Air Quality Assessment

155 Drummond Street, Camden

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Air Quality Assessment

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1 INTRODUCTION

1.1 Scope

GEM Air Quality Ltd has been commissioned to undertake a detailed air quality assessment based on the potential impacts of existing and future traffic levels on a residential development located at 155 Drummond Street in Camden, London. The pollutants modelled as part of this assessment are nitrogen oxides (NOx) and particulate matter (PM_{10}).

The impacts of vehicle emissions have been assessed using the techniques detailed within Volume 11, Section 3 of the Design Manual for Roads and Bridges (DMRB)[1] and the London Local Air Quality Management Technical Guidance (LLAQM.TG16)[2]. The impact of road traffic emissions will be assessed using the ADMS-Roads air dispersion model. This model has been devised by Cambridge Environmental Research Consultants (CERC) and is described as a "*comprehensive tool for investigating air pollution problems due to small networks of roads*".

It should be noted that the short-term impacts of NO_2 and PM_{10} emissions have not been modelled as dispersion models are inevitably poor at predicting short-term peaks in pollutant concentrations, which are highly variable from year to year, and from site to site. Notwithstanding this, general assumptions have been made about short term concentrations based on the modelled annual mean concentrations.

In addition to this, the assessment has also assessed the potential impact on local air quality from demolition and construction activities at the site.

1 Design Manual for Roads and Bridges, Vo 11, Section 3, Part 1 – HA207/07, Highways Agency, May 2007

2 London Local Air Quality Management (LLAQM), Technical Guidance, April 2016 (LLAQM.TG (16))

2 Pollutants & Legislation

2.1 Pollutant Overview

In most urban areas of the UK, traffic generated pollutants have become the most common pollutants. These are nitrogen dioxide (NO_2), fine particulates (PM_{10}), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO_2). This air quality assessment focuses on NO_2 and PM_{10}, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO_2 and PM_{10}.

Table 1 – Overview of NO_2 and PM_{10}

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM_{10})	Tiny particulates of solid or liquid nature suspended in the air	Road transport; Power generation plants; Production processes e.g. windblown dust	Soil erosion; Volcanoes; Forest fires; Sea salt crystals	Asthma; Lung cancer; Cardiovascular problems
Nitrogen Dioxide (NO_2)	Reddish-brown coloured gas with a distinct odour	Road transport; Power generation plants; Fossil fuels – extraction & distribution; Petroleum refining	No natural sources, although nitric oxide (NO) can form in soils	Pulmonary edema; Various environmental impacts e.g. acid rain

2.2 Air Quality Strategy

The UK Government and the devolved administrations published the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland on 17 July 2007[3]. The Strategy provides an over-arching strategic framework for air quality management in the UK.

With regards to this assessment, the Air Quality Strategy contains national air quality standards and objectives established by the Government to protect human health. The objectives for nitrogen dioxide and particulates (PM_{10} and $PM_{2.5}$) have been set, along with seven other pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, PAHs, sulphur dioxide and ozone). Those which are limit values required by EU Daughter Directives on Air Quality have been transposed into UK law through the Air Quality Standards Regulations 2010 which came into force on 11th June 2010. Table 2 provides the UK Air Quality Objectives for NO_2 and PM_{10}.

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007

Table 2 – UK Air Quality Objectives for Nitrogen Dioxide and Particulate Matter

Pollutant	Objective	Concentration measured as
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean
	40µg/m^3	Annual mean
Particles ($PM_{2.5}$)	25µg/m^3 (except Scotland)	Annual Mean
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1 hour mean
	40µg/m^3	Annual mean

Objectives for $PM_{2.5}$ were also introduced by the UK Government and the Devolved Administrations in 2010. However, these are not included in Regulations as the Air Quality Strategy has adopted an “exposure reduction” approach for $PM_{2.5}$ in order to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas.

As defined in Table 4, background $PM_{2.5}$ concentrations are well below the limit value of 25.0 µg/m^3. As such, no further consideration has been given to $PM_{2.5}$ within this assessment.

2.3 Clean Air Strategy

The Clean Air Strategy[4] was published in January 2019 and sets out the comprehensive action that is required from across all parts of government and society to tackle all sources of air pollution. New legislation will create a stronger and more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

4 Clean Air Strategy 2019, Department for Environment, Food and Rural Affairs, January 2019

2.4 London Local Air Quality Management (LLAQM)

At the core of LLAQM delivery are three pollutant objectives; these are: nitrogen dioxide (NO_2), particulate matter (PM_{10}) and sulphur dioxide (SO_2). All current Air Quality Management Areas (AQMAs) across the UK are declared for one or more of these pollutants, with NO_2 accounting for the majority. In Greater London, AQMAs are declared for NO_2 and PM_{10} in equal proportions. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

2.4.1 London Borough of Camden

The Council has declared an Air Quality Management Area (AQMA). The AQMA encompasses the whole of the borough and has been declared for NO_2 and PM_{10} from road transport. The proposed development is located within this AQMA.

3 PLANNING POLICY & GUIDANCE

3.1 National Planning Policy & Guidance

3.1.1 National Planning Policy Framework

On a national level, air quality can be a material consideration in planning decisions. The updated National Planning Policy Framework (NPPF) for England, released in February 2019, is considered a key part of the Governments reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

Paragraph 103 within the NPPF states that the "*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.*".

It goes on to state in paragraph 181 that "*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 Air Quality Management Areas 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*".

3.1.2 Land-Use Planning & Development Control

In January 2017, Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) produced guidance to ensure that air quality is adequately considered in the land-use planning and development control processes[5].

The guidance document is particularly applicable to assessing the effect of changes in exposure of members of the public resulting from residential and mixed-use developments, especially those within urban areas where air quality is poorer. It is also relevant to other

[5] Land-Use Planning & Development Control: Planning for Air Quality. Guidance from Environmental Protection UK and the Institute of Air Quality Management for the consideration of air quality within the land-use planning and development control processes. EPUK & IAQM. January 2017

forms of development where a proposal could affect local air quality and for which no other guidance exists.

3.2 Regional Planning Policy

3.2.1 The Mayor's Air Quality Strategy

In October 2010, the Mayor's Air Quality Strategy[6] was released. The strategy sets out a framework for delivering improvements to London's air quality and includes measures aimed at reducing emissions from transport, homes, offices and new developments, as well as raising awareness of air quality issues and its impact on health.

3.2.2 The London Plan

In March 2016, the updated London Plan was published by the Greater London Authority[7]. The London Plan provides an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The Plan brings together the geographic and locational aspects of the Mayor's other strategies, including a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste.

Policy 7.14 relates specifically to improving air quality and states the following:

"The Mayor recognises the importance of tackling air pollution and improving air quality to London's development and the health and well-being of its people. He will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimize public exposure to pollution".

It goes on to state the following with regards to planning decisions:

"Development proposals should:

a minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3)

b promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition'

[6] Clearing the Air: The Mayor's Air Quality Strategy. October 2010
[7] The London Plan. The Spatial Development Strategy for London. Consolidated with Alterations. March 2016

- c *be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)).*
- d *ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches*
- e *where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified".*

A draft version of the new London Plan was published in July 2019. Policy SI1 relates specifically to air quality and states the following:

"A - *Development plans, through relevant strategic, site specific and area-based policies should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.*

B - To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a. lead to further deterioration of existing poor air quality

b. create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c. reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality

d. create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a. Development proposals must be at least air quality neutral

b. Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address *local problems of air quality in preference to post-design or retro-fitted mitigation measures*

c. *Major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1*

d. *Development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people, which do not demonstrate that design measures have been used to minimise exposure should be refused.*

C - Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an Air Quality Positive approach. To achieve this a statement should be submitted demonstrating:

a. *How proposals have considered ways to maximise benefits to local air quality, and*

b. *What measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.*

D - In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E - Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development".

3.2.3 Supplementary Planning Guidance (SPG)

Control of Dust and Emissions during Construction and Demolition SPG

The Greater London Authority (GLA) released the "Control of Dust and Emissions during Construction and Demolition" SPG in July 2014[8]. The guidance seeks to reduce emissions of

[8] The Control of Dust and Emissions during Construction and Demolition SPG. Greater London Authority, July 2014

dust and PM_{10} from construction and demolition activities in London. It also aims to manage emissions of nitrogen oxides (NOx) from construction and demolition machinery. The SPG:

- Provides more detailed guidance on the implementation of all relevant policies in the London Plan and the Mayor's Air Quality Strategy to neighbourhoods, boroughs, developers, architects, consultants and any other parties involved in any aspect of the demolition and construction process;
- Sets out the methodology for assessing the air quality impacts of construction and demolition in London; and
- Identifies good practice for mitigating and managing air quality impacts that is relevant and achievable, with the overarching aim of protecting public health and the environment.

The principles of the SPG apply to all developments in London as their associated construction and demolition activity may all contribute to poor air quality unless properly managed and mitigated.

Sustainable Design and Construction SPG

The Greater London Authority (GLA) released the "Sustainable Design and Construction" SPG in July 2014[9]. The SPG aims to support developers, local planning authorities and neighbourhoods to achieve sustainable development. It provides guidance on to how to achieve the London Plan objectives effectively, supporting the Mayor's aims for growth, including the delivery of housing and infrastructure.

[9] Sustainable Design and Construction SPG. Greater London Authority, July 2014

4 Assessment Methodology

4.1 Construction Phase

Based on the "Control of Dust and Emissions during Construction and Demolition" SPG discussed in the previous section, the main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentrations or airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment on site.

In relation to the most likely impacts, the guidance states the following:

"*The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of particulate matter in all size fractions.*

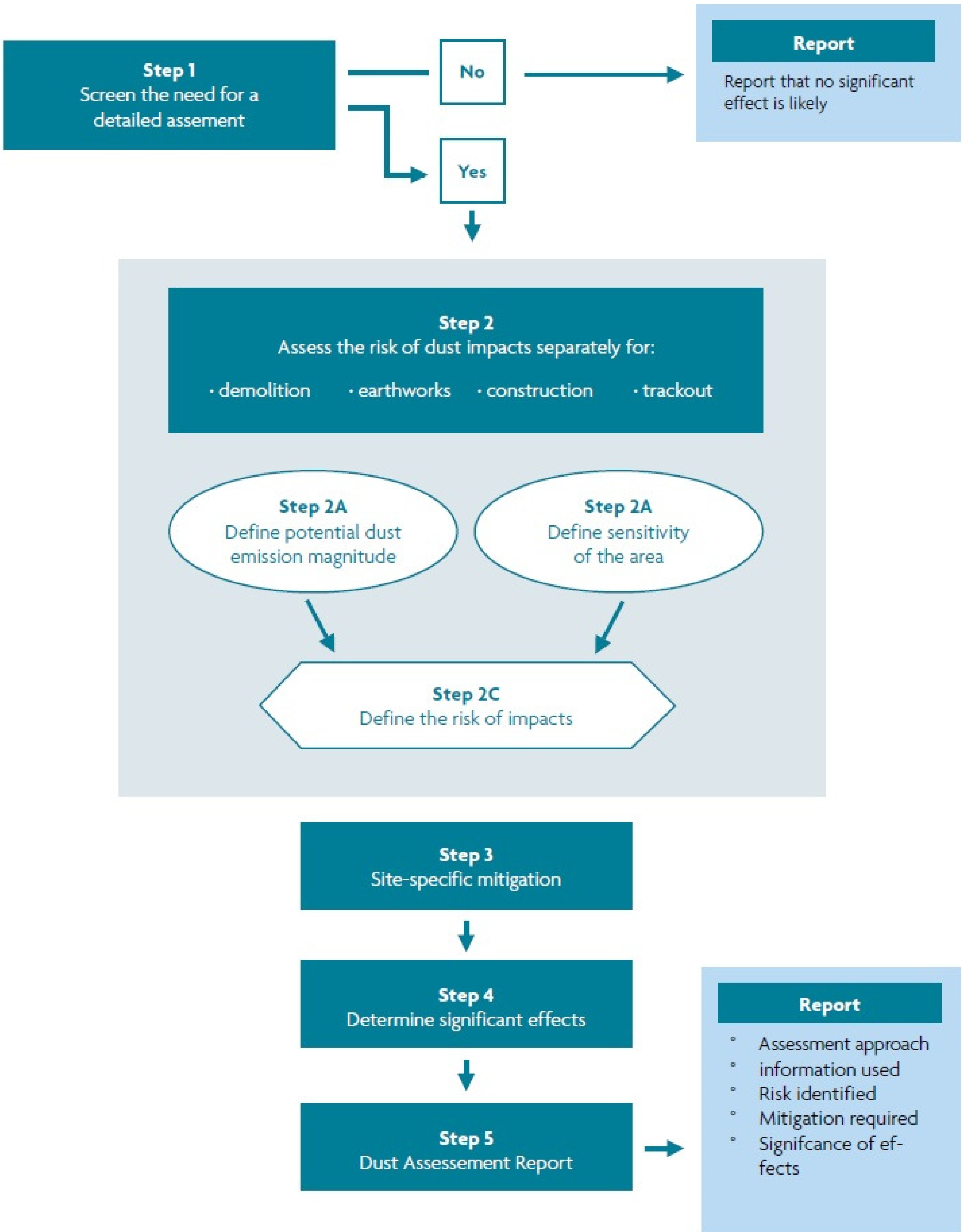
Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed".

The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- Demolition;
- Earthworks;
- Construction; and
- Track out.

With regards to the proposed development the potential for dust emissions is assessed for each activity that is likely to take place. The assessment procedure assumes no mitigation measures are applied. The conditions with no mitigation thus form the baseline or "do-nothing" situation for a construction site. The assessment procedure uses the steps provided in the guidance and summarised in Figure 1.

Figure 1 – Dust Assessment Procedure



4.2 Operational Phase (Traffic Emissions)

4.2.1 Modelled Scenarios

Two scenarios have been modelled as part of this assessment. These are as follows:

- **Scenario 1 (2018)** – existing levels of air quality / model verification; and
- **Scenario 2 (2023)** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure.

The current baseline year (2018) has been modelled as this corresponds with the latest air quality monitoring undertaken by the Council. A future year has been chosen (2023) representing the baseline year plus 5 years and will provide an assessment of the future impact of traffic emissions on the proposed development once completed and fully occupied.

4.2.2 ADMS-Roads

Modelling the impact of traffic emissions on the proposed development will be undertaken using the latest version of the ADMS-Roads model[10]. ADMS-Roads is significantly more advanced than that of most other air dispersion models in that it incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

4.2.3 Emission Factors

Defra and the Devolved Administrations have provided an updated Emission Factors Toolkit (Version 9.0) which incorporates updated NOx emissions factors and vehicle fleet information[11]. These emission factors have been integrated into the latest ADMS-Roads modelling software. However, in order to undertake a worst-case assessment emission factors for 2018 have been used for all modelled years.

The modelled emission factors do not take account of any potential improvements in local air quality as a result of the proposed tightening of emissions within the London Low Emission Zone (LEZ) in October 2020 or the extension of the Ultra-Low Emission Zone (ULEZ) in October 2021. As such, the predicted concentrations in 2023 are worst case.

4.2.4 Traffic Data

Baseline traffic flows along the local roads are available from the Department for Transport (DfT)[12]. Baseline data has been projected to 2018 and 2023. Projection of traffic data has been undertaken using growth factors specific to the London Borough of Camden, obtained

[10] Model Version: 4.1.1. Interface Version 4.1.1 (18/01/2018)
[11] https://laqm.defra.gov.uk/documents/EFT2019_v9.0.xlsb
[12] http://www.dft.gov.uk/traffic-counts/

from TEMPro[13]. The projected flow rates are provided in Table 3. It is assumed that the percentage HDV and speed will remain unchanged in future years.

The modelled speeds have been derived from the London Atmospheric Emissions Inventory (LAEI)[14]. However, where a link approaches a junction a speed of 20 kph has been modelled in order to represent queuing traffic at a junction.

Table 3 – Annual Average Daily Traffic Flows, Percentage HDV and Speeds for Modelled Roads

Link Name	AADT 2018	AADT 2023	HDV (%)	Speed (kph)
A400 Hampstead Road	32,010	33,668	9.3%	21
A501 Euston Road	63,322	66,602	5.8%	16

4.2.5 Street Canyons

A street canyon may be defined as a relatively narrow street with buildings on both sides, where the height of the buildings is generally greater than the width of the road. Street canyons may result in elevated pollutant concentrations from road traffic emissions due to a reduced likelihood of the pollutants becoming dispersed in the atmosphere. Street canyons have been modelled as part of this assessment along the A400 Hampstead Road.

4.3 Background Concentrations

Background NOx, NO_2 and PM_{10} concentrations have been obtained from Defra[15]. These 1 km x 1 km grid resolution maps are derived from a base year of 2017 (for NOx, NO_2, PM_{10} and $PM_{2.5}$ only), which are then projected to future years (2018). Background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ derived from Defra are provided in Table 4.

Table 4 – Background NOx, NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Location	Pollutant	X	Y	2018
Model Verification	NO_2	529500	182500	40.9
	NOx			77.0
	PM_{10}			19.5
	$PM_{2.5}$			13.0

13 TEMPro (Trip End Model Presentation Program) version 7, Department for Transport
14 LAEI (2016), Greater London Authority
15 http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017

Urban background NO_2 concentrations are also available from a monitoring site located at Tavistock Gardens, approximately 600 metres east of the proposed development. A concentration of 35.4µg/m^3 was recorded at this site in 2018. A similar concentration was recorded at the Bloomsbury background monitoring site, along with a background PM_{10} concentration of 17.0µg/m^3. These background concentrations have been used in favour of the Defra background concentrations provided in Table 4.

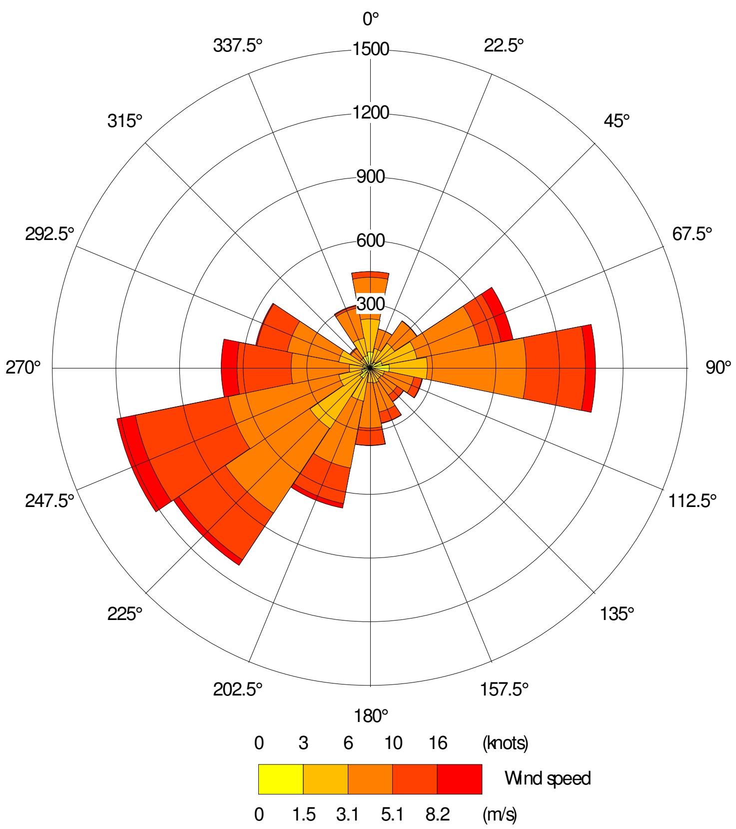
4.4 Surface Roughness

A surface roughness of 1.5 metre has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for large urban areas. This value has been used across the modelled domain.

4.5 Meteorological Data

Hourly sequential meteorological data from the London City Airport meteorological station has been used. Wind speed and direction data from the London City Airport meteorological station has been plotted as a wind rose in Figure 2.

Figure 2 – Wind Speed and Direction Data, London City Airport (2018)



4.6 Model Output

4.6.1 NOx/NO_2 Relationship

Following recent evidence that shows the proportion of primary NO_2 in vehicle exhaust has increased[16]. As such, a new NOx to NO_2 calculator has been devised[17]. This new calculator has been used to determine NO_2 concentrations for this assessment, based on predicted NOx concentrations using ADMS-Roads. Converted NO_2 concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NOx concentrations are adjusted before conversion to NO_2.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short-term impacts of NO_2 and PM_{10}. Research undertaken in 2003[18] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3.

For PM_{10}, a relationship between the annual mean and the number of 24-hour mean exceedences has been devised and is as follows:

- No. 24-hour mean exceedences = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

This relationship has been applied to the modelled annual mean concentrations in order to estimate the number of 24-hourly exceedences.

4.6.3 Model Verification

The Council undertakes monitoring of NO_2 and PM at a roadside site located at along the A501 Euston Road. This is the nearest roadside monitoring site to the proposed development. Monitored concentrations from this site have been used for the purposes of model verification during the baseline year (2018). The location of this verification site is provided in Table 5.

Table 5 – Modelled Verification Locations

Monitoring ID	Location	X	Y	Height (m)
V3	Euston Road	529878	182648	3.0

16 Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007
17 https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v7.1.xlsm
18 Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

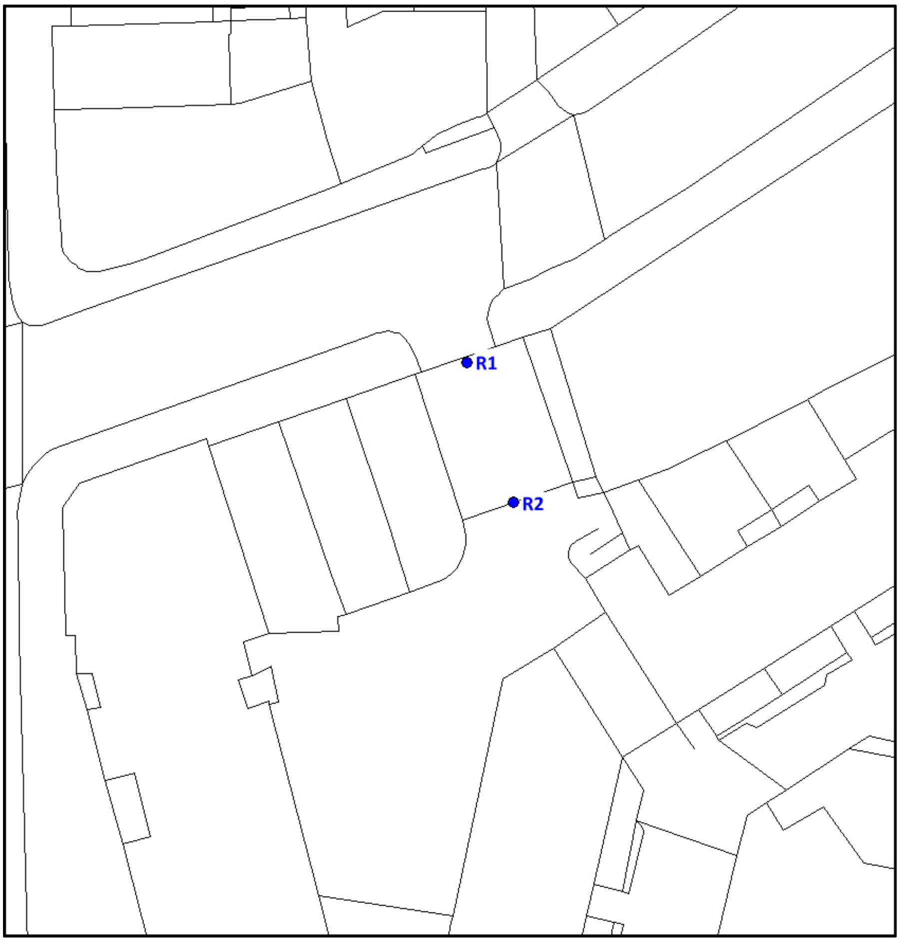
4.6.4 Receptor Locations

In order to assess the potential impact of the traffic emissions from the local road network, a number of receptors have been identified representing the different facades of the proposed development. The location of these receptors, together with their height above ground level is provided in Table 6 and represented in Figure 3.

Table 6 – Modelled Receptor Locations

AQA ID	X	Y	Height (m)	Description
R1	529259	182488	7.5, 10.5, 13.5 & 16.5	Proposed Receptors: First Floor to Fourth Floor
R2	529262	182479		

Figure 3 – Modelled Receptor Locations



4.7 Significance Criteria

4.7.1 Construction Phase

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A development is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (see Table 7); and
- the sensitivity of the area to dust impacts, which is defined as low, medium or high sensitivity (see Table 8).

These two factors are combined to determine the risk of dust impacts with no mitigation applied (see Table 9). The risk category assigned to the development can be different for each of the four potential activities (demolition, earthworks, construction and trackout).

Table 7 – Dust Emission Magnitude

Activity	Dust Emission Class		
	Large	Medium	Small
Demolition	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level	Total building volume 20,000 – 50 000m^3, potentially dusty construction material, demolition activities 10-20 m above ground level	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months
Earthworks	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes	Total site area 2,500 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting	Total building volume 25,000 m3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>50 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m	10 – 50 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100 m;	<10 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Table 8 – Sensitivity of the Area to Dust Soiling Effects on People and Property, and to Human Health Impacts

Sensitivity of the Area to Dust Soiling Effects					
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

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

Table 9 – Risk of Dust Impacts

Construction Activity	Sensitivity of Area	Dust Emission Magnitude		
		Large	Medium	Small
Demolition	High	High Risk	Medium Risk	Medium Risk
	Medium	High Risk	Medium Risk	Low Risk
	Low	Medium Risk	Low Risk	Negligible
Earthworks	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Construction	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Track out	High	High Risk	Low Risk	Low Risk
	Medium	Medium Risk	Low Risk	Negligible
	Low	Low Risk	Low Risk	Negligible

4.7.2 Operational Phase

The significance of emissions will be determined by comparing the predicted results to the Air Pollution Exposure Criteria (APEC) detailed in the *Air Quality and Planning Guidance* written by the London Air Pollution Planning and the Local Environment (APPLE) working group[19]. The Air Pollution Exposure Criteria is considered appropriate to describe the significance of the impacts predicted, together with an indication as to the level of mitigation required in order for the development to be approved. The APEC table is provided below.

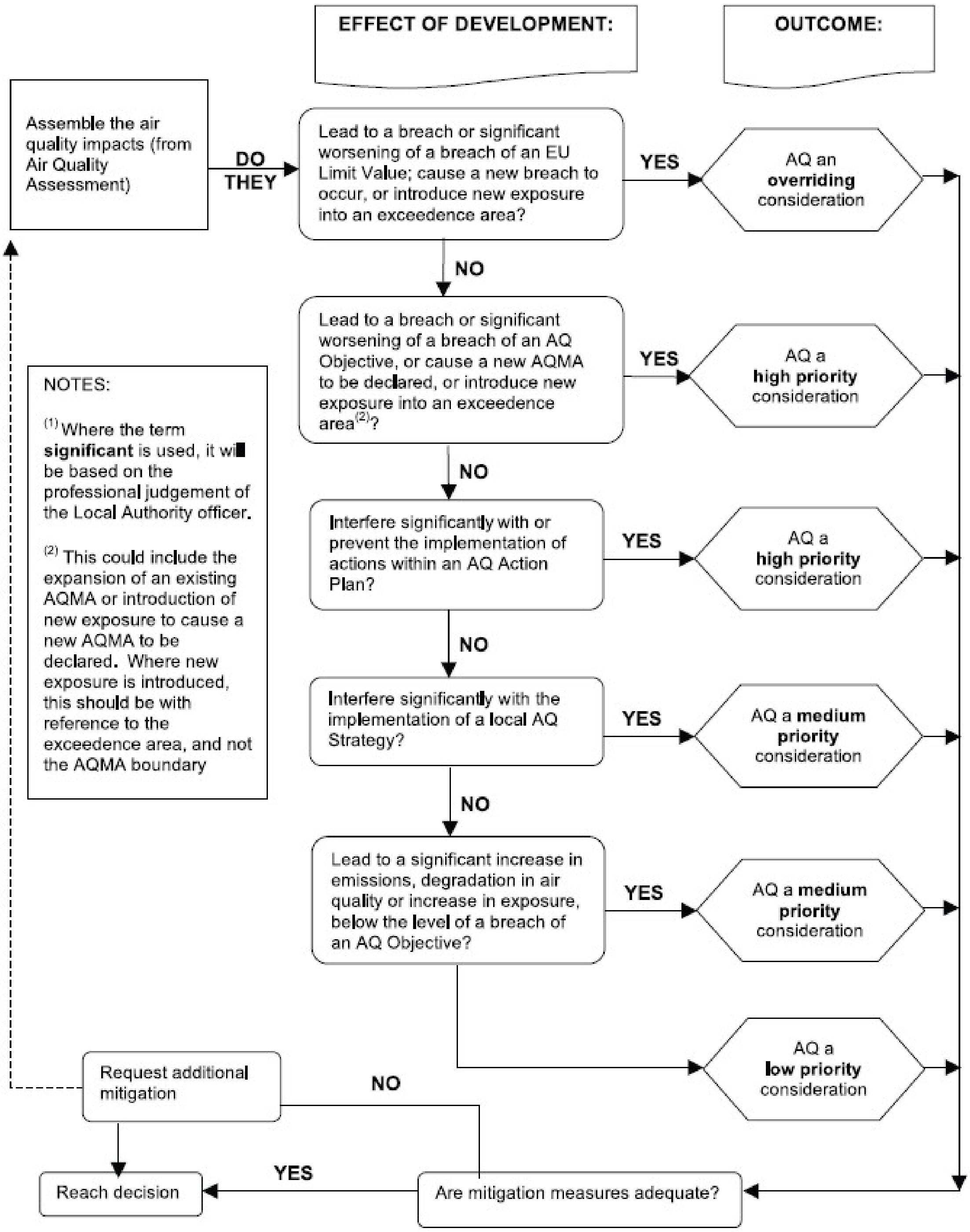
Table 10 – Air Pollution Exposure Criteria (APEC)

APEC Category	NO_2	PM_{10}	Recommendations
A	>5% below national annual mean objective	>5% below national annual mean objective >1-day less than national 24-hour objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national annual mean objective	Between 5% above or below national annual mean objective Between 1-day above or below national 24-hour objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered
C	>5% above national annual mean objective	>5% above national annual mean objective >1-day more than national 24-hour objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated

Furthermore, the guidance released by Environmental Protection UK also provides steps for a Local Authority to follow in order to assess the significance of air quality impacts of a development proposal. This procedure, shown in Figure 4, has also been applied to the modelled results.

19 Air Quality and Planning Guidance, written by the London Air Pollution Planning and the Local Environment (APPLE) working group, January 2007

Figure 4 – Assessing the Significance of Air Quality Impacts of a Development Proposal



5 Air Quality Assessment

5.1 Impact from Construction Activities

The assessment of construction activities has focused on demolition, earthworks, construction and track out activities at the site. Using the criteria provided in Table 7 the dust emission magnitude for each activity is as follows:

- Demolition = Small;
- Earthworks = N/A;
- Construction = Small; and
- Track out = Small.

The sensitivity of the surrounding area to dust soiling and human health (Table 11) is then defined based on the criteria in Table 8, which includes the number of highly sensitive receptors that fall within a certain distance of the proposed construction phase (see Figure 5).

Table 11 – Overall Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	N/A	High	High
Human Health	High	N/A	High	High

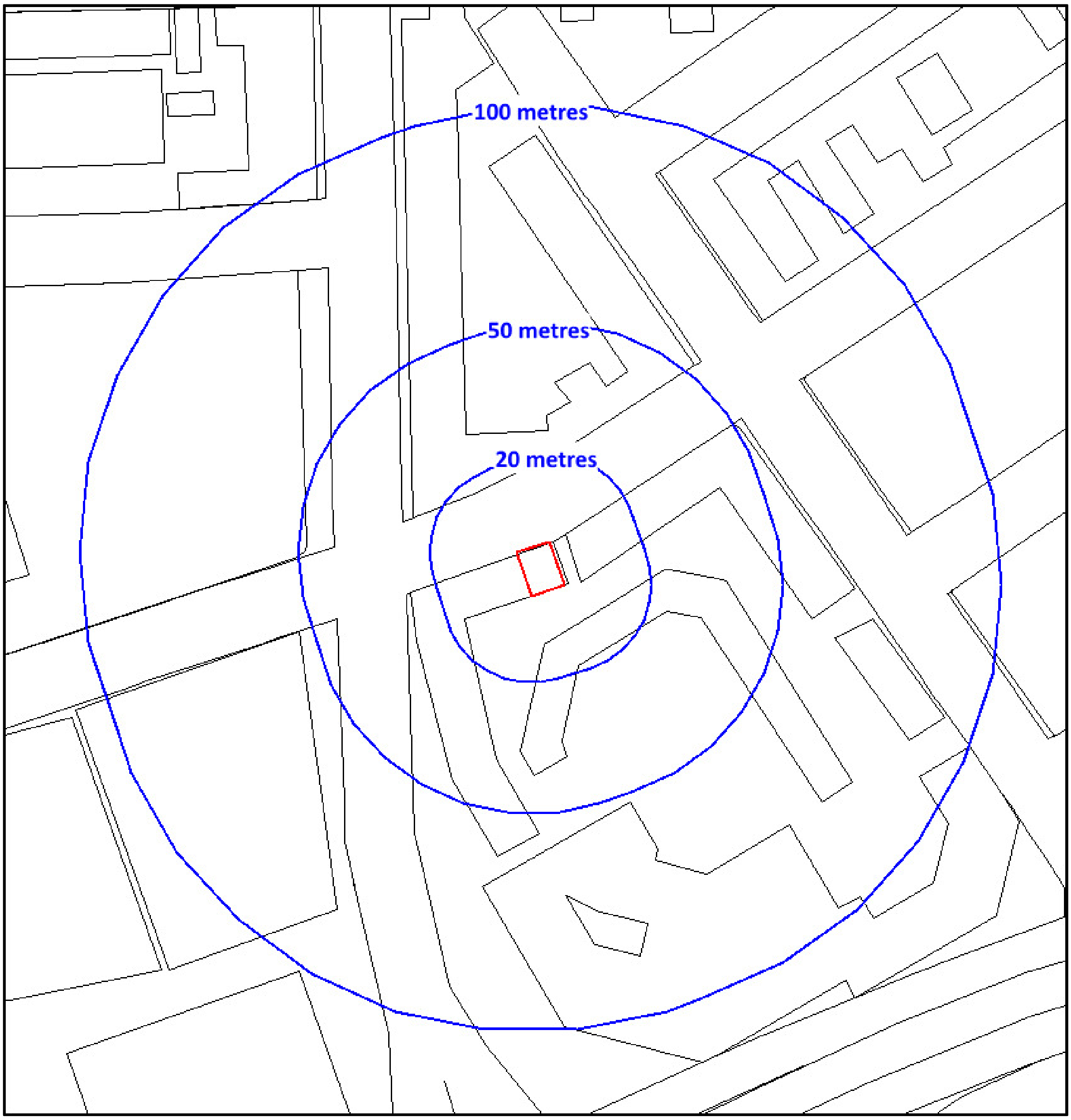
The dust emission magnitudes and sensitivity of the surrounding area are combined to determine the risk of dust impacts with no mitigation applied. These are summarised in Table 12.

Table 12 – Summary of Dust Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	N/A	Low Risk	Low Risk
Human Health	Medium Risk	N/A	Low Risk	Low Risk

It should also be noted that the likelihood of an adverse impact occurring is correlated to wind speed and wind direction. As such, unfavourable wind speeds and wind directions must occur at the same time as a dust generating activity in order to generate an adverse impact. The overall impacts also assume that the dust generating activities are occurring over the entirety of the site meaning that as an activity moves further away from a potential receptor the magnitude and significance of the impact will be further reduced.

Figure 5 – Distance from the Proposed Development



5.2 Impact of Vehicle Emissions

5.2.1 Model Verification

Using the guidance provided within the London Local Air Quality Management Technical Guidance TG(16), the modelled output has been verified against the monitoring data obtained from the sites listed in Table 5. The following tables provide a summary of the model verification process for NOx/NO_2 and PM_{10} concentrations.

Table 13 – Comparison of Modelled and Monitored NO_2 and PM_{10} Concentrations (µg/m^3), 2018

Verification Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/ monitored] x100
NO_2			
CD9	46.6	82.3	-43.3%
PM_{10}			
CD9	18.7	22.6	-17.4%

As described in the Technical Guidance (LAQM.TG16), in order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within ±25% (ideally ±10%) of the monitored concentrations. In order to improve the confidence in modelled concentrations across the modelled domain the model output has been adjusted. This is described further in the next section.

Based on Table 13, modelled PM_{10} has been adjusted by a factor of 1.2

5.2.2 Model Adjustment

In order to undertake model adjustment, it is first necessary to derive the monitored and modelled road contributions of NOx (excluding background). The modelled road contribution NOx is taken directly from the ADMS-Roads output before it has been converted to NO_2 using the NOx to NO_2 calculator described in Section 4.6.1. The NOx to NO_2 calculator can also be used to derive monitored road contributions of NOx from NO_2 diffusion tube results. A summary of these calculations is provided in Table 14.

Table 14 – Monitored NOx and NO_2 concentrations

Site ID	Monitored Total NO_2	Defra Background NO_2	Monitored road contribution NO_2 (total – background)	Monitored road contribution NOx (total – background)	Modelled road contribution NOx (excludes background)	Ratio of monitored road contribution NOx / modelled road contribution NOx
CD9	82.3	35.4	46.9	143.4	27.4	5.2

Once the monitored and modelled road contributions of NOx (excluding background) have been derived the contributions of NOx are compared and a ratio derived. In this case the ratio is 5.2 and this factor has been used to adjust the modelled road contribution of NOx. This is shown in Table 15.

Table 15 – Adjustment of Modelled NOx Contributions

Site ID	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NOx	Modelled total NO_2 (based on empirical NOx/NO_2 relationship)	Monitored total NO_2	% Difference [(modelled – monitored) / monitored] x 100
CD9	5.2	142.6	82.1	82.3	-0.3%

Following adjustment of the modelled NOx concentrations by a factor of 5.2 the total NO_2 concentration at the model verification location has been calculated using the method described in Section 4.6.1. The revised NO_2 concentration, shown in Table 15, indicates a more acceptable model performance when compared against the monitored NO_2 concentrations. As such, an adjustment factor of 5.2 has been applied to all modelled NOx concentrations across the model domain before conversion to NO_2.

5.2.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO_2 in 2018 and 2023 are provided in Table 16. As mentioned in Section 4.6.1, NO_2 concentrations have been calculated from the predicted NOx concentrations using the latest NOx-NO_2 conversion spreadsheet available from the Air Quality Archive.

Table 16 – Predicted NO_2 Concentrations, Annual Mean (µg/m^3)

Receptor ID	2018				2023			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
R1	45.0	42.3	40.1	38.5	45.4	42.7	40.3	38.7
R2	44.5	42.2	40.1	38.5	45.0	42.5	40.3	38.7
Objective	**40.0**							

The ADMS predictions for annual mean NO_2 concentrations in 2018 and 2023 indicate that the annual mean objective (40 µg/m^3) would be approached (in blue) or exceeded (in red) across all facades of the proposed development and at all levels.

Nitrogen dioxide also has an hourly objective of 200 µg/m^3 not to be exceeded more than 18 times in one year. However, the hourly mean concentration has not been calculated directly by ADMS Roads. This is as a result of an evaluation of continuous monitoring data from across the UK that revealed that the relationship between the annual mean and hourly mean NO_2 concentrations was very weak. Nonetheless, research undertaken in 2003[20] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3. Given that predicted NO_2 concentrations in 2018 and 2023 are below 60 µg/m^3 at all modelled receptors the likelihood of the short-term objective for NO_2 being exceeded is considered low.

[20] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

5.2.4 Particulate Matter

Predicted annual mean concentrations for PM_{10} in 2018 and 2023 are provided in Table 17.

Table 17 – Predicted PM_{10} Concentrations, Annual Mean (µg/m³)

Receptor ID	2018				2023			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
R1	20.7	20.6	20.6	20.5	20.7	20.6	20.6	20.5
R2	20.7	20.6	20.6	20.5	20.7	20.6	20.6	20.5
Objective	**40.0**							

The ADMS predictions for annual mean PM_{10} concentrations in 2018 and 2023 indicate that the annual mean objective (40 µg/m³) would be achieved at all the modelled receptor locations. In addition, the maximum number of days when PM_{10} concentrations are more than 50 µg/m³ is 4, less than the 35 exceedences allowed in the regulations.

6 Conclusions And Recommendations

6.1 Impact from Construction Activities

A qualitative assessment of dust levels associated with the proposed development has been carried out. For construction and track out, the impact of dust soiling and PM_{10} can be reduced to negligible through appropriate mitigation measures, which are listed in Table 18 and are applicable to a low risk site. Implementation of these Best Practice Measures will help reduce the impact of the construction activities.

For demolition, the following measures should be adopted:

- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions during the demolition phase.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

With these mitigation measures enforced, the likelihood of nuisance dust episodes occurring at those receptors adjacent to the development are considered low. Notwithstanding this, the developer should take into account the potential impact of air quality and dust on occupational exposure standards (in order to minimise worker exposure) and breaches of air quality objectives that may occur outside the site boundary. Monitoring is not recommended at this stage, however, continuous visual assessment of the site should be undertaken and a complaints log maintained in order determine the origin of a particular dust nuisance. Keeping an accurate and up to date complaints log will isolate particular site activities to a nuisance dust episode and help prevent it from reoccurring in the future.

Table 18 – Mitigation of Construction Activities

Construction Activity	Mitigation Measures
Site Management	Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary.
	Display the head or regional office contact information.
	Record and respond to all dust and air quality pollutant emissions complaints.
	Make a complaints log available to the local authority when asked.
	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 when asked.
	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.
	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.
Preparing and Maintaining the Site	Plan site layout: machinery and dust causing activities should be located away from receptors.
	Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site.
	Avoid site runoff of water or mud.
Operating Vehicle/Machinery and Sustainable Travel	Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone.
	Ensure all non-road mobile machinery (NRMM) comply with the standards set within this guidance.
	Ensure all vehicles switch off engines when stationary – no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where possible.
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
Operations	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.
	Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible).
	Use enclosed chutes, conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Waste Management	Reuse and recycle waste to reduce dust from waste materials
	Avoid bonfires and burning of waste materials.

6.2 Impact of Vehicle Emissions

The predicted concentrations of PM_{10} in all modelled years are below the relevant objectives. Predicted concentrations at all the modelled receptors fall within APEC Category A, which states that there are "no air quality [PM_{10}] grounds for refusal, however, mitigation of any emissions should be considered". Overall, using the flow chart presented in Figure 4, air quality (PM_{10}) is a low priority consideration at the modelled locations in each of the modelled years.

The ADMS predictions for annual mean NO_2 concentrations in 2018 and 2023 indicate that the annual mean concentration would be approached or exceeded across all facades of the proposed development and at all levels. The predicted concentrations at these receptors fall within APEC Category B and C, meaning mitigation measures will need to be adopted in order to protect the future inhabitants from poor air quality. These are outlined in the following section.

6.2.1 Building Mitigation

Based on the outcome of this assessment mitigation measures would be required in order to mitigate the impact of poor air quality (NO_2) at all the proposed residential units.

The Institute of Air Quality Management (IAQM) issued a position statement in relation to the mitigation of development air quality impacts[21]. Based on this statement, the IAQM recommends that the following basic hierarchy be used for mitigating the operational air quality impacts associated with the particular development:

1. Preference should be given to **preventing or avoiding** exposure/impacts to the pollutant in the first place by eliminating or isolating potential sources or by replacing sources or activities with alternatives;
2. **Reduction and minimisation** of exposure/impacts should next be considered, once all options for prevention/avoidance have been implemented so far as is reasonably practicable (both technically and economically);
3. **Off-setting** a new development's air quality impact by proportionately contributing to air quality improvements elsewhere (including those identified in air quality action plans and low emission strategies) should only be considered once the solutions for preventing/avoiding, and then for reducing/minimising, impacts have been exhausted.

Where possible, option2 would need to be applied to the proposed development so that the future occupants are not reliant solely on opening windows or doors in order to ventilate their properties. This would require an additional form of ventilation, whereby clean air is drawn in naturally or mechanically and maintained thereafter. Typically, clean air is drawn in at roof

21 Position Statement – Mitigation of Development Air Quality Impacts, IAQM, January 2015

level where pollutant concentrations are lower. These inlets should be placed as high as possible e.g. roof level, and as far away from other emission sources as possible.

A mechanical ventilation system that draws air in from the roof may be considered acceptable as predicted NO_2 concentrations on the fourth floor are below the relevant air quality objectives. However, the inlets should be placed as high as possible (roof level) and as far away from the local roads as possible. If such a system is installed, windows should be sealed so as not to compromise the effectiveness of the ventilation system and the clean air that it is delivering.

Alternatively, air could be drawn in and filtered[22]. Such filtration systems would "scrub" the incoming air stream of NO_2, reducing the concentrations of NO_2 to well below the air quality objective within the building. Such systems are becoming more common, particularly at city centre locations where traffic emissions make it difficult to find locations where clean air can be drawn into the property. A filtered ventilation system would also allow the inlets to be placed anywhere regardless of the predicted NO_2 concentrations, although they should ideally be placed as far away from emission sources as possible in order to reduce the burden on the filters. If such a filtration system is installed the Council will require details relating to the mechanical ventilation and air filtration systems, as well as the ongoing maintenance and cleaning of these systems. If such a system is installed, windows should be sealed so as not to compromise the effectiveness of the ventilation system and the clean air that it is delivering.

[22] Such devices include the AAC Swiftpack® with Nitrosorb® media for NO_2 and NOx removal, or the City Breathe: Indoor Air Quality Filtration System