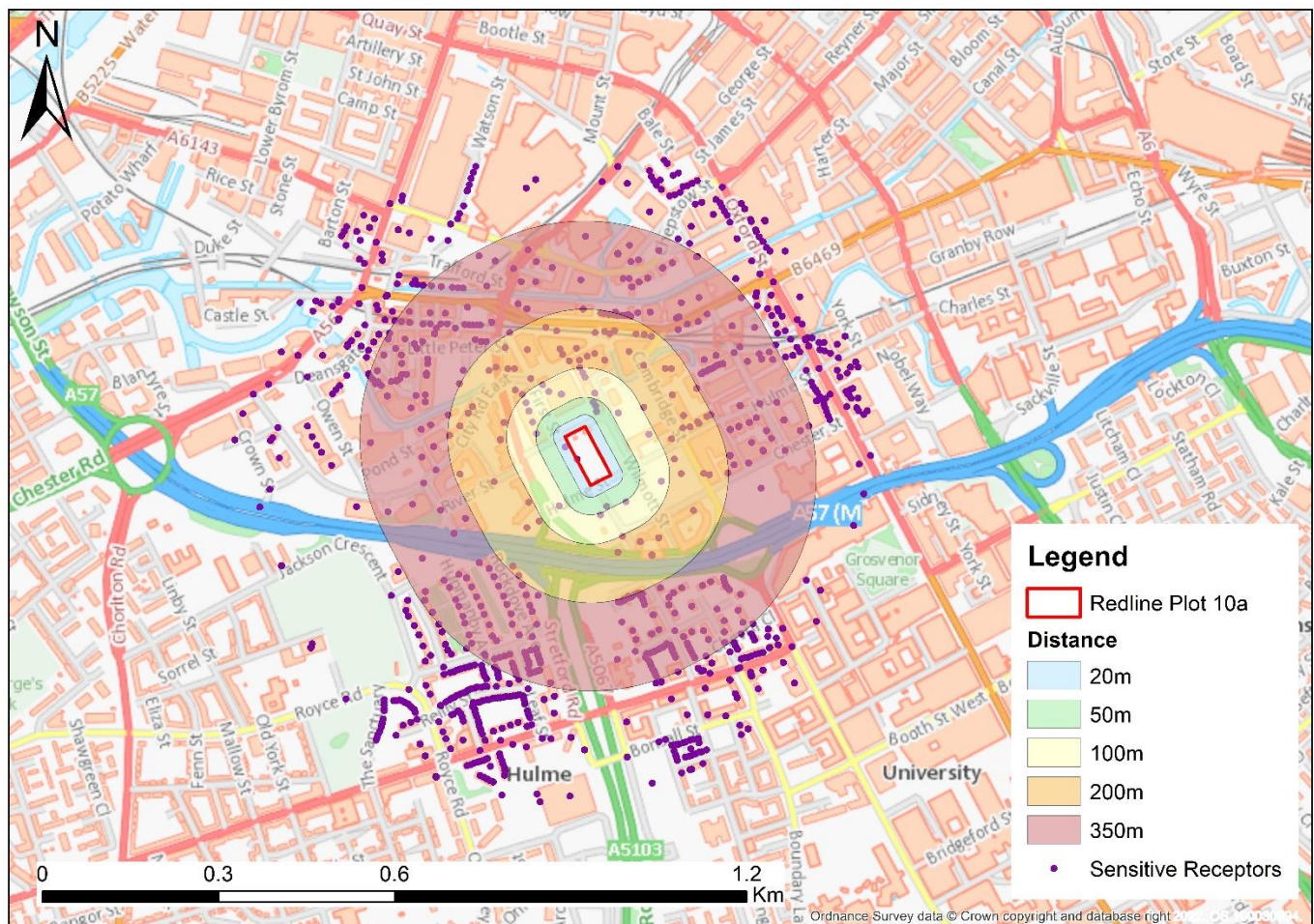


Figure 4-6: Sensitive Receptor Locations

⁵⁵ Department for Environment, Food and Rural Affairs (Defra) (2019). MAGIC <https://magic.defra.gov.uk/MagicMap.aspx>

⁵⁶ Typical ecological receptors of significance include Special Conservation Areas (SCAs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), RAMSAR sites, Local Nature Reserves with dust sensitive features.

5.0

Impact Evaluation

5.0 Impact Evaluation

5.1 Construction Phase Impacts

5.1.1 Need for a Detailed Assessment

An assessment was undertaken as there are 'human receptors' within 350m of the boundary of the site; and 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance.

5.1.2 Risk of Dust Impacts Assessment

Dust Emission Magnitude Analysis

The dust emission magnitude is based on the scale of the anticipated work and classified as Table 5-1 below. Assumptions listed are based on indicative design information provided by Jon Matthews Architects.

Stage	Relevant Definition	Highest Potential Dust Emission Magnitude
Demolition	No proposed demolition activities	N/A
Earthworks	- Estimated site area is 2,500 m² – 10,000 m² (estimated 3,100 m²) - Potentially loamy dusty soil type	Medium
Construction	- Estimated total building volume is >100,000 m³ - Potentially dust construction material (concrete piles)	Large
Track out	Estimated to be between 10-50 HDV (>3.5 tonnes) outward movements in any one day	Medium

Table 5-1: Determination of the potential dust emission magnitude

The highest dust emission magnitude is likely to be Large.

5.1.3 Sensitivity of the Area

The surrounding area has a significant density of sensitive receptors, which have wide range of sensitivities to dust soiling and health effects. The numbers of these receptors likely to be affected by earthworks and construction activities during the construction phase has been assessed. The analysis involved counting receptors, identified via the current Address Base Plus geographical data set, within each of the distance bands from the Application Site boundary. Buffers illustrating the assessment distances of 20, 50, 100, 200 and 350 metres from the Application Site boundary are illustrated in Figure 5-1. The analysis of sensitive receptors within each distance band is presented in Table 5-2.

Defra MAGIC mapping has been reviewed to determine the presence of any sensitive ecological sites⁵⁷. There are no designated ecological receptors sensitive to dust within 500m of the site boundary and therefore the sensitivity of the area to ecological receptors is negligible.

⁵⁷ Typical ecological receptors of significance include Special Conservation Areas (SCAs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs), RAMSAR sites, Local Nature Reserves with dust sensitive features.

Distance (metres)	Receptor Type					Totals
	Residential / Development (High)	Non-Residential Development (High)	Commercial / Retail / Office (Medium)	Commercial / Leisure / Transport (Low)	Ecological	
20	0	1	0	1	0	2
50	0	2	2	3	0	7
100	381	9	8	7	0	405
200	1420	45	25	23	0	1513
350	6332	154	137	63	0	6686

Table 5-2: Number of Receptors in Each Distance Band

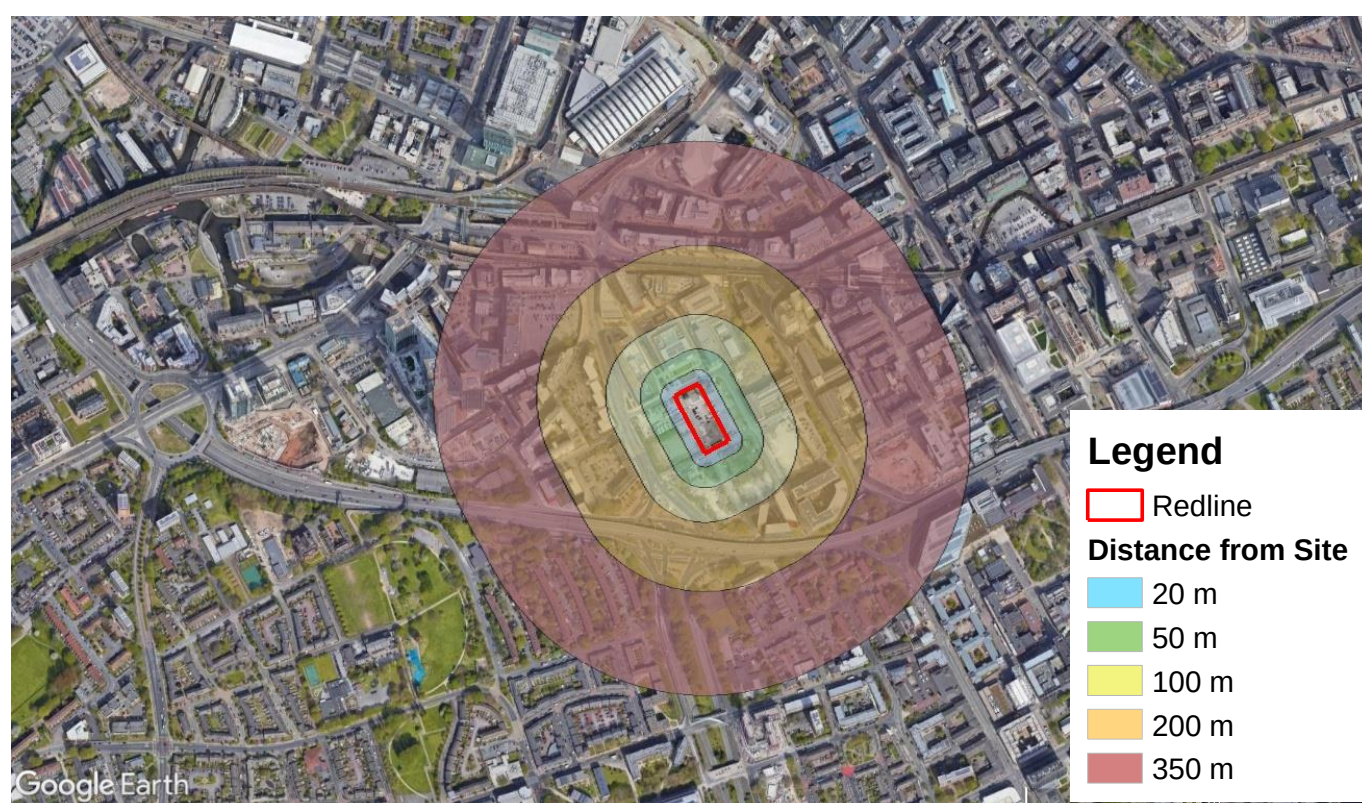


Figure 5-1: Construction Dust Buffer Zones (courtesy of Google Earth)

In summary, the evaluation shows that:

- 1-10 high risk receptors are located within 20m of the Proposed Development boundary
- 1-10 high risk receptors are located within 50m of the Proposed Development boundary

The sensitivity of the area to dust soiling effects on people and property from earthworks and construction activities is therefore **Medium**.

The Defra PM₁₀ background concentration in the area of the Proposed Development is <14.0µg/m³ and the urban background monitoring sites PM₁₀ concentration in the area of the Proposed Development is <20µg/m³. There are 1-10 high sensitivity receptors within 20m and 50m of the Proposed Development boundary. The sensitivity of the area to human health impacts for earthworks and construction activities is therefore **Low**.

Sensitive receptors are also susceptible to dust soiling and health effects resulting from construction vehicle trackout. The IAQM guidance states that trackout may occur from roads up to 500 m from large sites and 200m from medium sites. As the highest dust emission magnitude is large, a 500m distance band has been applied accounting for sensitive

receptors 50m from the potential construction routes (Figure 5-2). It is assumed the construction traffic will travel west from the site to join Medlock Street and onwards to the south to the A57 (M).

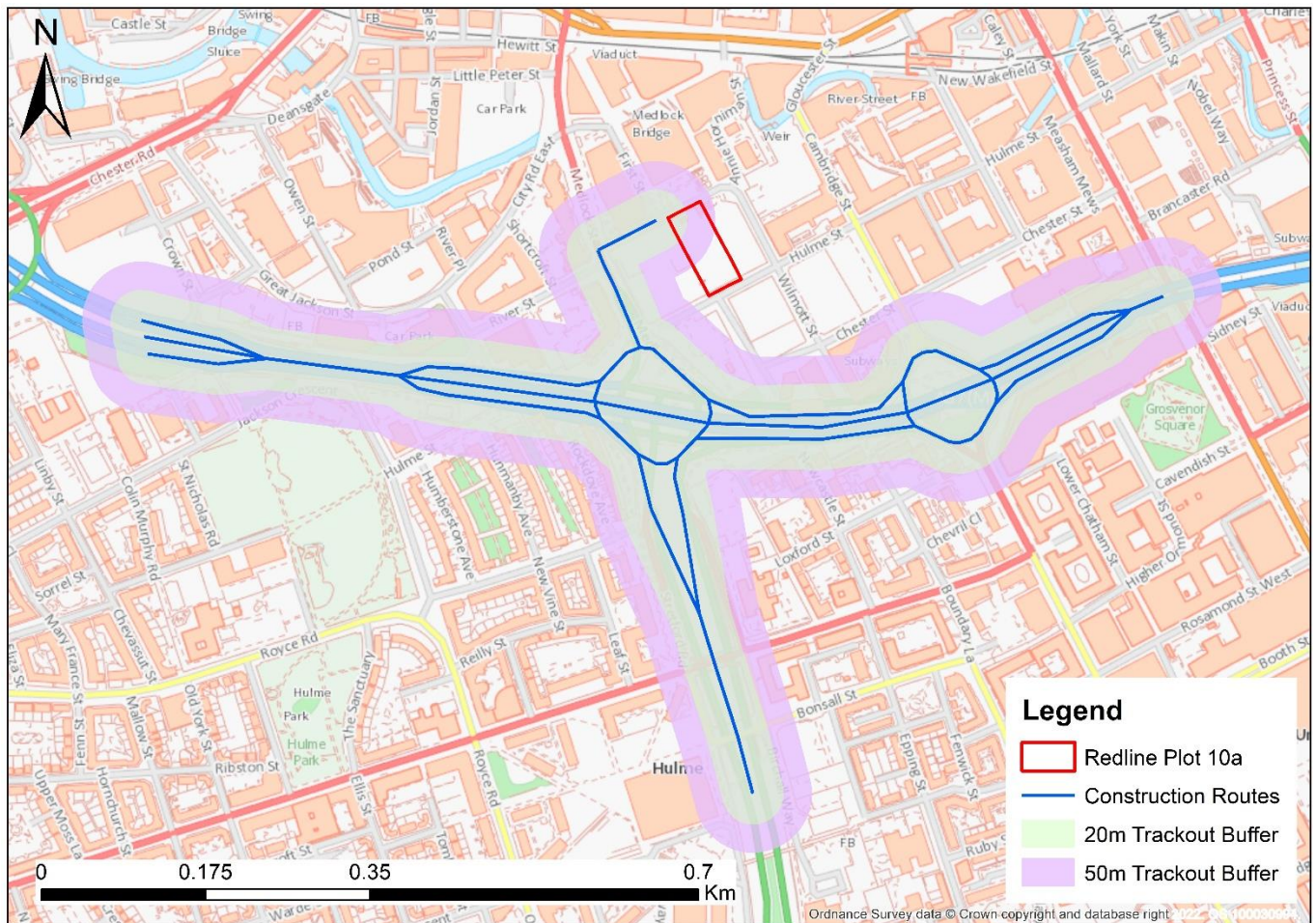


Figure 5-2: Trackout 500m Distance Band around the Site Exit Route

An evaluation of numbers of sensitive receptors lying within 20m and 50m of the edge of the carriageway of those links identified in Step 2A has been carried out and the number of these receptors likely to be affected by trackout on roads used by construction vehicles is summarised in Table 5-3.

Distance (metres)	Receptor Type					Totals
	Residential / Development (High)	Non-Residential Development (High)	Commercial / Retail / Office (Medium)	Commercial / Leisure / Transport (Low)	Ecological	
20	1082	3	0	0	0	1085
50	2112	305	5	0	0	2422

Table 5-3: Number of Receptors Identified in Distance Bands from the Edge of Carriageways Potentially Included in Construction Traffic Routes

In summary, the evaluation shows that:

- >100 high risk residential receptors are located within 20m of the of the potential construction traffic routes

The sensitivity of the area to dust soiling effects on people and property from trackout activities is therefore **High**.

The Defra PM₁₀ background concentration in the area of the Proposed Development is <14.0µg/m³ and the urban background monitoring sites PM₁₀ concentration in the area of the Proposed Development is <20µg/m³. There are >100 high sensitivity receptors within 20 m of the construction phase boundary of roads used by construction traffic within 250 m of the Site exits. The sensitivity of the area to human health impacts for trackout activities is therefore **Medium**.

Using the IAQM guidance, the sensitivity of the surrounding area has been determined for dust soiling effects and human health effects, based on the receptor type and density, as well as low annual mean PM₁₀ concentrations. The determined sensitivities for each phase of construction are summarised in Table C4 in Appendix C.

There are no ecological sensitive receptors within 50 m of the boundary of the site; and within 50 m of the route used by construction vehicles on the public highway, up to 500 m from the site entrance. Therefore, no further consideration of dust impact on ecological receptors has been undertaken.

Sensitivity of Areas Analysis

The sensitivity of the receptors and area has been defined for both dust soiling and human-health impact as shown in Table 5-4.

Receptor Sensitivity	Relevant Definition	Sensitivity of the Receptors	Relevant Definition	Sensitivity of the Area
Dust Soiling for Earthworks and Construction	Dwellings	High	1-10 receptors within 20 m of site.	Medium
Dust Soiling for Trackout	Dwellings	High	>100 receptors within 20 m of route used by construction traffic.	High
Human-Health Effects of PM ₁₀ for Earthworks and Construction	Dwellings	High	<24 µg/m ³ annual mean PM ₁₀ concentration. 1-10 receptors within 20 m of site.	Low
Human-Health Effects of PM ₁₀ for Trackout	Dwellings	Low	<24 µg/m ³ annual mean PM ₁₀ concentration. >100 receptors within 20 m of route used by construction traffic	Medium

Table 5-4: Determination of the sensitivity of the surrounding area

5.1.4 Risk of Impact

The risk of dust impact to both dust soiling and human-health effects for each construction activities are summarised in Table 5-5.

Potential Impact (Sensitivity of the Area)	Dust Risk (Dust Emission Category)				
	Demolition (N/A)	Earthworks (Medium)	Construction (Large)	Trackout (Medium)	Overall Risk
Dust Soiling (High for Construction and Trackout and Medium for Earthworks)	N/A	Medium	High	Medium	High
Human-health (Low for Earthworks and Construction and Medium for Trackout)	N/A	Low	Low	Low	Low
Overall Risk	N/A	Medium	High	Medium	High

Table 5-5: Risk of Impacts

The dust impact assessment has demonstrated that the risk of dust soiling without any mitigation is High for construction, and Medium for earthworks and trackout.

The risk of adverse human-health effects of PM₁₀ without any mitigation is low for earthworks, construction and trackout.

The overall risk of unmitigated impacts is **High** for earthworks, construction and trackout.

5.2 Operation Phase

5.2.1 Nearby Receptors

Detailed dispersion modelling of NO_x, PM₁₀ and PM_{2.5} emissions from operational traffic was used to undertake assessment of the impact on existing nearby receptors. The results are presented in Appendix I and include two different scenarios:

- a) 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- b) 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Interpretation of worst-case data indicates the following:

- Assuming worst case conditions, i.e., no decrease in background pollutant concentrations between base year and opening year, no improvement in vehicle emission factors from 2022, the worst-case impact is 'moderate' at Receptor 5 (8 First Street), where there is a predicted increase of 0.3 µg/m³. There are no new exceedances of the NO₂ annual mean air quality objective.
- Assuming best case conditions in which vehicle emission factors decrease in line with predicted trends, air quality concentrations at all modelled receptor locations are reduced, including receptor 5, which is reduced to a 0.2 µg/m³ slight increase in NO₂, the impact at all other receptors will be negligible.
- Modelled PM₁₀ and PM_{2.5} concentrations in both the best- and worst-case scenarios meet the annual mean PM_{2.5} objectives at all modelled receptor locations. The impact of operation traffic phase increases is negligible at all locations.

5.2.2 Human Exposure

Air quality conditions for future occupiers and visitors of the Proposed Development will be influenced by local background and road emissions. Impacts from the proposed standby generators have not been included within this evaluation as they were scoped out of further assessment.

Detailed dispersion modelling of NO_x, PM₁₀ and PM_{2.5} emissions from operational traffic was used to undertake assessment of human exposure at the development. The results are presented in Appendix J and include two different scenarios:

- a) 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- b) 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Interpretation of worst-case data indicates the following:

- Exceedances of the annual mean NO₂ objective predicted at ground floor level at Receptors 3 and 4. There are no predicted exceedances at first floor level or higher.
- Since all modelled NO₂ values are below 60 µg/m³, exceedance of national short-term NO₂ objectives is unlikely at all receptor locations on all floors
- Exceedance of national annual mean and short-term mean PM₁₀ objectives is unlikely at all modelled receptor locations. The maximum predicted annual mean PM₁₀ concentration of 21.2 µg/m³ is well below the annual mean objective (40 µg/m³).
- Exceedance of the national annual mean PM_{2.5} objective is unlikely at all modelled receptor locations. The maximum predicted annual mean PM_{2.5} concentration is 12.1 µg/m³ is well below the annual mean objective (25 µg/m³).

6.0

Assumptions and Limitations

6.0 Assumptions and Limitations

6.1 Dispersion Modelling- General

Topographical features such as hills can have a significant effect on the dispersion of pollutants, generally when the ground level within 1 km of the sources varies by more than 100m (1 in 10). A review of the local area indicated difference in height of <100m. The use of terrain data was therefore excluded from further consideration within the assessment.

6.2 Model Verification

The local air quality impacts were assessed based on the results from atmospheric dispersion modelling. A series of assumptions have been made in relation to the dispersion modelling used to predict impacts from the Proposed Development. These have been outlined in the impact assessment methodology outlined in Section 3.4.4.

The uncertainty in the predictions for the current baseline was reduced by carrying out model verification and adjustment of results to align with measured concentrations. This process is summarised in Appendix G.

6.3 Future Year Emission Factors

A greater level of uncertainty is associated with predictions for future years than for the base year, with greater uncertainty the further into the future the predictions are made. Sensitivity testing has therefore been undertaken with modelling using both the base year and future year EFT v11.0 factors produced by Defra.

Results are presented for two different scenarios in Appendix I and J, for existing and proposed on-site receptors, respectively:

- a) 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- b) 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Interpretation of results was made using worst-case data.

6.4 Construction Details

Assumptions relating to quantities for earthworks and construction are based on the design details provided by Jon Matthews Architects.

7.0

Mitigation

7.0 Mitigation

7.1 Construction

The primary aim of the dust risk assessment is to identify the appropriate site-specific mitigation measures that will be adopted to ensure there will be no significant effect on local amenity and public health.

Full details of mitigation measures are presented in Appendix J and should be read in accordance with the findings of the construction dust assessment (Chapter 5).

The Client will commit to the implementation of the best practice mitigation measures identified above during the construction phase of the development. It is anticipated that the generation of dust and harmful pollutants emissions from construction site activities will be reduced with the correct implementation of these measures.

7.2 Operation

7.2.1 Impacts on Surrounding Receptors

It is anticipated that the impact of the operation phase on sensitive receptors is likely to be negligible, apart from one residential receptor (R5) where impacts could range between slight and moderate, depending upon how quickly vehicle emission factors and pollution baseline levels improve. Further mitigation measures are provided within the development design and Framework Travel Plan produced by Vectos⁵⁸ and are summarised as follows:

- Provision of adequate cycle parking facilities within the proposals, to encourage cycling
- No on-site car parking, to further encourage sustainable travel modes
- Management of Travel Plan via an appointed co-ordinator to encapsulate all measures to be undertaken to encourage sustainable travel
- Production and implementation of Delivery and Servicing Plans, to manage these trips to occur outside the network peak hours

7.2.2 Impacts on Future Users of the Proposed Development

Good practice design (as Building Regulations often consider WHO guidelines which are usually more stringent), see Table 7-1 below. Compliance with WHO recommended guidelines for residential and non-residential elements is considered 'best practice' but is non-mandatory at present, i.e., suitable control can be adopted on an 'as-required' basis. The WHO recommended guidelines were recently updated in September 2021⁵⁹. The update includes Air Quality Guideline (AQG) levels for the pollutants of relevance to this assessment (NO₂, PM₁₀ and PM_{2.5}) which are significantly lower than the previous WHO guidelines, which correspond to the lower range of the interim targets for PM₁₀ and PM_{2.5} and the higher range for NO₂.

Pollutant	Averaging Period	Air Quality Objective (AQO) (µg/m ³)	WHO Guidelines (µg/m ³)	
			Interim Target	AQG Level
NO ₂	Annual mean	40	40 to 20	10
PM ₁₀	Annual mean	40	70 to 20	15
PM _{2.5}	Annual mean	25	35 to 10	5

Table 7-1: Comparison of WHO Guidelines with National Air Quality Objectives

The ventilation strategy is mixed mode. The ground floor will be fully mechanically ventilated making use of heat recovery to reduce heating demands. From first floor upwards the strategy will be mixed mode, with the ability for windows to be opened based on ambient conditions.

⁵⁸ First Street Plot 9A Framework Travel Plan VN81029 Issue 8. Prepared by Vectos. 20 December 2021.

⁵⁹ World Health Organisation (WHO) (2021) WHO global air quality guidelines, Particulate matter (PM_{2.5} and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, <https://apps.who.int/iris/handle/10665/345329>.

Worst case modelling indicates the possibility of minor exceedances of the annual mean NO₂ objective at ground floor level on facades facing Hulme street. However, annual mean objectives are normally non-applicable for non-residential use, and modelling has indicated no potential for exceedances of the NO₂ short-term (hourly) objectives throughout the building.

Whereas PM_{10/2.5} filtration is unlikely to be required for planning (as it considers exceedances of national air quality objectives) it is recommended to be considered for good practice design (as Building Regulations often consider WHO guidelines which are usually more stringent), see Table 7-1 above. Maximum modelled concentrations of PM₁₀ and are predicted to be below the WHO interim target, but above the WHO interim target, with maximum concentrations of 17.5 µg/m³ PM₁₀ and 11.3µg/m³ PM_{2.5} predicted in the worst-case future scenario (Appendix J). The long term WHO air quality guidance levels of 15 and 5µg/m³, are both exceeded for the respective particulate pollutants.

Consideration should be main for integrating particulate filters into the intakes of the air handling units where this is practicable, to help strive towards achieving the more stringent WHO guideline values. MVHR intakes should be positioned on higher floors and non-road facing facades where concentrations of ambient pollutants are expected to be lower.

Under these conditions, it is anticipated that the exposure of future occupants to poor air quality will be unlikely, and no additional mitigation measures will be required.

The IAQM⁶⁰ have published comprehensive guidance on indoor air quality. Further consultancy advice on indoor air quality can be provided on request but is not currently a prerequisite for planning applications.

⁶⁰ Institute of Air Quality Management (IAQM) (2021), Indoor Air Quality Guidance: Assessment, Monitoring, Modelling and Mitigation, version 1.0, September 2021, https://iaqm.co.uk/wp-content/uploads/2013/02/iaqm_indoorairquality.pdf

8.0

Residual Effects

8.0 Residual Effects

8.1 Construction

With appropriate mitigation in place, it is considered that the residual effects on dust soiling and human health from the construction phase activities would be reduced and not significant.

The mitigation measures required are detailed in Appendix J and are based upon the IAQM guidance Selection of appropriate mitigation measures should be based on the findings of the construction dust assessment (section 5.1).

8.2 Operation

Residual effects on human health from operation phase emissions are expected to be negligible.

9.0

Conclusion

9.0 Conclusion

This report presents the Air Quality Assessment for the redevelopment of Plot 10a, First Street, Manchester. A review of current legislation and national and local policy has been made.

An assessment has been made of existing baseline air quality conditions and potential impacts associated with construction and operational of the Proposed Development.

The Proposed Development lies within Greater Manchester Air Quality Management Area (AQMA) which was declared in July 2001 due to exceedances of the annual mean nitrogen dioxide (NO₂) objective threshold and 24-hour particulate matter (PM₁₀) objective. Existing conditions within the study area indicate that there is potential for nitrogen dioxide (NO₂) concentrations in the wider area to exceed the National Air Quality Objective threshold levels.

Emissions of construction dust have been assessed using the qualitative approach outlined in the IAQM guidance. It was concluded that in the absence of any adequate mitigation, there is a *High* risk from construction, and *Medium* risk from earthworks and trackout dust-generating activities associated with the Proposed Development. However, with appropriate mitigation measures implemented, it is anticipated that the dust generation and harmful emissions from construction site activities will not be significant.

Operation phase impacts are expected to be is likely to be negligible. No car parking is included within the development proposals,

Heating, cooling and hot water for the development will be provided by air source heat pumps powered by electricity. There will be a requirement for back-up diesel generators (life safety and tenant). Generators will operate less than 50 hours per year, based on required maintenance testing. The flues will be located at roof level. Based on the current design, the location of the generator flues and roof top community terrace are >10m horizontal distance. There will also be a 6m separation screen with flues emitting just above this level. Based on the size, minimum operation hours and proposed location of the generators, they are not expected to have a significant impact on local air quality.

Although no car parking is included as part of the Proposed Development, predicted daily vehicle trips are predicted to exceed the IAQM threshold criterion (100 vehicles per day) for when a detailed assessment of transport emissions is required. Detailed assessment of transport related emissions indicated negligible air quality impacts at all surrounding receptors, apart from one residential receptor (8 First Street) where potential impacts are predicted to range between 'slight' and 'moderate'. It should be noted that operational traffic predictions also contain potential contributions from the Plot 10b development and are considered to be very much worst-case. Mitigation measures include the exclusion of standard car parking places and a Travel Plan has been prepared to encourage future users of the building to use Public Transport modes.

The assessment has demonstrated possible exceedances of the annual mean nitrogen dioxide objective at ground floor level of facades facing Hulme Street in the worst-case future scenario. The annual mean objective does not apply to non-residential land uses. Since all modelled NO₂ values are below 60µg/m³, exceedance of national short-term NO₂ objectives is unlikely at all floors at all facades Exceedances of fine particulate (PM₁₀) and (PM_{2.5}) objectives is unlikely at all floors at all facades.

The ventilation strategy is mixed mode. The ground floor will be fully mechanically ventilated making use of heat recovery to reduce heating demands. From first floor upwards the strategy will be mixed mode, with the ability for windows to be opened based on ambient conditions. As there are no exceedances of annual mean NO₂ concentrations at building facades, there will be no requirement for gaseous filtration. MVHR intakes should be positioned on higher floors and non-road facing facades where concentrations of ambient pollutants are expected to be lower. Openable windows can be utilised for purge or natural ventilation purposes. It should be noted that although levels of PM₁₀ and PM_{2.5} are compliant with current air quality objectives, best practice threshold values published by the World Health Organisation (WHO) are exceeded. Consideration should be given to integrating particulate filters into the MVHR design where this is practicable. Under these conditions, it is anticipated that the exposure of future occupants to poor air quality will be unlikely, and no additional mitigation measures will be

required.

It can therefore be concluded that there are no air quality constraints to the construction and operation of the Proposed Development.

10.0

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10.0 References

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9.0

Glossary

11.0 Glossary

Term/Acronym	Details
$\mu\text{g}/\text{m}^3$	Micrograms (one-millionth of a gram) per cubic metre of air
AADT	Annual average daily traffic
AQAL	Air Quality Assessment Level
AQAP	Air quality action plan
AQMA	Air quality management area. Areas where the air quality objectives are likely to be exceeded. Declared by way of an order issued under the Section 83(1) of the Environment Act 1995.
AQO	Air quality objective. Air quality targets to be achieved locally as set out in the Air Quality Regulations 2000 and subsequent Regulations. Objectives are expressed as pollution concentrations over certain exposure periods, which should be achieved by a specific target date. Some objectives are based on long term exposure (e.g. annual averages), with some based on short term objectives. Objectives only apply where a member of the public may be exposed to pollution over the relevant averaging time.
AQS	Air quality strategy
ASR	Annual status report
CURED	Calculator Using Realistic Emissions for Diesels
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
Earthworks	The process of soil stripping, ground-levelling, excavation and landscaping.
EfT	Emission Factor Toolkit
EU	European union
Exceedance	Concentrations of a specified air pollutant greater than the appropriate Air Quality Objective.
HDV	Heavy duty vehicle
IAQM	Institute of Air Quality Management
LA	Local authority
LAQM	Local air quality management
LAQM, TG	Local air quality management technical guidance
LDV	Light duty vehicle
Limit Values / EU limit values	The maximum pollutant levels set out in the EU Daughter Directives on Air Quality. In some cases, the limit values are the same as the national air quality objective but may allow a longer period for achieving.
LT	Long-term averaging period (i.e. Annual mean)
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
PCM	Pollution climate model
PM_{10}	The fraction of particulates in air of very small size (less than 10 micrometres).
$\text{PM}_{2.5}$	Fine particles in the (ambient) air 2.5 micrometres or less in size.
Ramsar/ Ramsar site	The Convention on Wetlands of International Importance, called the Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Ramsar sites are wetlands of international importance, designated under the Ramsar Convention.
SAC/ pSAC/ cSAC	Special area of conservation / potential SAC / candidate SAC
SPA / pSPA	Special protection area / potential special protection area
SPG	Supplementary planning guidance
SSSI	Site of special scientific interest

Term/Acronym	Details
ST	Short-term averaging period (i.e. Daily, hourly, or 15-min means)
TC	Transport Consultant
TEMPRO	Trip End Model Presentation Program
TP	Travel Plan
Trackout	The transfer of dust or dirt on the local road network and then re-suspended by vehicles on the network.
TS	Transport Statement

Table 11-1: Glossary

Appendices

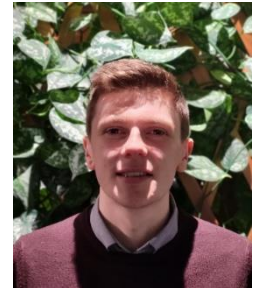
Appendix A – Air Quality Assessment Authors

Author: **Tom Vaughan**

Thomas is a Graduate Air Quality Consultant with Cundall, having joined the company in 2022. He has an MSc degree in Environment and Development from Lancaster University, which examined sustainable development practices, atmospheric greenhouse gas modelling, climate change and the Earth system, environmental impact assessments and data assimilation techniques.

He also has a BSc in Physics with Astronomy from the University of Surrey, which included electromagnetism, waves and oscillations, equations of gases, nuclear physics and computational modelling.

He has experience in atmospheric data processing and modelling, as well as geographical information systems (GIS).



Reviewer: **Jenny Carrington**

Jenny Carrington is a Chartered Scientist (CSci) and is based in Birmingham, where she works as a Principal Air Quality Consultant. Jenny is a Member of the Institute of Air Quality Management (IAQM) and the Institution of Environmental Sciences (IES) and an Affiliate member of the Chartered Institution of Building Services (CIBSE).

Jenny has sixteen years' experience working in the environmental sector for a range of both public and private clients. She is responsible for undertaking air quality assessments and is fully conversant with atmospheric dispersion modelling through the use of ADMS software as part of more detailed air quality assessments. She also has responsibility for managing air quality monitoring programs.

In her role as an environmental specialist Jenny has worked on a range of multi-disciplinary projects often fulfilling the role of project manager in coordinating third parties to enable a successful completion of the project. She is experienced in producing air quality chapters for Environmental Statements for a range of different developments and has previously reviewed Environmental Statement's on behalf of Local Authorities.



Reviewer: **Glyn Hodgkiss**

Glyn is a Principal Consultant in Cundall's Air Quality Team. He has 30 years' experience working in the environmental field and has specialised in Air Quality for over 15 years. He is a Chartered Environmentalist (CEnv) and Member of the Institute of Air Quality Management.

Working in both the private and public sectors, Glyn has gained extensive experience in monitoring and modelling air quality. His role in Local Government included air quality action planning, working with developers to minimise air quality impacts of new development, working on regional planning policy initiatives and on the delivery of government funded air quality improvement programs. He has also worked in private sector consultancy on the delivery of multiple air quality assessments ranging from small, single source dispersion modelling studies through to complex multi-source assessments and major road and infrastructure projects. This work has provided valuable support in the design, planning, construction and operation of new developments.

Glyn has a pedigree in collaborative working, bringing together the expertise of Cundall alongside other consultants and stakeholders to promote smooth project progression from inception to conclusion.



Appendix B – Consultation with Manchester City Council

From: Laura Miller <laura.miller@manchester.gov.uk>
Sent: 26 September 2022 09:01
To: Jenny Carrington <j.carrington@cundall.com>
Cc: Brittany Huggins <b.huggins@cundall.com>
Subject: Re: Plot 10 First Street, Air Quality Assessment

Hi Jenny,

I have looked at the proposals and they seem acceptable to me.

If you haven't downloaded already we have an [Air Quality Guidance](#) document on our website.

Kind Regards

Laura

Laura Miller (MRes, MA, BSc(Hons))

Please note that due to working compressed hours Wednesdays are a non-working day for me, I will respond to your email when I return to the office

Environmental Protection Officer
Environmental Protection Section

Environmental Health
Neighbourhoods Directorate

Manchester City Council

email: laura.miller@manchester.gov.uk

website: www.manchester.gov.uk

Telephone: 0161 234 1742

Internal: 31742

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From: Jenny Carrington <j.carrington@cundall.com>
Sent: 15 September 2022 15:01
To: laura.miller@manchester.gov.uk
Cc: Brittany Huggins <b.huggins@cundall.com>
Subject: RE: Plot 10 First Street, Air Quality Assessment

Good Afternoon Laura

Following on from the emails below regarding our Air Quality Assessment of Plot 9A First Street, we have also been commissioned to carry out an AQA for the neighbouring Plot 10. Proposals are for 28,063sqm of commercial office space (Use Class E(c)) over 12 storeys (excluding ground floor and basement) with winter gardens, gym space, cycle spaces, and associated facilities and hard and soft landscaping areas.

There will be no car parking.

Heating, cooling and hot water provision for the development will be provided by air source heat pumps powered by electricity. There will be a life safety back-up generators, operating less than 50 hours per year with flues located at roof level.

We therefore proposed to carry out an AQA based on the methodology below, which is similar that already outlined and agreed with you for the neighbouring Plot 9a.

- Baseline assessment of existing air quality in the area using findings the Local Authority review and assessment process and data available from the Defra Local Air Quality Management website. We have obtained a copy of the latest Greater Manchester ASR. Interpretation and recommendations will be based on worst case 2019 data, due to the Covid-19 lockdown in 2020 and subsequent reduction in ambient air pollution.
- An assessment of new exposure at the Proposed Development in accordance with IAQM/EPUK guidance. This will be based on existing baseline conditions, using available Greater Manchester monitoring data in the area and Defra background predictions. Consideration that given the commercial nature of the development, the short-term, rather than long-term objectives are applicable.
- Undertaking a construction dust risk assessment following the latest Institute of Air Quality Management (IAQM) guidance;
- Where appropriate, recommending appropriate mitigation measures in line with IAQM/EPUK guidance and Local policy; and
- Preparation of a report to accompany the documents for the planning application.

If you disagree with any elements of the proposed scope please let me know, otherwise I will proceed with the assumption it is acceptable.

Thank you for your assistance in this matter and feel free to call me with any further queries.

Many thanks
Kind regards
Jenny
Jenny Carrington
Principal Air Quality Consultant
Cundall

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From: Laura Miller <laura.miller@manchester.gov.uk>
Sent: 12 October 2021 08:35

To: Hodgkiss, Glyn <g.hodgkiss@cundall.com>
Subject: Plot 9A First Street, Air Quality Assessment

Good morning Glyn,

I have been forwarded your email below as I am officer covering this part of the city centre.

I have read your proposals and agree with what is being recommended.

PM2.5 - Please consider the previous WHO guideline for PM2.5 of 10ug/m3 annual average, as we're signed up with GMCA to be a BreatheLife city by 2030 and achieve this limit (notwithstanding the latest WHO guideline updates). This would future proof the development.

Kind Regards

Laura

Laura Miller (MRes, MA, BSc(Hons))

Please note that due to working compressed hours Wednesdays are a non-working day for me, I will respond to your email when I return to the office

Environmental Protection Section
Environmental Health
Neighbourhoods Directorate
Manchester City Council

Telephone: 0161 234 1742/0161 234 5004
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website: www.manchester.gov.uk

For the latest support and information about the coronavirus visit www.manchester.gov.uk/coronavirus

We are now on Twitter, for latest news and updates follow us [@EnvHealthMcr](https://twitter.com/EnvHealthMcr)

I ❤️ MCR

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Dear Lisa & Graeme,

Cundall has been commissioned to carry out an air quality assessment in support of the planning application at Plot 9A, First Street, Manchester.

The Proposed Development will deliver 21,500sqm of commercial office space over 11 floors with winter gardens, and associated gym space.

It is part of a wider vision to create a mixed-use neighbourhood in the area, supported by a mixture of leisure, office and residential blocks. The proposed development does not include any car parking.

Lighting and heating for the Proposed Development are to electrically powered. There will be a diesel fuelled back-up generator, allowing for required maintenance testing, operating hours are anticipated to be below 50 hours per year. Proposals are for the emergency generator to be located within an external roof plant area at 10th Floor. At the time of writing, generator requirements / specifications are not available, although design measures will be adopted to see that the compliance with the relevant requirements are achieved. Further screening will be provided once design details and specifications are confirmed.

We are therefore proposing the following scope of work:

- Baseline assessment of existing air quality in the area using findings the Local Authority review and assessment process and data available from the Defra Local Air Quality Management website. We have obtained a copy of the latest Greater Manchester ASR and reviewed the Clean Air Greater Manchester website for 2019 and 2020 data. Interpretation and recommendations will be based on worst case 2019 data, due to the Covid lockdown in 2020 and subsequent reduction in ambient air pollution.
- An assessment of new exposure at the Proposed Development in accordance with IAQM/EPUK guidance. This will be based on existing baseline conditions, using available Greater Manchester monitoring data in the area and Defra background predictions. Consideration that
- given the commercial nature of the development, the short-term, rather than long-term objectives are applicable. We are also aware of the site's location within the proposed Clean Air Zone
- Undertaking a construction dust risk assessment following the latest Institute of Air Quality Management (IAQM) guidance;
- Where appropriate, recommending appropriate mitigation measures in line with IAQM/EPUK guidance and Local policy; and
- Preparation of a report to accompany the documents for the planning application.

If you disagree with any elements of the proposed scope please let me know, otherwise I will proceed with the assumption it is acceptable.

Thank you for your assistance in this matter and feel free to call me with any further queries.

Best Regards,

Glyn

Glyn Hodgkiss

Principal Air Quality Consultant

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Appendix C – IAQM Construction Assessment Methodology

Screening (Step 1)

As 'human receptors' were identified within 50 m of the boundary of the site; and within 50 m of the route(s) to be used by construction vehicles on the public highway, up to 500 m from the site entrance, a detailed risk assessment was undertaken.

Dust Emission (Step 2A)

The potential dust emission magnitude for different activities have been defined based on the criteria listed in Table C-1.

Stage	Description	Large	Medium	Small
Demolition	Definitions for demolition are:	1. Total building volume >50,000 m ³ 2. Potentially dusty construction material (e.g. concrete) 3. On-site crushing and screening 4. Demolition activities >20 m above ground level	5. Total building volume 20,000 m ³ – 50,000 m ³ 6. Potentially dusty construction material (e.g. concrete) 7. Demolition activities 10 – 20 m above ground level	8. Total building volume <20,000 m ³ 9. Construction material with low potential for dust release (e.g. metal cladding or timber) 10. Demolition activities <10 m above ground, demolition during wetter months
Earthworks	Earthworks will primarily involve excavating material, haulage, tipping, and stockpiling. This may also involve levelling the site and landscaping.	11. Total site area >10,000 m ² 12. Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) 13. >10 heavy earth moving vehicles active at any one-time formation of bunds >8 m in height 14. Total material moved >100,000 tonnes	15. Total site area 2,500 m ² – 10,000 m ² 16. Moderately dusty soil type (e.g. silt) 17. 5-10 heavy earth moving vehicles active at any one-time formation of bunds 4 m – 8 m in height 18. Total material moved 20,000 tonnes – 100,000 tonnes	19. Total site area <2,500 m ² 20. Soil type with large grain size (e.g. sand) 21. <5 heavy earth moving vehicles active at any one-time formation of bunds <4 m in height 22. Total material moved <20,000 tonnes, earthworks during wetter months
Construction	The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s) / infrastructure, method of construction, construction materials, and duration of build.	23. Total building volume >100,000 m ³ 24. On-site concrete batching and sandblasting	25. Total building volume 25,000 m ³ – 100,000 m ³ 26. Potentially dusty construction material (e.g. concrete) 27. On-site concrete batching	28. Total building volume <25,000 m ³ 29. Construction material with low potential for dust release (e.g. metal cladding or timber)

Stage	Description	Large	Medium	Small
Trackout	Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology, and duration. Only receptors within 50 m of the routes used by vehicles on the public highway and up to 500 m from the site entrances are considered to be at risk from the effects of dust.	30. >50 HDV (>3.5 tonnes) outward movements in any one day 31. Potentially dusty surface material (e.g. high clay content) 32. Unpaved road length >100 m	33. 10-50 HDV (>3.5 tonnes) outward movements in any one day 34. Moderately dusty surface material (e.g. high clay content) 35. Unpaved road length 50 m – 100 m	36. <10 HDV (3.5 tonnes) outward movements in any one day 37. Surface material with low potential for dust release 38. Unpaved road length <50 m

Table C-1: Potential Dust Emission Magnitude Criteria

Sensitivity of the Area (Step 2B)

The sensitivity of the area takes account of several factors:

1. The specific sensitivities of receptors in the area;
2. The proximity and number of those receptors;
3. In the case of PM₁₀, the local background concentration; and
4. Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Table C-2 provides guidance on the sensitivity of different types of receptor.

Description	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Sensitivities of People to Dust Soiling Effects	1. Users can reasonably expect enjoyment of a high level of amenity 2. The appearance, aesthetics, or value of their property would be diminished by soiling 3. 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 4. Indicative examples include dwellings, museums, and other culturally important collections, medium, and long-term car parks, and car showrooms	5. Users would expect a to enjoy a reasonable level of amenity, but would not reasonably expect a to enjoy the same level of amenity as in their home 6. The appearance, aesthetics, or value of their property could be diminished by soiling 7. The people or property wouldn't reasonably be expected a to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land 8. Indicative examples include parks and places of work	9. The enjoyment of amenity would not reasonably be expected; or 10. Property would not reasonably be expected a to be diminished in appearance, aesthetics, or value by soiling 11. 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 12. Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short-term car parks, and roads

Description	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Sensitivities of People to the Health Effects of PM₁₀	13. Locations where members of the public are exposed over a time period relevant to the air quality objective for PM₁₀ (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) 14. 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	15. Locations where the people exposed are workers d, and exposure is over a time period relevant to the air quality objective for PM₁₀ (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). 16. Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM₁₀, as protection is covered by Health and Safety at Work legislation	17. Locations where human exposure is transient. 18. Indicative examples include public footpaths, playing fields, parks, and shopping streets
Sensitivities of Receptors to Ecological Effects	19. Locations with an international or National designation and the designated features may be affected by dust soiling 20. Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain 21. Indicative examples include a Special Area of Conservation designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings	22. Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown 23. Locations with a National designation where the features may be affected by dust deposition 24. Indicative example is a Site of Special Scientific Interest with dust sensitive features	25. Locations with a local designation where the features may be affected by dust deposition. 26. Indicative example is a local Nature Reserve with dust sensitive features

Table C-2: Sensitivities of People to Dust Soiling Effects, Health Effects of PM₁₀, and Sensitivities of Receptors to Ecological Effects

Full details of the sensitivities of receptors are provided in the IAQM Guidance document.

Table C-3, Table C-4, and Table C-5 show how the sensitivity of the area has been determined for dust soiling, human-health, and ecosystem impacts respectively.

These tables take account of several factors which may influence the sensitivity of the area. The highest level of sensitivity from each table has been recorded.

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

Table C-3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Annual Mean PM ₁₀ Concentration (µg/m³)	Number of Receptors ^d	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<28	>10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table C-4: Sensitivity of the Area to Human-Health Impacts

Table C5 Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table C-5: Sensitivity of the Area to Ecological Impact

The highest level of sensitivity from each table has been recorded. Professional judgement has been used to determine alternative sensitivity categories with consideration of additional factors, such as any pre-existing screening between the source and the receptors, the season during which the works will take place, and duration of the potential impact.

Risk of Impact Definition

The dust emission magnitude (Step 2A) was combined with the sensitivity of the area (Step 2B) to determine the risk of impact with no mitigation applied. Tables C-6 to C-9 provide the method of assigning the level of risk of each activity and used to determine the level of site-specific mitigation.

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

Table C-6 Risk of Impact – Demolition

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

Table C-7: Risk of Impact – Earthworks

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

Table C-8: Risk of Impact – Construction

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

Table C-9: Risk of Impact – Trackout

Appendix D – IAQM Local Air Quality Assessment Screening Criteria

Comparison Against IAQM Criteria

IAQM's guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' (updated in January 2017) was issued to ensure that air quality is adequately considered in the land-use planning and developmental control process.

It provides a decision-making process which assists with the understanding of air quality impacts and implications because of development proposals. It provides a framework for air quality considerations within local development control processes, promoting a consistent approach to the treatment of air quality issues within development control decisions.

The guidance includes a method for screening the requirement for an air quality assessment, the undertaking of an air quality assessment, the determination of the air quality impact associated with a development proposal and whether this impact is significant.

The guidance also provides some clarification as to when air quality constitutes a material consideration and highlights the links to other relevant issues (for example traffic speed reduction measure and the use of alternative technology to provide energy) and the importance of the understanding of these with the input from other discipline specialists. The 'creeping baseline' is another issue raised about cumulative impacts.

The guidance note is widely accepted as the most appropriate reference method for this purpose. This guidance refers to the Town and Country Planning (Development Management Procedure) Order (England) 2010 [(Wales) 2012] definition of a 'major' development when scoping assessments required for the planning process.

A 'major' development includes developments where:

- The number of dwellings is 10 or above;
- The residential development is carried out of a site of more than 0.5ha where the number of dwellings is unknown;
- The provision of more than 1,000m² commercial floor space; or,
- Development carried out on land of 1ha or more.

There are two types of air quality impacts to be considered:

- The impact of existing sources in the local area on the Proposed Development (governed by background pollutant levels and proximity to sources of air pollution); and,
- The impacts of the Proposed Development on the local area.

Regarding the changes in air quality or exposure to air pollution, the guidance indicates that each local authority will be likely to have their own view on the significance of this; these are to be described in relation to whether a National Air Quality Objective (NAQO) predicted to be met, or at risk of not being met. Exceedances of these objectives are considered as significant, if not mitigated.

As part of the impact of the Proposed Development on the local area, a two-staged assessment is recommended as per current guidance.

Stage 1: Determines whether an air quality assessment is required. In order to proceed to Stage 2, it requires any of the criteria under (A) coupled with any of the criteria under (B) in Table D-1 to apply.

Stage 2: Where an assessment is deemed appropriate, this may take the form of a Simple Assessment or a Detailed Assessment, using suitable guidance provided in Table D-2.

Criteria to Proceed to Stage 2

A. If any of the following apply:

- 10 or more residential units of a site area of more than 0.5ha
- More than 1,000m² of floor space for all other uses or a site area greater than 1ha

B. Coupled with any of the following:

- The development has more than 10 parking spaces
- The development will have a centralised energy facility or other centralised combustion process

Note: Consideration should still be given to the potential impacts of neighbouring sources on the site, even if an assessment of impacts of the development on the surrounding area is screened out.

Table D-1: Stage 1 Criteria

The Development will	Indicative Criteria to Proceed to an Air Quality Assessment
1. Cause a significant change in Light Duty Vehicle (LDV) traffic slows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	A change of LDV flows of: • More than 100 AADT within or adjacent to an Air Quality Management Area (AQMA) • More than 500 AADT elsewhere.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A Change of HDV flows of: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. Traffic lights, or roundabouts.
5. Introduce or change a bus station.	Where bus flows will change by: • More than 25 AADT within or adjacent to an AQMA • More than 100 AADT elsewhere.
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO _x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing NO ₂ concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

Table D-2: Indicative Criteria for Requiring an Air Quality Assessment

Impact Descriptors for Individual Receptors

The IAQM guidance contains a two Stage process for determining the likely significant effects of the impacts on air quality:

- A qualitative or quantitative description of the impacts on local air quality arising from the development; and
- A judgement on the overall significance of the effects of any impacts.

A framework for describing the impacts is set out in IAQM guidance and summarised in Table D-3 below.

Long-term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Table D-3: Indicative Criteria for Requiring an Air Quality Assessment

For air quality impacts arising from surrounding sources on new occupants of a development, then the impacts are best described in relation to whether an air quality objective will not be met or is at risk of not being met. Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provisions is made to reduce their exposure by some means.

Changes of less than 0.5%, will be described as Negligible.

Appendix E – Results of Screening Assessment

Where the Development will:	Indicative Criteria to Proceed to an Air Quality Assessment	Information Relevant to the Proposed Development
1. Cause a significant change in Light Duty Vehicle (LDV) traffic slows on local roads with relevant receptors.	IAQM Guidance states a change of LDV flows of: - More than 100 AADT within or adjacent to an Air Quality Management Area (AQMA) - More than 500 AADT elsewhere.	Traffic data for the cumulative impact of Plot 10a and 10b indicated creases of >100 AADT on nearby road links. Assessment of the impact of increased transport emissions on nearby receptors was therefore scoped in. Dispersion modelling has been carried out to assess the impact on nearby receptors and also to enable an on-site exposure assessment.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors.	A Change of HDV flows of: - More than 25 AADT within or adjacent to an AQMA - More than 100 AADT elsewhere.	No increase in HDV flows is predicted
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA	No realignment of >5m proposed
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. Traffic lights, or roundabouts.	No new junctions are proposed as part of the current scheme
5. Introduce or change a bus station.	Where bus flows will change by: - More than 25 AADT within or adjacent to an AQMA - More than 100 AADT elsewhere.	No bus stations proposed
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).	No car parking proposed
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors.	Typically, any combustion plant where the single or combined NO _x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion.	Heating, cooling and hot water provision for the buildings will be provided by air source heat pumps (ASHPs) powered by electricity. There will be a requirement for back-up diesel generators (life safety and tenant). Generator will operate less than 50 hours per year, based on required maintenance testing. The flues will be located at roof level. Based on the current design, the location of the generator flues and roof top community terrace are >10m horizontal distance. There will also be a 6m separation screen with flues emitting just above this level. Based on the size, minimum operation hours and proposed location of the generators, they are not expected to have a significant impact on local air quality.

Table E-1: Indicative Criteria for Requiring a Detailed Air Quality Assessment

Appendix F– Traffic Data

Site	Receptor Name/Description	Easting	Northing	Receptor Height (m)	2019 Annual Mean NO ₂ Value µg/m ³
MAN77	Hewitt Street	383602	397488	2.5	43.7
MAN82_84	Oxford Road	384233	397287	2.5	51.3

Table F-1: Verification Sites

Figure F1 Trip Distribution Provided By Transport Consultant- Base Flows

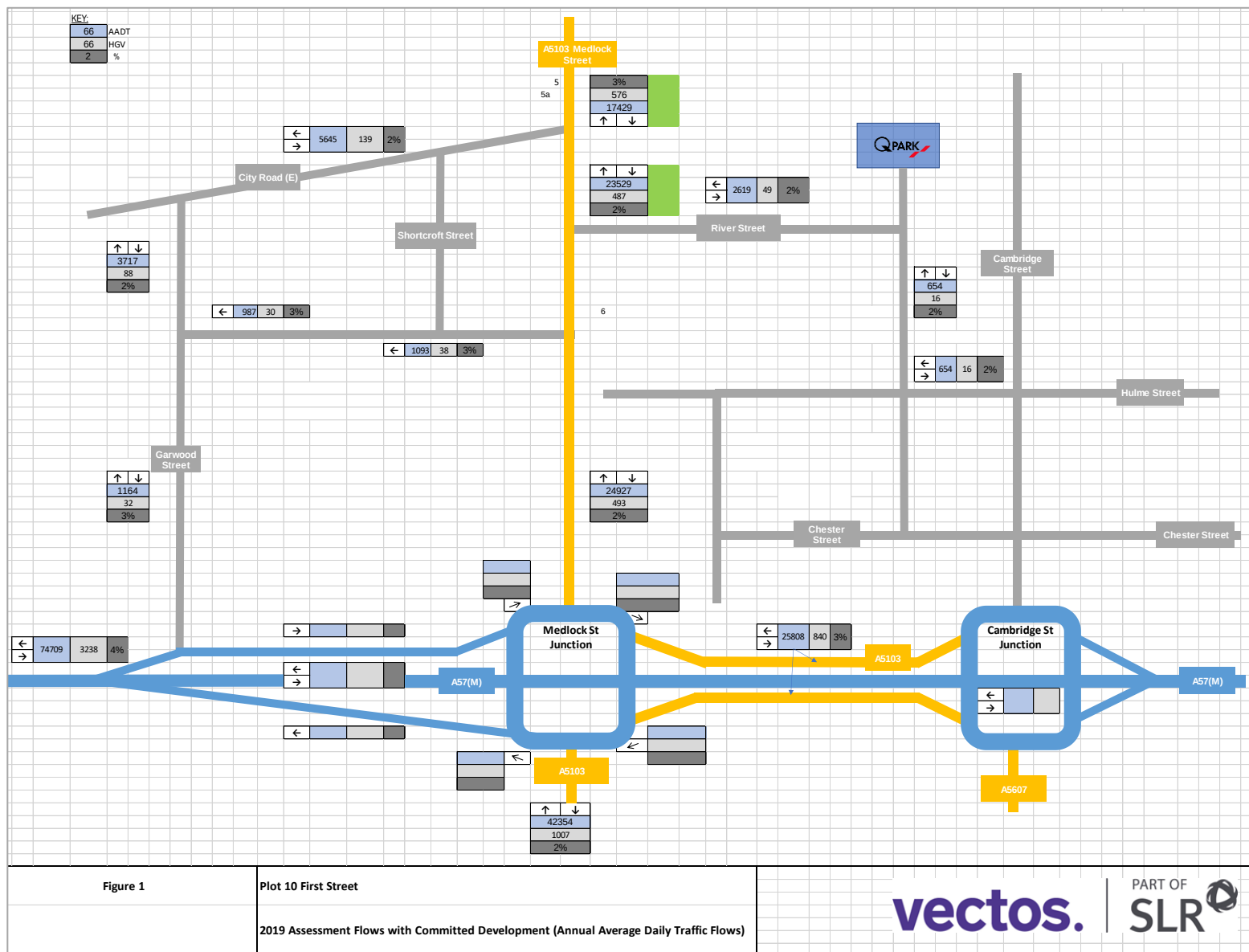


Figure F2 Trip Distribution Provided By Transport Consultant- Development Trips

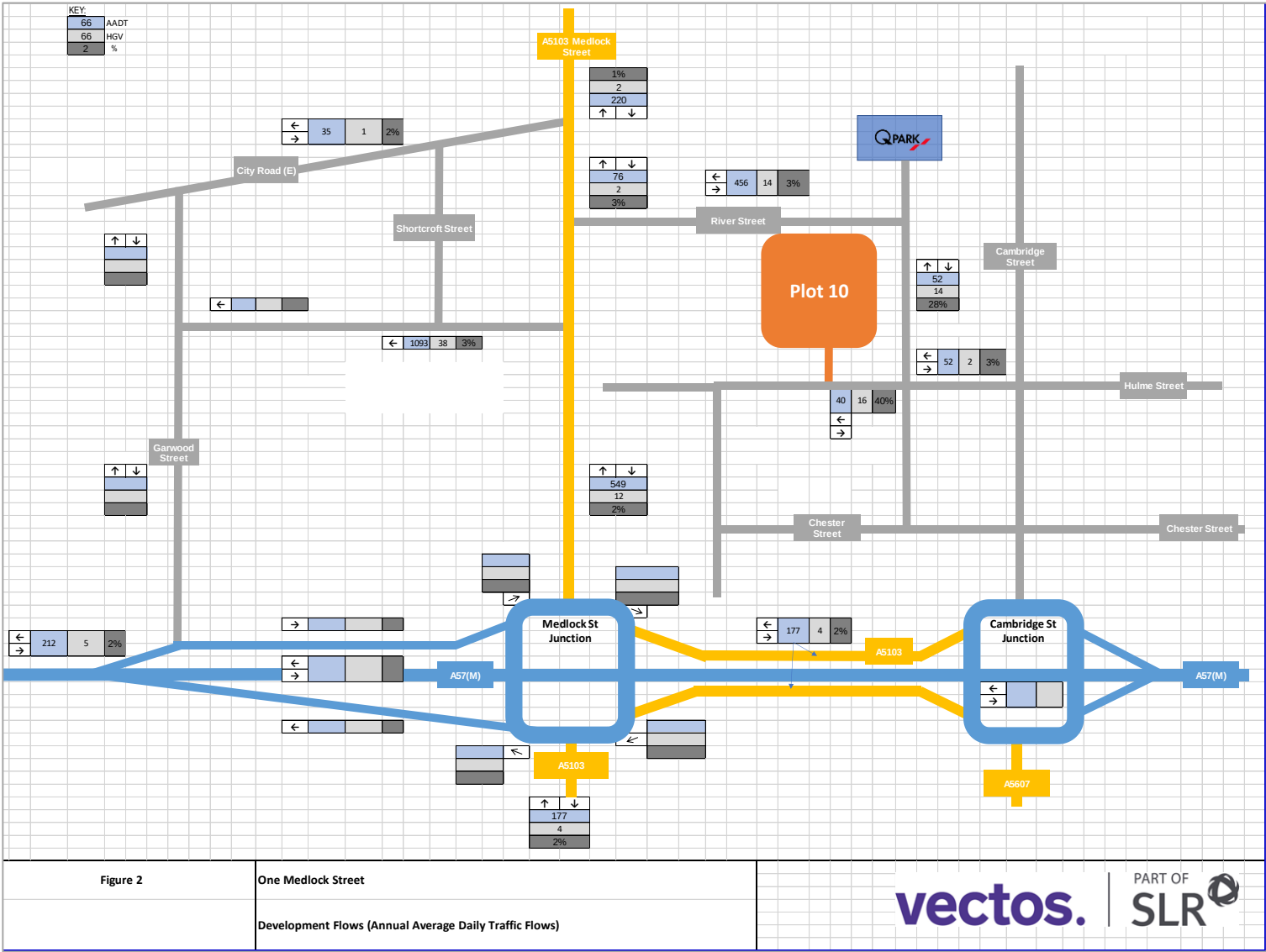


Figure F3 Trip Distribution Provided By Transport Consultant- 2027 Flows Including Development Trips

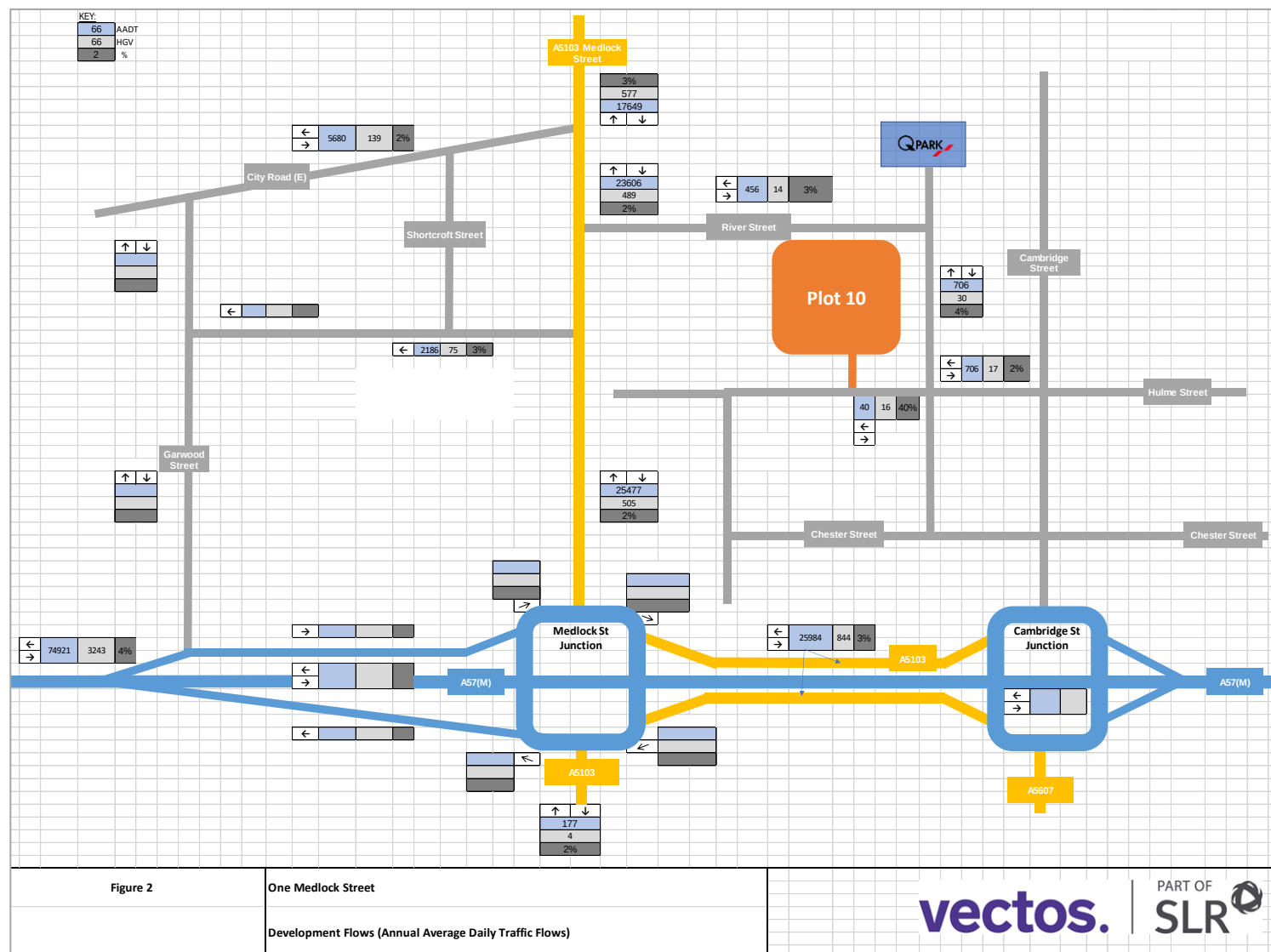
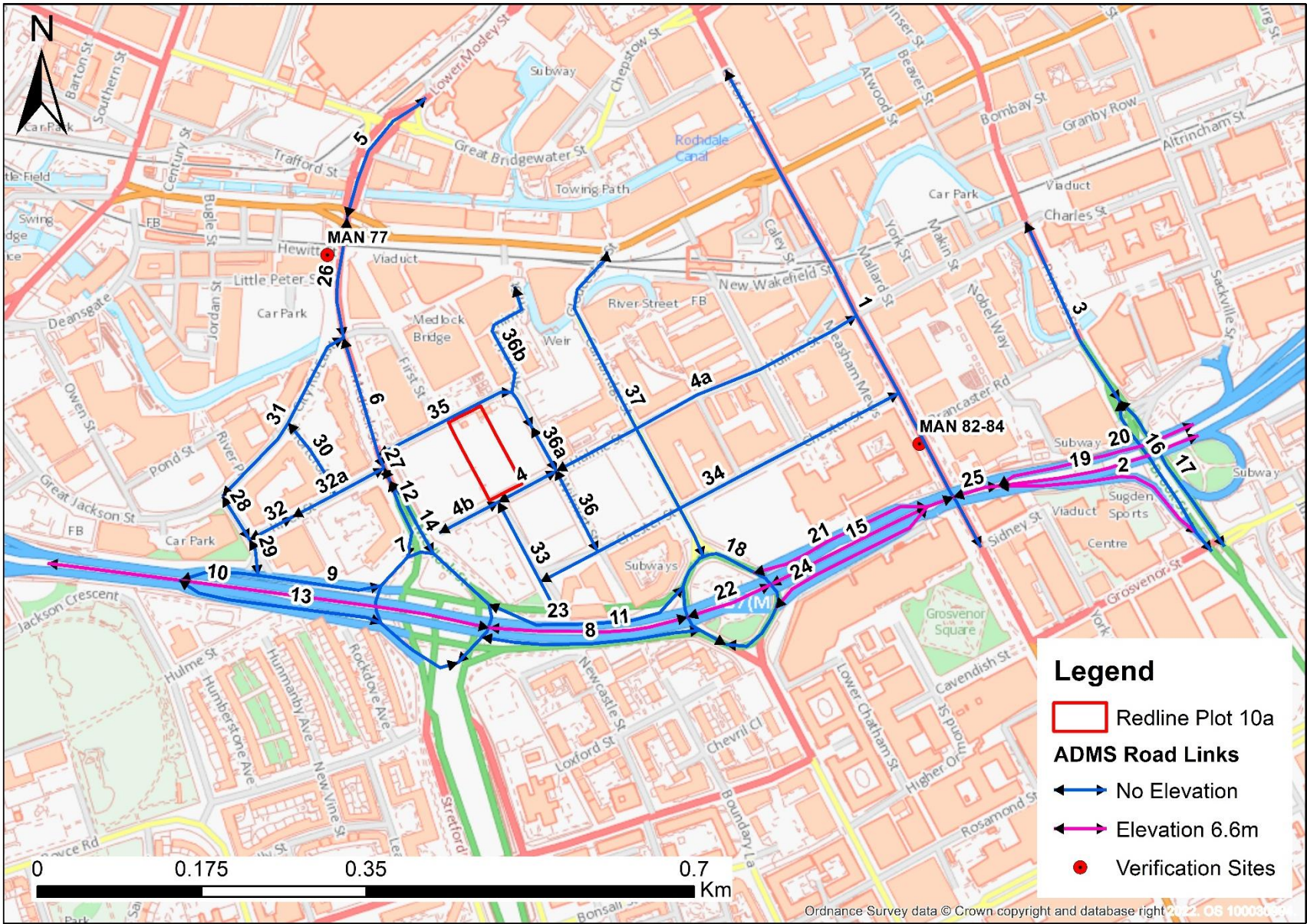


Figure F4 Road Links Used in Model and Position of Verification Sites



Link	Road	Road Width (m)	AADT			%HGV	Estimated Speed (kph)
			2019	2027DM*	2027DS		
1	Oxford Road	8.3	5463	5463	5463	43.6	32
2	Mancunian Way Slip	5.0	12904	12904	12904	3.3	64
3	Brook Street	9.7	8081	8081	8081	4.5	32
4	Hulme Street	18.0	654	654	706	2.4	32
4a	Hulme Street	8.0	654	654	706	2.4	32
4b	Hulme Street	8.0	654	654	706	2.4	32
5	Medlock Street	14.1	17429	17429	17649	3.3	32
6	Medlock Street N	6.2	23529	23529	23606	2.1	32
7	Roundabout 1	12.8	25808	25808	25808	3.3	20
8	Mancunian Way Slip W	6.8	25808	25808	25984	3.2	20
10	Mancunian Way	17.9	74709	74709	74921	4.3	64
11	Mancunian Way	16.2	59556	59556	59556	3.8	64
12	Albion Street	7.2	11765	11765	11803	2.1	20
14	Albion Street	6.5	11765	11765	11803	2.1	20
15	Mancunian Way	18.6	64977	64977	64977	4.1	64
16	Brook Street	7.6	4041	4041	4041	4.5	20
17	Brook Street	7.5	4041	4041	4041	4.5	20
18	Roundabout 2	10.4	25808	25808	25984	3.2	20
19	Mancunian Way	7.9	38941	38941	38941	3.5	64
20	Mancunian Way	5.3	38941	38941	38941	3.5	32
21	Mancunian Way Slip	5.0	12904	12904	12904	3.3	20
22	Mancunian Way	15.6	64977	64977	64977	4.1	64
23	Mancunian Way Slip E	7.5	25808	25808	25984	3.2	20
24	Mancunian Way Slip	5.0	12904	12904	12904	3.3	20
25	Mancunian Way	21.7	64977	64977	64977	4.1	64
26	Medlock Street	17.0	17429	17429	17649	3.3	64
27	Medlock Street	17.5	23529	23529	23606	2.1	32
31	City Road East	9.6	5645	5645	5680	2.4	64
32	River Street	20.6	1093	1093	1093	3.5	32
32a	River Street	8.6	1093	1093	1093	3.5	32
35	River Street	6.2	2619	2619	3075	2.0	32
36a	Wilmott Street	14.3	654	654	706	2.4	32
36b	Wilmott Street	6.5	654	654	706	2.4	32
*No growth factor applied in accordance with advice provided by Transport Consultant							

Table F-2: Historic Traffic Data

Appendix G – Model Verification

Model Verification

Model verification is the process of comparing monitored and modelled pollutant concentrations for the same year, at the same locations, and adjusting modelled concentrations wherever necessary to be consistent with monitoring data. This increases the robustness of modelling results.

Discrepancies between modelled and measured concentrations can arise for a number of reasons, for example:

- Traffic data uncertainties
- Background concentration estimates
- Meteorological data uncertainties
- Sources not explicitly included within the model, for example car parks and bus stops
- Overall model limitations, including treatment of roughness and meteorological data, treatment of speeds), and:
- Uncertainty in monitoring data, particularly diffusion tubes

Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of all of these aspects.

Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of all of these aspects.

Using the guidance provided in Chapter 7 of LAQM.TG (22), the modelled output has been verified against the monitoring data obtained by Manchester City Council, using the closest locations to the Proposed Development.

The performance of the dispersion model was assessed by comparing the modelled concentrations with measured concentrations. Meteorological data, monitored concentrations, vehicle emission rates and traffic data for 2019 were all used in the model verification process.

The model adjustment was undertaken using methodology which requires the determination of the ratio between the measured and modelled road contributed NO_x at each comparison site. The ratio between them, referred to as the adjustment factor, is applied to the modelled road contributed NO_x. The modelled NO₂ is then determined using the Defra NO_x/NO₂ calculator.

Table G-1 presents a summary of the model performance prior to bias adjustment. The model verification is based on Defra EFT V11.0 emission factors.

Ref	Description	Monitored NO ₂ (µg/m ³)	Modelled NO ₂ (µg/m ³)	% Difference (Modelled-Measured) / Measured
MAN77	Hewitt Street	43.7	34.2	-22.0
MAN82_84	Oxford Road	51.3	40.3	-20.3

Table G-1: Model Performance Prior To Bias Adjustment

These comparisons show that the model underpredicted annual mean concentrations of NO₂. Model verification was therefore carried out and an adjustment factor calculated and applied in all scenarios, in accordance with the methodology prescribed in LAQM.TG (22). A regression analysis was undertaken of modelled and measured road NO_x concentrations at these locations. The derived adjustment factor (2.926) was then applied to the modelled road NO_x concentrations to adjust for model bias. The comparison of modelled with measured values was then repeated

and the results are shown in Table G-2.

Ref	Description	Monitored NO ₂ (µg/m ³)	Modelled NO ₂ (µg/m ³)	% Difference (Modelled-Measured) / Measured
MAN77	Hewitt Street	43.7	41.4	-7.5
MAN82_84	Oxford Road	51.3	52.5	2.9

Table G-2: Model Performance After Bias Adjustment

The accuracy of the adjusted model was also considered via the calculation of the Root Mean Square Error (RMSE) and fractional bias.

With the unadjusted model results, the RMSE was 10.0µg/m³, while with the adjusted model results this was reduced to 2.5 µg/m³ so the adjustment has reduced the average error or uncertainty in the model results. LAQM.TG (22) states that ideally, an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m³ for the annual average NO₂ objective. In this respect, the model results are therefore considered robust. The agreement before and after adjustment is illustrated in Figure G-1 and Figure G-2.

Before adjustment

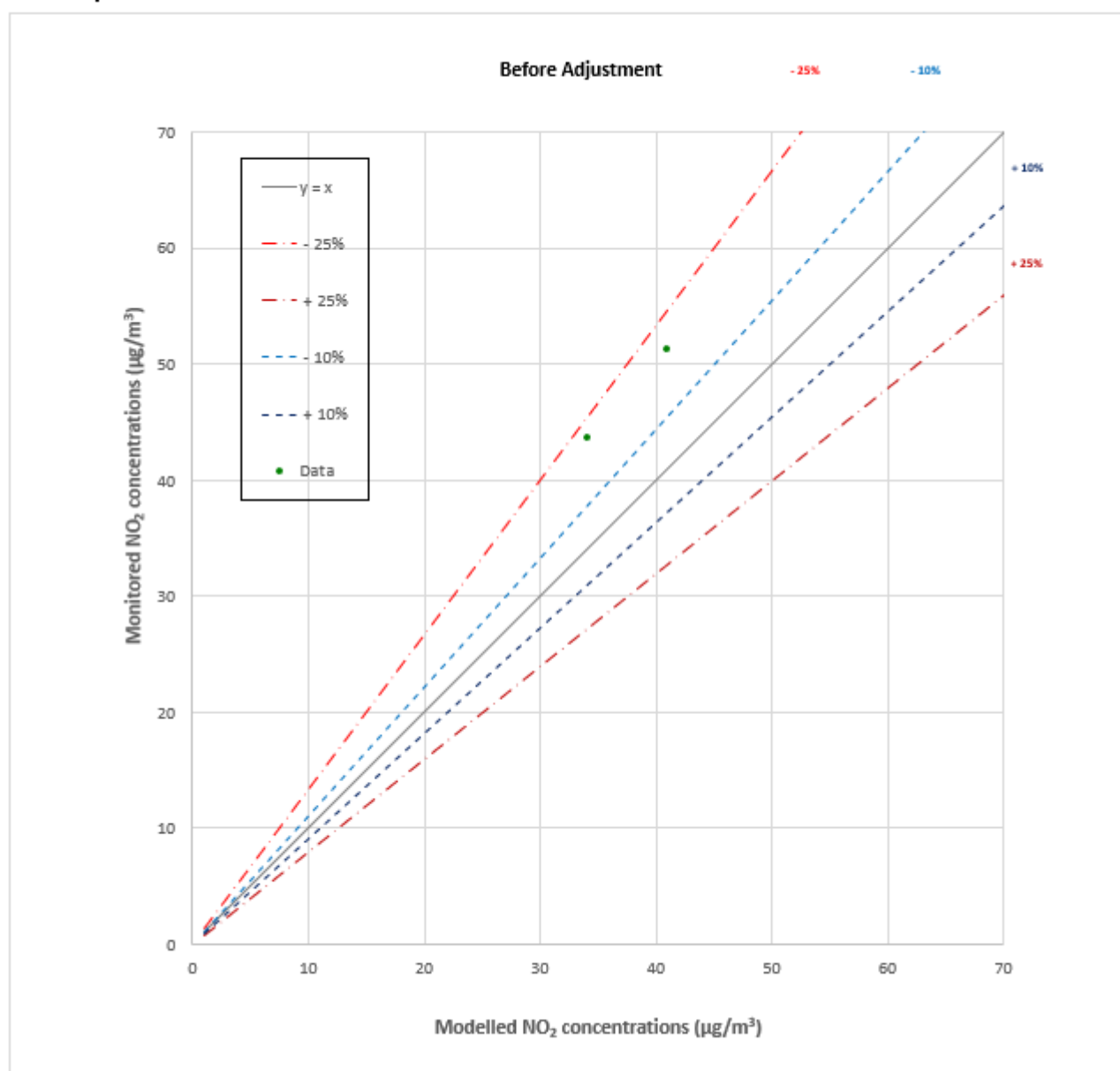


Figure G-1: Before Adjustment

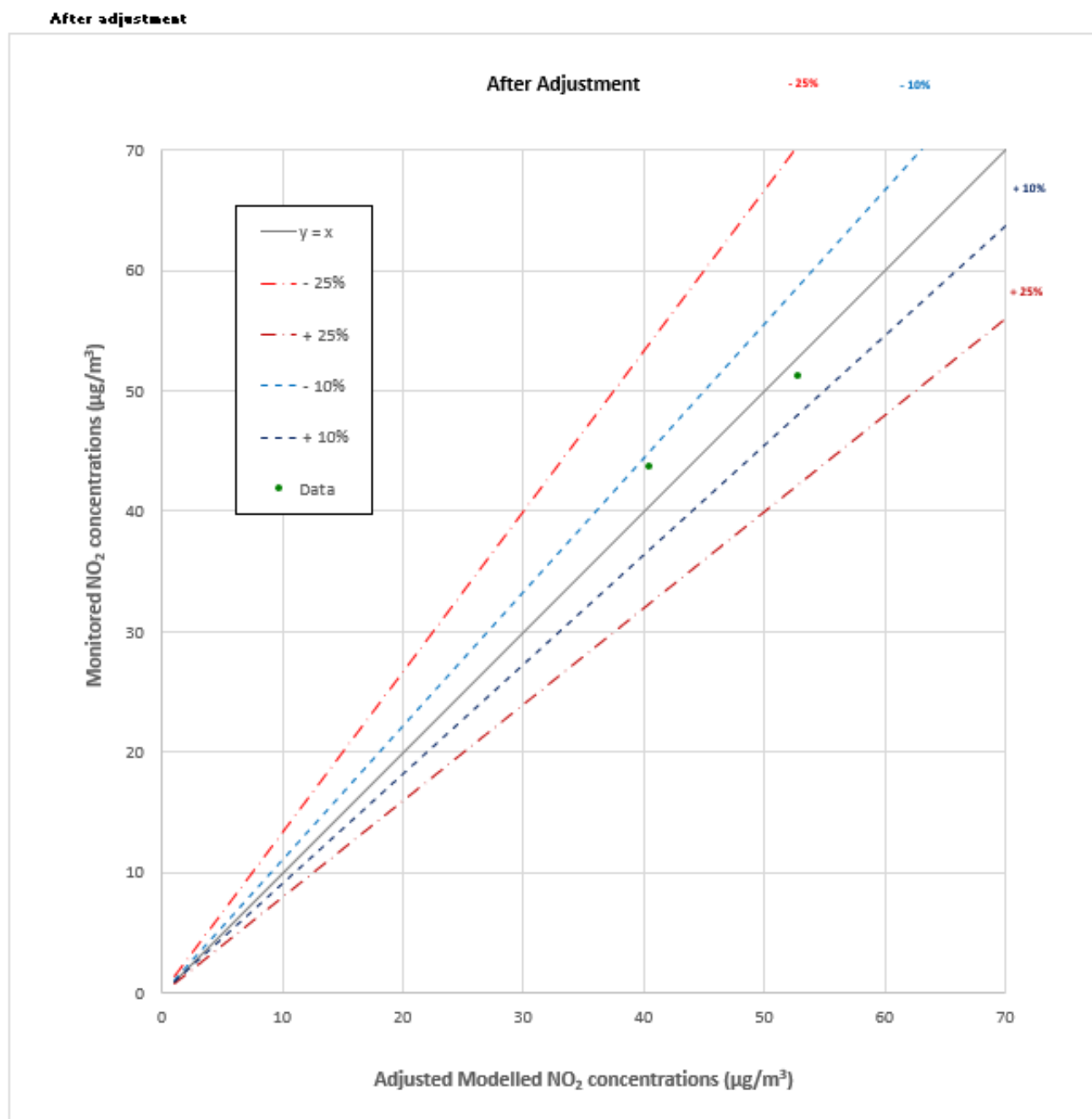


Figure G-2: After Adjustment

The fractional bias was 0.23 with the unadjusted model, which shows a slight tendency to under-predict, and 0.02 with the adjusted model, which shows that the under prediction has been mostly removed.

The final adjusted total NO₂ concentration predicted at the diffusion tubes sites is within $\pm 25\%$ of the measured values and is therefore considered satisfactory.

In accordance with Defra guidance, the road contributed NO_x adjustment factor was also applied to the road contributed PM concentration. The total PM₁₀ and PM_{2.5} concentrations are derived by adding the adjusted road contribution value to the Defra background concentrations.

Appendix H– Dispersion Modelling Results- Existing Receptors

Long-Term NO₂ Concentrations- Impacts from Road Traffic Emissions at Existing Receptors

The effects of the operation phase road traffic NO₂ emissions on existing sensitive receptors close to the Proposed Development are presented in Table H-1.

Results are presented for 2 different scenarios:

- 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Assuming worst case conditions, i.e., no decrease in background pollutant concentrations between base year and opening year, no improvement in vehicle emission factors from 2022, the worst-case impact is 'moderate' at Receptor 5, where there is a predicted increase of 0.3 µg/m³. There are no new exceedances of the NO₂ annual mean air quality objective.

Assuming best case conditions in which vehicle emission factors decrease in line with predicted trends, air quality concentrations at all modelled receptor locations are reduced, including receptor 5, which is reduced to a 0.2 µg/m³ slight increase in NO₂, the impact at all other receptors will be negligible.

Receptor ID	Floor	Annual Mean NO ₂ Concentrations µg/m ³							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
1	GF	37.2	37.4	0.2	Negligible	34.5	34.6	0.1	Negligible
2	GF	38.5	38.6	0.1	Negligible	35.3	35.3	0.1	Negligible
3	GF	66.1	66.3	0.1	Negligible	52.9	53.0	0.1	Negligible
3a	1	60.5	60.6	0.1	Negligible	49.2	49.3	0.1	Negligible
3b	2	52.9	53.0	0.1	Negligible	44.3	44.4	0.1	Negligible
3c	3	46.7	46.7	0.1	Negligible	40.4	40.4	<0.1	Negligible
3d	4	42.0	42.1	<0.1	Negligible	37.5	37.5	<0.1	Negligible
3e	5	38.7	38.7	<0.1	Negligible	35.5	35.5	<0.1	Negligible
3f	6	36.4	36.5	<0.1	Negligible	34.1	34.1	<0.1	Negligible
3g	7	34.9	34.9	<0.1	Negligible	33.2	33.2	<0.1	Negligible
4	GF	71.1	71.3	0.2	Negligible	56.3	56.4	0.1	Negligible
4a	1	64.7	64.8	0.1	Negligible	52.0	52.1	0.1	Negligible
4b	2	57.2	57.2	0.1	Negligible	47.1	47.1	<0.1	Negligible
4c	3	49.2	49.2	0.1	Negligible	41.9	42.0	<0.1	Negligible
4d	4	42.5	42.5	<0.1	Negligible	37.8	37.8	<0.1	Negligible
4e	5	38.5	38.5	<0.1	Negligible	35.3	35.3	<0.1	Negligible
4f	6	36.2	36.2	<0.1	Negligible	33.9	33.9	<0.1	Negligible
4g	7	34.7	34.7	<0.1	Negligible	33.0	33.1	<0.1	Negligible
4h	15	31.4	31.4	<0.1	Negligible	31.1	31.1	<0.1	Negligible
5	GF	44.2	44.5	0.3	Moderate	38.8	39.0	0.2	Slight

Receptor ID	Floor	Annual Mean NO ₂ Concentrations µg/m ³							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
6	GF	36.9	37.1	0.1	Negligible	34.4	34.4	0.1	Negligible
7	GF	39.7	39.8	0.1	Negligible	36.0	36.0	<0.1	Negligible
8	GF	39.4	39.5	0.1	Negligible	35.8	35.9	0.1	Negligible
9	GF	44.9	44.9	0.1	Negligible	39.2	39.2	<0.1	Negligible
10	GF	54.6	54.6	<0.1	Negligible	45.3	45.3	<0.1	Negligible
11	GF	39.0	39.1	<0.1	Negligible	35.6	35.7	<0.1	Negligible
12	GF	39.6	39.6	<0.1	Negligible	35.9	35.9	<0.1	Negligible
13	GF	37.8	37.8	<0.1	Negligible	34.8	34.9	<0.1	Negligible
14	GF	52.9	52.9	<0.1	Negligible	44.2	44.2	<0.1	Negligible
15	GF	43.3	43.3	<0.1	Negligible	39.5	39.5	<0.1	Negligible
16	GF	41.3	41.3	<0.1	Negligible	36.9	37.0	<0.1	Negligible
17	GF	51.4	51.4	0.1	Negligible	44.4	44.5	0.1	Negligible
17a	1	48.9	48.9	0.1	Negligible	42.9	43.0	<0.1	Negligible
17b	2	45.5	45.6	<0.1	Negligible	40.9	40.9	<0.1	Negligible
18	GF	48.6	48.7	0.1	Negligible	41.4	41.5	0.1	Negligible
18a	1	46.2	46.3	0.1	Negligible	40.0	40.0	<0.1	Negligible
18b	2	43.0	43.0	<0.1	Negligible	38.0	38.0	<0.1	Negligible
19	GF	41.8	41.9	<0.1	Negligible	37.3	37.4	<0.1	Negligible
Notes: Exceedances of the annual mean air quality objective are indicated in bold. Values greater than 60µg/m ³ are underlined.									

Table H-1: NO₂ Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Long Term PM₁₀ Concentrations: Impacts from Road Traffic Emissions at Existing Receptors

The effects of the operation phase road traffic PM₁₀ emissions on existing sensitive receptors close to the Proposed Development are presented in Table H-2.

Results are presented for 2 different scenarios:

- 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Modelled PM₁₀ concentrations in both the best- and worst-case scenarios meet the annual mean PM₁₀ objectives at all modelled receptor locations. The impact of operation traffic phase increases is negligible at all locations.

Receptor ID	Floor	Annual Mean PM ₁₀ Concentrations µg/m ³ (Daily Exceedances of 50 µg/m ³ in brackets)							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
1	GF	16.5 (1)	16.6 (1)	0.1	Negligible	16.4 (1)	16.5 (1)	0.1	Negligible
2	GF	16.8 (1)	16.8 (1)	<0.1	Negligible	16.8 (1)	16.8 (1)	<0.1	Negligible
3	GF	24.6 (11)	24.6 (11)	<0.1	Negligible	24.3 (11)	24.4 (11)	<0.1	Negligible
3a	1	23.0 (8)	23.0 (8)	<0.1	Negligible	22.8 (8)	22.8 (8)	<0.1	Negligible
3b	2	20.9 (5)	20.9 (5)	<0.1	Negligible	20.8 (4)	20.8 (4)	<0.1	Negligible
3c	3	19.2 (2)	19.2 (2)	<0.1	Negligible	19.1 (2)	19.1 (2)	<0.1	Negligible
3d	4	17.9 (1)	17.9 (1)	<0.1	Negligible	17.8 (1)	17.8 (1)	<0.1	Negligible
3e	5	17.0 (1)	17.0 (1)	<0.1	Negligible	16.9 (1)	16.9 (1)	<0.1	Negligible
3f	6	16.3 (0)	16.4 (0)	<0.1	Negligible	16.3 (0)	16.3 (0)	<0.1	Negligible
3g	7	15.9 (0)	15.9 (0)	<0.1	Negligible	15.9 (0)	15.9 (0)	<0.1	Negligible
4	GF	25.9(15)	26.0 (15)	0.1	Negligible	25.7 (14)	25.7 (14)	0.1	Negligible
4a	1	24.4 (11)	24.4 (11)	<0.1	Negligible	24.2 (11)	24.2 (11)	<0.1	Negligible
4b	2	22.6 (7)	22.6 (7)	<0.1	Negligible	22.5 (7)	22.5 (7)	<0.1	Negligible
4c	3	20.1 (4)	20.2 (4)	<0.1	Negligible	20.1 (3)	20.1 (3)	<0.1	Negligible
4d	4	18.1 (1)	18.1 (1)	<0.1	Negligible	18 (1)	18 (1)	<0.1	Negligible
4e	5	16.9 (1)	16.9 (1)	<0.1	Negligible	16.9 (1)	16.9 (1)	<0.1	Negligible
4f	6	16.3 (0)	16.3 (0)	<0.1	Negligible	16.3 (0)	16.3 (0)	<0.1	Negligible
4g	7	15.9 (0)	15.9 (0)	<0.1	Negligible	15.9 (0)	15.9 (0)	<0.1	Negligible
4h	15	15.0 (0)	15.0 (0)	<0.1	Negligible	15 (0)	15 (0)	<0.1	Negligible
5	GF	18.4 (2)	18.4 (2)	0.1	Negligible	18.3 (2)	18.4 (2)	0.1	Negligible
6	GF	16.4 (0)	16.5 (0)	<0.1	Negligible	16.4 (0)	16.4 (0)	<0.1	Negligible
7	GF	17.1 (1)	17.1 (1)	<0.1	Negligible	17.1 (1)	17.1 (1)	<0.1	Negligible
8	GF	17.1 (1)	17.1 (1)	<0.1	Negligible	17 (1)	17 (1)	<0.1	Negligible
9	GF	18.4 (2)	18.4 (2)	<0.1	Negligible	18.3 (2)	18.3 (2)	<0.1	Negligible
10	GF	21.1 (5)	21.1 (5)	<0.1	Negligible	20.9 (5)	20.9 (5)	<0.1	Negligible
11	GF	17.2 (1)	17.2 (1)	<0.1	Negligible	17.1 (1)	17.2 (1)	<0.1	Negligible
12	GF	17.4 (1)	17.4 (1)	<0.1	Negligible	17.3 (1)	17.3 (1)	<0.1	Negligible
13	GF	16.8 (1)	16.8 (1)	<0.1	Negligible	16.7 (1)	16.7 (1)	<0.1	Negligible

Receptor ID	Floor	Annual Mean PM ₁₀ Concentrations µg/m ³ (Daily Exceedances of 50 µg/m ³ in brackets)							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
14	GF	20.5 (4)	20.5 (4)	<0.1	Negligible	20.4 (4)	20.4 (4)	<0.1	Negligible
15	GF	18.3 (2)	18.3 (2)	<0.1	Negligible	18.2 (2)	18.2 (2)	<0.1	Negligible
16	GF	17.6 (1)	17.6 (1)	<0.1	Negligible	17.5 (1)	17.5 (1)	<0.1	Negligible
17	GF	20.3 (4)	20.3 (4)	<0.1	Negligible	20.1 (4)	20.2 (4)	<0.1	Negligible
17a	1	19.6 (3)	19.7 (3)	<0.1	Negligible	19.5 (3)	19.5 (3)	<0.1	Negligible
17b	2	18.8 (2)	18.8 (2)	<0.1	Negligible	18.7 (2)	18.7 (2)	<0.1	Negligible
18	GF	19.4 (3)	19.4 (3)	<0.1	Negligible	19.3 (3)	19.3 (3)	<0.1	Negligible
18a	1	18.8 (2)	18.8 (2)	<0.1	Negligible	18.7 (2)	18.7 (2)	<0.1	Negligible
18b	2	18.0 (1)	18.0 (1)	<0.1	Negligible	17.9 (1)	17.9 (1)	<0.1	Negligible
19	GF	17.8 (1)	17.8 (1)	<0.1	Negligible	17.7 (1)	17.7 (1)	<0.1	Negligible

Table H-2: PM₁₀ Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Long Term PM_{2.5} Concentrations: Impacts from Road Traffic Emissions at Existing Receptors

The effects of the operation phase road traffic PM_{2.5} emissions on existing sensitive receptors close to the Proposed Development are presented in Table H-3.

Results are presented for 2 different scenarios:

- 2019 Background with traffic flows factored to 2027 and 2022 emission factors (worst case)
- 2019 Background with traffic flows factored to 2027 and 2027 emission factors (best case)

Modelled PM_{2.5} concentrations in both the best- and worst-case scenarios meet the annual mean PM_{2.5} objectives at all modelled receptor locations. The impact of operation traffic phase increases is negligible at all locations.

Receptor ID	Floor	Annual Mean PM _{2.5} Concentrations µg/m ³							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
1	GF	10.7	10.8	<0.1	Negligible	10.7	10.7	<0.1	Negligible
2	GF	10.9	10.9	<0.1	Negligible	10.9	10.9	<0.1	Negligible
3	GF	15.4	15.4	<0.1	Negligible	15.1	15.1	<0.1	Negligible
3a	1	14.4	14.4	<0.1	Negligible	14.2	14.2	<0.1	Negligible
3b	2	13.2	13.2	<0.1	Negligible	13.1	13.1	<0.1	Negligible
3c	3	12.3	12.3	<0.1	Negligible	12.2	12.2	<0.1	Negligible
3d	4	11.5	11.5	<0.1	Negligible	11.5	11.5	<0.1	Negligible
3e	5	11.0	11.0	<0.1	Negligible	11.0	11.0	<0.1	Negligible
3f	6	10.7	10.7	<0.1	Negligible	10.6	10.6	<0.1	Negligible
3g	7	10.4	10.4	<0.1	Negligible	10.4	10.4	<0.1	Negligible
4	GF	16.1	16.2	<0.1	Negligible	15.9	15.9	<0.1	Negligible
4a	1	15.2	15.3	<0.1	Negligible	15.0	15.0	<0.1	Negligible
4b	2	14.2	14.2	<0.1	Negligible	14.0	14.0	<0.1	Negligible
4c	3	12.8	12.8	<0.1	Negligible	12.7	12.7	<0.1	Negligible
4d	4	11.6	11.6	<0.1	Negligible	11.6	11.6	<0.1	Negligible
4e	5	11.0	11.0	<0.1	Negligible	10.9	10.9	<0.1	Negligible
4f	6	10.6	10.6	<0.1	Negligible	10.6	10.6	<0.1	Negligible
4g	7	10.4	10.4	<0.1	Negligible	10.4	10.4	<0.1	Negligible
4h	15	9.9	9.9	<0.1	Negligible	9.9	9.9	<0.1	Negligible
5	GF	11.8	11.9	0.1	Negligible	11.7	11.8	0.1	Negligible
6	GF	10.7	10.7	<0.1	Negligible	10.7	10.7	<0.1	Negligible
7	GF	11.1	11.1	<0.1	Negligible	11.0	11.0	<0.1	Negligible
8	GF	11.1	11.1	<0.1	Negligible	11.0	11.0	<0.1	Negligible
9	GF	11.8	11.8	<0.1	Negligible	11.7	11.7	<0.1	Negligible
10	GF	13.4	13.4	<0.1	Negligible	13.2	13.2	<0.1	Negligible
11	GF	11.1	11.1	<0.1	Negligible	11.1	11.1	<0.1	Negligible
12	GF	11.2	11.2	<0.1	Negligible	11.2	11.2	<0.1	Negligible
13	GF	10.9	10.9	<0.1	Negligible	10.8	10.8	<0.1	Negligible

Receptor ID	Floor	Annual Mean PM _{2.5} Concentrations µg/m ³							
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)				2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)			
		DM	DS	DS-DM	Impact	DM	DS	DS-DM	Impact
14	GF	13.1	13.1	<0.1	Negligible	12.9	12.9	<0.1	Negligible
15	GF	11.7	11.7	<0.1	Negligible	11.7	11.7	<0.1	Negligible
16	GF	11.3	11.3	<0.1	Negligible	11.3	11.3	<0.1	Negligible
17	GF	12.9	12.9	<0.1	Negligible	12.7	12.7	<0.1	Negligible
17a	1	12.5	12.5	<0.1	Negligible	12.4	12.4	<0.1	Negligible
17b	2	12.0	12.0	<0.1	Negligible	11.9	11.9	<0.1	Negligible
18	GF	12.4	12.4	<0.1	Negligible	12.3	12.3	<0.1	Negligible
18a	1	12.1	12.1	<0.1	Negligible	11.9	12.0	<0.1	Negligible
18b	2	11.6	11.6	<0.1	Negligible	11.5	11.5	<0.1	Negligible
19	GF	11.5	11.5	<0.1	Negligible	11.4	11.4	<0.1	Negligible

Table H-3: PM_{2.5} Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Appendix I Dispersion Modelling Results- New Receptors

Long-Term NO₂ Concentrations- Emissions from Road Traffic

The effects of the operation phase road traffic NO₂ emissions on new receptors within the Proposed Development are presented in Table I-1.

Receptor ID	Floor	Annual Mean NO ₂ Concentration µg/m ³	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P1	GF	39.5	35.9
P1a	1	37.7	34.8
P1b	2	36.7	34.2
P1c	3	35.8	33.7
P1d	4	34.9	33.1
P1e	5	34.4	32.8
P1f	6	33.4	32.3
P1g	7	32.9	32.0
P1h	8	32.4	31.7
P1i	9	32.1	31.5
P1j	10	31.8	31.3
P1k	11	31.6	31.2
P1l	12	31.4	31.1
P2	GF	37.5	35.6
P2a	1	36.3	34.2
P2b	2	35.7	33.8
P2c	3	35.1	33.4
P2d	4	34.5	33.0
P2e	5	34.1	32.7
P2f	6	33.4	32.3
P2g	7	32.9	32.0
P2h	8	32.5	31.7
P2i	9	32.2	31.5
P2j	10	31.9	31.4
P2k	11	31.6	31.2
P2l	12	31.4	31.1
P3	GF	40.2	36.4
P3a	1	39.6	35.9
P3b	2	38.9	35.4
P3c	3	37.1	34.8
P3d	4	36.2	34.2

Receptor ID	Floor	Annual Mean NO ₂ Concentration µg/m ³	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P3e	5	35.7	33.8
P3f	6	34.7	33.1
P3g	7	34.1	32.7
P3h	8	33.6	32.4
P3i	9	32.2	31.5
P3j	10	31.9	31.3
P3k	11	31.6	31.2
P3l	12	31.4	31.1
P4	GF	41.2	36.9
P4a	1	39.8	36.1
P4b	2	38.6	35.3
P4c	3	37.2	34.5
P4d	4	35.9	33.7
P4e	5	35.2	33.3
P4f	6	33.8	32.5
P4g	7	33.1	32.1
P4h	8	32.5	31.7
P4i	9	32.1	31.5
P4j	10	31.8	31.3
P4k	11	31.5	31.2
P4l	12	31.3	31.0

Table I-1: Annual Mean NO₂ Concentrations at Modelled Receptors During the Operation Phase

Results are presented for 2 different scenarios:

- 2019 Background with 2027 traffic flows and 2022 emission factors (worst case)
- 2019 Background with 2027 traffic flows and 2027 emission factors (best case)

Following interpretation of modelled results, the following exceedances of the annual mean objective were recorded:

- **P1**- No exceedances on any floors in worst case and best-case scenarios
- **P2**- No exceedances on any floors in worst case and best-case scenarios
- **P3**- Worst case: exceedances on ground floor only; best case: no exceedances on any floors
- **P4**- Worst case: exceedances on ground floor only; best case: no exceedances on any floors

Long Term PM₁₀ Concentrations: Operation Phase Road Traffic Emissions

The effects of the operation phase road traffic PM₁₀ emissions are presented in Table I-2.

Modelled PM₁₀ concentrations in all scenarios meet the annual mean PM₁₀ objectives at all receptor locations.

Receptor ID	Floor	Annual Mean PM ₁₀ Concentration µg/m ³ (Daily Exceedances of 50 µg/m ³ in brackets)	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P1	GF	17.1 (1)	17 (1)
P1a	1	16.6 (1)	16.6 (1)
P1b	2	16.4 (0)	16.3 (0)
P1c	3	16.1 (0)	16.1 (0)
P1d	4	15.9 (0)	15.9 (0)
P1e	5	15.8 (0)	15.8 (0)
P1f	6	15.5 (0)	15.5 (0)
P1g	7	15.4 (0)	15.4 (0)
P1h	8	15.3 (0)	15.3 (0)
P1i	9	15.2 (0)	15.2 (0)
P1j	10	15.1 (0)	15.1 (0)
P1k	11	15.0 (0)	15.0 (0)
P1l	12	15.0 (0)	15.0 (0)
P2	GF	17.0 (1)	16.9 (1)
P2a	1	16.4 (0)	16.3 (0)
P2b	2	16.2 (0)	16.1 (0)
P2c	3	16.0 (0)	16.0 (0)
P2d	4	15.8 (0)	15.8 (0)
P2e	5	15.7 (0)	15.7 (0)
P2f	6	15.5 (0)	15.5 (0)
P2g	7	15.4 (0)	15.4 (0)
P2h	8	15.3 (0)	15.3 (0)
P2i	9	15.2 (0)	15.2 (0)
P2j	10	15.1 (0)	15.1 (0)
P2k	11	15.1 (0)	15.1 (0)
P2l	12	15.0 (0)	15.0 (0)
P3	GF	17.3 (1)	17.2 (1)
P3a	1	17.1 (1)	17.0 (1)
P3b	2	16.9 (1)	16.8 (1)
P3c	3	16.6 (1)	16.6 (1)
P3d	4	16.4 (0)	16.3 (0)
P3e	5	16.2 (0)	16.2 (0)

Receptor ID	Floor	Annual Mean PM ₁₀ Concentration µg/m ³ (Daily Exceedances of 50 µg/m ³ in brackets)	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P3f	6	15.9 (0)	15.9 (0)
P3g	7	15.7 (0)	15.7 (0)
P3h	8	15.6 (0)	15.6 (0)
P3i	9	15.2 (0)	15.2 (0)
P3j	10	15.1 (0)	15.1 (0)
P3k	11	15.1 (0)	15.0 (0)
P3l	12	15.0 (0)	15.0 (0)
P4	GF	17.5 (1)	17.4 (1)
P4a	1	17.2 (1)	17.1 (1)
P4b	2	16.8 (1)	16.8 (1)
P4c	3	16.5 (0)	16.5 (0)
P4d	4	16.2 (0)	16.1 (0)
P4e	5	16.0 (0)	16.0 (0)
P4f	6	15.6 (0)	15.6 (0)
P4g	7	15.4 (0)	15.4 (0)
P4h	8	15.3 (0)	15.3 (0)
P4i	9	15.2 (0)	15.2 (0)
P4j	10	15.1 (0)	15.1 (0)
P4k	11	15.0 (0)	15.0 (0)
P4l	12	15.0 (0)	15.0 (0)

Table I-2: PM₁₀ Annual Mean Concentrations at Modelled Receptors During the Operation Phase)

Long Term PM_{2.5} Concentrations: Operation Phase Road Traffic Emissions

The effects of the operation phase road traffic PM_{2.5} emissions are presented In Table I-3.

Modelled PM_{2.5} concentrations in all scenarios meet the annual mean PM_{2.5} objectives at all receptor locations.

Receptor ID	Floor	Annual Mean PM _{2.5} Concentration µg/m ³	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P1	GF	11.1	11.0
P1a	1	10.8	10.8
P1b	2	10.7	10.6
P1c	3	10.5	10.5
P1d	4	10.4	10.4
P1e	5	10.3	10.3
P1f	6	10.2	10.2
P1g	7	10.1	10.1
P1h	8	10.0	10.0
P1i	9	10.0	10.0
P1j	10	10.0	9.9
P1k	11	9.9	9.9
P1l	12	9.9	9.9
P2	GF	11.0	11.0
P2a	1	10.7	10.6
P2b	2	10.6	10.5
P2c	3	10.5	10.4
P2d	4	10.4	10.3
P2e	5	10.3	10.3
P2f	6	10.2	10.2
P2g	7	10.1	10.1
P2h	8	10.1	10.0
P2i	9	10.0	10.0
P2j	10	10.0	9.9
P2k	11	9.9	9.9
P2l	12	9.9	9.9
P3	GF	11.2	11.1
P3a	1	11.1	11.0
P3b	2	11.0	10.9
P3c	3	10.8	10.8
P3d	4	10.7	10.6
P3e	5	10.6	10.5
P3f	6	10.4	10.4

Receptor ID	Floor	Annual Mean PM _{2.5} Concentration µg/m ³	
		2019 Background with 2027 traffic flows and 2022 Emissions (Worst Case)	2019 Background with 2027 traffic flows and 2027 Emissions (Best Case)
P3g	7	10.3	10.3
P3h	8	10.2	10.2
P3i	9	10.0	10.0
P3j	10	10.0	9.9
P3k	11	9.9	9.9
P3l	12	9.9	9.9
P4	GF	11.3	11.2
P4a	1	11.1	11.0
P4b	2	10.9	10.9
P4c	3	10.7	10.7
P4d	4	10.6	10.5
P4e	5	10.4	10.4
P4f	6	10.3	10.2
P4g	7	10.1	10.1
P4h	8	10.1	10.0
P4i	9	10.0	10.0
P4j	10	9.9	9.9
P4k	11	9.9	9.9
P4l	12	9.9	9.9

Table I-3: PM_{2.5} Annual Mean Concentrations at Modelled Receptors During the Operation Phase

Appendix J – Mitigation Measures for Construction

Primary measures are those that will be implemented at all times; Secondary measures will be implemented as necessary (in agreement with the local authority), while n/a measures are not required for a given level of risk.

Site Management	Low Risk	Medium Risk	High Risk
1. Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary.	Primary		
2. Display the head or regional office contact information.	Primary		
3. Record and respond to all dust and air quality pollutant emissions complaints.	Primary		
4. Make a complaint log available to the local authority.	Primary		
5. Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority.	Primary		
6. Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry, or windy conditions.	Primary		
7. Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.	Primary		
8. Develop and implement a stakeholder communications plan that includes community engagement before work commences on-site.	n/a	Primary	
9. Develop a dust management plan .	n/a	Primary	
10. Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.	n/a		Primary

Table J-1: Construction Mitigation Measures- Site Management

Preparing and Maintaining the Site	Low Risk	Medium Risk	High Risk
11. Plan site layout: machinery and dust causing activities will be located away from receptors.	Primary		
12. Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on-site.	Primary		
13. Avoid site runoff of water or mud.	Primary		
14. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	Secondary	Primary	
15. Keep site fencing, barriers, and scaffolding clean using wet methods.	Secondary	Primary	
16. Remove materials from site as soon as possible.	Secondary	Primary	
17. Cover, seed, or fence stockpiles to prevent wind whipping.	Secondary	Primary	
18. Agree monitoring locations with the local authority.	n/a	Primary	
19. Where possible, commence baseline monitoring at least three months before phase begins.	n/a	Primary	
20. Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly.	n/a	Primary	
21. Carry out regular dust soiling checks of buildings within 100 m of site boundary and, if necessary, cleaning to be provided.	n/a	Secondary	Primary
22. Consider, if practical, installation of green walls, screens, or other green infrastructure to minimise the impact of dust and pollution.	n/a	Secondary	

Table J-2: Construction Mitigation Measures- Preparing and Maintaining the Site

Operating Vehicle/Machinery and Sustainable Travel	Low Risk	Medium Risk	High Risk
23. Ensure all non-road mobile machinery (NRMM) complies with relevant local standards.	Primary		
24. Ensure all vehicles switch off engines when stationary – no idling vehicles.	Primary		
25. Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment.	Primary		
26. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	n/a	Secondary	Primary
27. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	n/a	Primary	
28. Impose and signpost a maximum-speed-limit of 10 mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority).	Secondary		Primary

Table J-3: Construction Mitigation Measures- Operating Vehicle/Machinery and Sustainable Travel

Operations	Low Risk	Medium Risk	High Risk
29. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Primary		
30. Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water).	Primary		
31. Use enclosed chutes, conveyors, and covered skips.	Primary		
32. Minimise drop heights from conveyors, loading shovels, hoppers, and other loading, or handling equipment, and use fine water sprays on such equipment.	Primary		
33. Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	n/a	Primary	

Table J-4: Construction Mitigation Measures- Operations

Waste Management	Low Risk	Medium Risk	High Risk
34. Reuse and recycle waste to reduce dust from waste materials	Primary		
35. Avoid bonfires and burning of waste materials.	Primary		

Table J-5: Construction Mitigation Measures- Waste Management Activities

Measurement Specific to Demolition	Low Risk	Medium Risk	High Risk
36. Ensure water suppression is used during demolition operations.	Primary		
37. Avoid explosive blasting, using appropriate manual, or mechanical alternatives.	Primary		
38. Bag and remove any biological debris or damp down such material before demolition.	Primary		
39. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	Secondary		Primary

Table J-6: Construction Mitigation Measures- Demolition Activities

Measurement Specific to Earthworks	Low Risk	Medium Risk	High Risk
40. Consider re-vegetating earthworks and exposed areas/soil stockpiles to stabilise surfaces.	n/a	Secondary	Primary
41. Consider the use of hessian, mulches, or trackifiers where it is not possible to re-vegetate or cover with topsoil.	n/a	Secondary	Primary
42. Only remove secure covers in small areas during work and not all at once.	n/a	Secondary	Primary

Table J-7: Construction Mitigation Measures- Earthworks Activities

Measurement Specific to Construction	Low Risk	Medium Risk	High Risk
43. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	Secondary	Primary	
44. Avoid scabbling (roughening of concrete surfaces) if possible	Secondary		Primary
45. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	n/a	Secondary	Primary
46. For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.	n/a	Secondary	

Table J-8: Construction Mitigation Measures- Construction Activities

Measures Specific To Trackout	Low Risk	Medium Risk	High Risk
47. Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.	Secondary	Primary	
48. Avoid dry sweeping of large areas.	Secondary	Primary	
49. Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.	Secondary	Primary	
50. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site).	Secondary	Primary	
51. Record all inspections of haul routes and any subsequent action in a site log book.	Secondary	Primary	
52. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned.	n/a	Primary	
53. Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;	n/a	Primary	
54. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size, and layout permits.	n/a	Primary	
55. Access gates to be located at least 10 m from receptors where possible.	n/a	Primary	
56. Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site.	n/a	Secondary	Primary

Table J-9: Construction Mitigation Measures- Trackout Activities

