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3 Viveash Close, Hayes: Air Quality Assessment

**Prepared for
General Food Trading Co Ltd**

**Report Ref: AQ0937
Date: March 2017**

3 Viveash Close, Hayes

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 proposed development located at 3 Viveash Close in Hayes, Middlesex. The pollutants modelled as part of this assessment are nitrogen oxides (NO_x) and particulate matter (PM₁₀).

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 Local Air Quality Management Technical Guidance (LAQM.TG16)². The impact of road traffic emissions will be assessed using the ADMS-Roads Extra 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 NO₂ and PM₁₀ 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, Volume 11, Section 3, Part 1 – HA207/07, Highways Agency, May 2007

² Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance (TG16), Defra, April 2016

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 (NO₂), fine particulates (PM₁₀), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO₂). This air quality assessment focuses on NO₂ and PM₁₀, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO₂ and PM₁₀.

Table 1 – Overview of NO₂ and PM₁₀

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM₁₀)	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 (NO₂)	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 2007³. 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 (PM₁₀ 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 NO₂ and PM₁₀.

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

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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/m³. As such, no further consideration has been given to PM_{2.5} within this assessment.

2.3 London Local Air Quality Management (LLAQM)

At the core of LLAQM delivery are three pollutant objectives; these are: nitrogen dioxide (NO₂), particulate matter (PM₁₀) and sulphur dioxide (SO₂). All current Air Quality Management Areas (AQMAs) across the UK are declared for one or more of these pollutants, with NO₂ accounting for the majority. In Greater London, AQMAs are declared for NO₂ and PM₁₀ 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.

2.3.1 London Borough of Hillingdon

The London Borough of Lambeth has declared an Air Quality Management Area (AQMA). The AQMA covers an area from the southern boundary north to the border defined by, the A40 corridor from the western borough boundary, east to the intersection with the Yeading Brook north until its intersection with the Chiltern-Marylebone railway line. As such, the proposed development lies 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 National Planning Policy Framework (NPPF) for England, released on 27th March 2013, 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. The NPPF replaces the Planning Policy Statement 23 (PPS23) *Planning and Pollution Control*⁴.

The NPPF states that the “planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability”.

It goes on to state that “planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas 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 processes⁵.

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

⁴ Planning Policy Statement 23: Planning and Pollution Control, Office of the Deputy Prime Minister (ODPM), November 2004

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

3.2 Local Planning Policy

3.2.1 The Mayor's Air Quality Strategy

In October 2010, the Mayor's Air Quality Strategy⁶ 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 Authority⁷. 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

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- 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".*

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 2014⁸. The guidance seeks to reduce emissions of dust and PM₁₀ 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.

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

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Sustainable Design and Construction SPG

The Greater London Authority (GLA) released the “Sustainable Design and Construction” SPG in July 2014⁹. 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.

In relation to air quality the SPG provides guidance on the following key areas:

- assessment requirements;
- construction and demolition;
- design and occupation;
- air quality neutral policy for buildings and transport; and
- emissions standards for combustion plant

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

4 ASSESSMENT METHODOLOGY

4.1 Construction Phase

Dust is a major environmental concern associated with construction activities. Residents living in proximity to such a site can potentially be affected by site dust up to 1 km from the source, although continual or severe concerns about dust sources are most likely to be experienced near to dust sources, generally within 100 metres. In general, large dust particles (greater than 30 μm) make up the greatest proportion of dust emitted from construction sites and will largely deposit within 100 m of sources. Intermediate sized particles (10-30 μm) are likely to travel up to 250-500 m. Smaller particles (less than 10 μm), which make up a small proportion of the dust emitted, can travel up to 1km from sources¹⁰.

Based on the 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 PM₁₀ concentrations, as a result of dust generating activities on site; and
- An increase in concentrations of 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 PM₁₀ 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”.

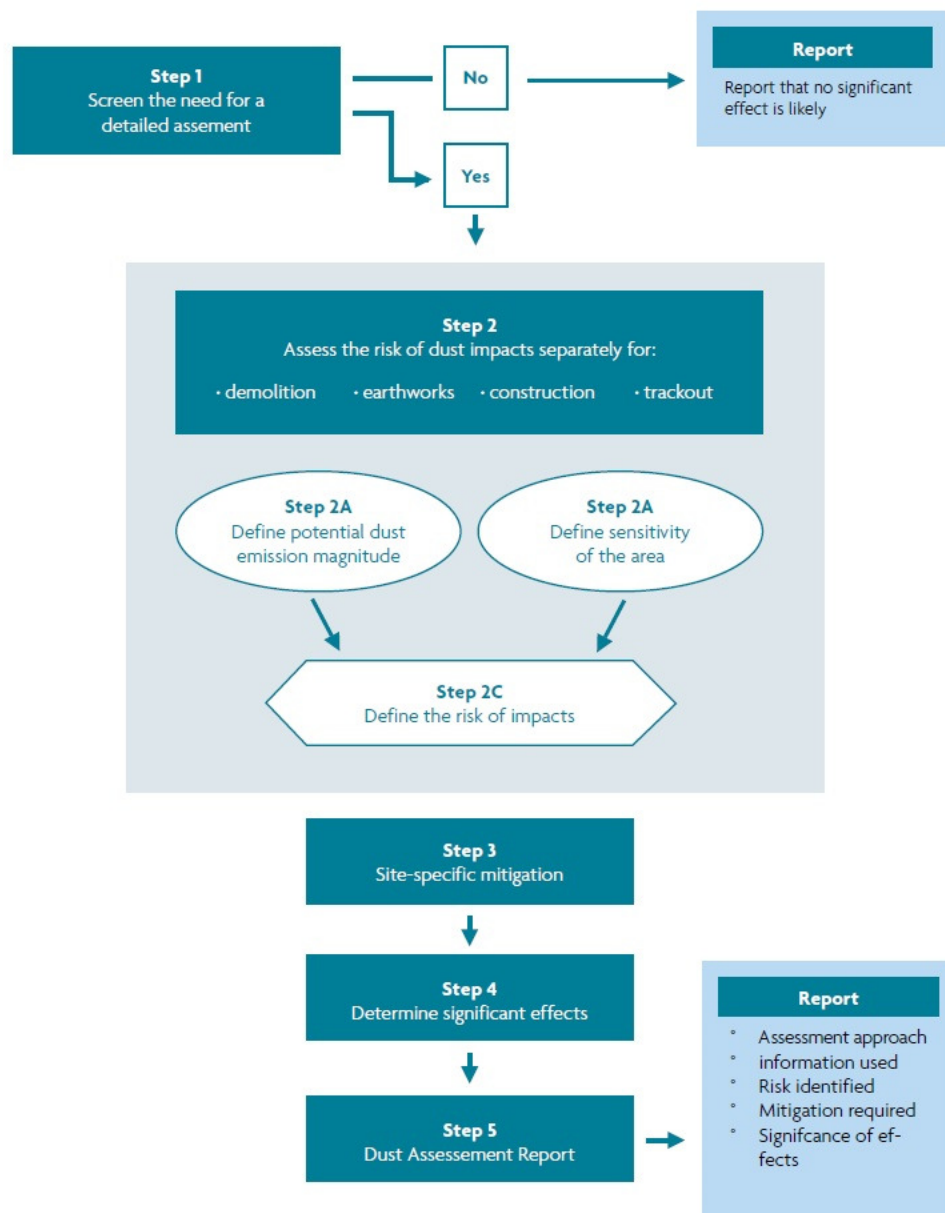
The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

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

¹⁰ Minerals Policy Statement (MPS) 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Office of the Deputy Prime Minister, 2005

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

A future year has been chosen (2020) for the assessment, along with the baseline year (2015). The future year represents the assumed first full year of occupation following completion of the development. Two scenarios have been adopted as part of the assessment. These are as follows:

- **Scenario 1** – existing levels of air quality (2015); and
- **Scenario 2** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure (2020).

Predicted concentrations will be compared to the Air Quality Strategy objectives. Background pollutant concentrations and vehicle emission rates for all modelled years are based on the latest data issued by Defra. These background concentrations and emission factors are discussed further in the following sections.

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 model¹¹. 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 7.0) which incorporates updated NO_x emissions factors and vehicle fleet information¹². 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 2015 have been used for all modelled years.

4.2.4 Traffic Data

Baseline traffic flows along the local roads are available from the London Atmospheric Emissions Inventory (LAEI)¹³. Baseline data from the LAEI has been projected to 2015 and 2020. Projection of traffic data has been undertaken using growth factors specific to the London Borough of Hillingdon, obtained from TEMPro¹⁴ and National Road Traffic Forecasts

¹¹ Model Version: 4.0.1. Interface Version 4.0.1 (12/02/2016)

¹² http://laqm.defra.gov.uk/documents/EFT2016_v7.0.xlsm.zip

¹³ LAEI (2008), Greater London Authority

¹⁴ Tempro (Trip End Model Presentation Program) version 6 , dataset v5.4 Department for Transport

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(NRTF)¹⁵. 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). 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 2015	AADT 2020	HDV (%)	Speed (kph)
A312 North Hyde Road	18,436	20,115	3.5%	30
Station Road	11,591	12,647	16.1%	29
A437 Station Road	16,358	17,848	9.3%	36

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 not been modelled as part of this assessment.

¹⁵ National Road Traffic Forecasts (Great Britain) 1997, Department for Transport

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4.3 Background Concentrations

Background NO_x, NO₂ and PM₁₀ concentrations have been obtained from Defra¹⁶. These 1 km x 1 km grid resolution maps are derived from a base year of 2013 (for NO_x, NO₂, PM₁₀ and PM_{2.5} only), which are then projected to future years (2015). Background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5} derived from Defra are provided in Table 4.

Table 4 – Background NO_x, NO₂, PM₁₀ and PM_{2.5} Concentrations

Pollutant	X	Y	2015
NO ₂	509500	179500	32.1
NO _x			54.3
PM ₁₀			18.6
PM _{2.5}			13.7

In order to undertake a worst-case assessment, 2015 background concentrations have been assumed for all modelled scenarios.

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.

¹⁶ <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011>

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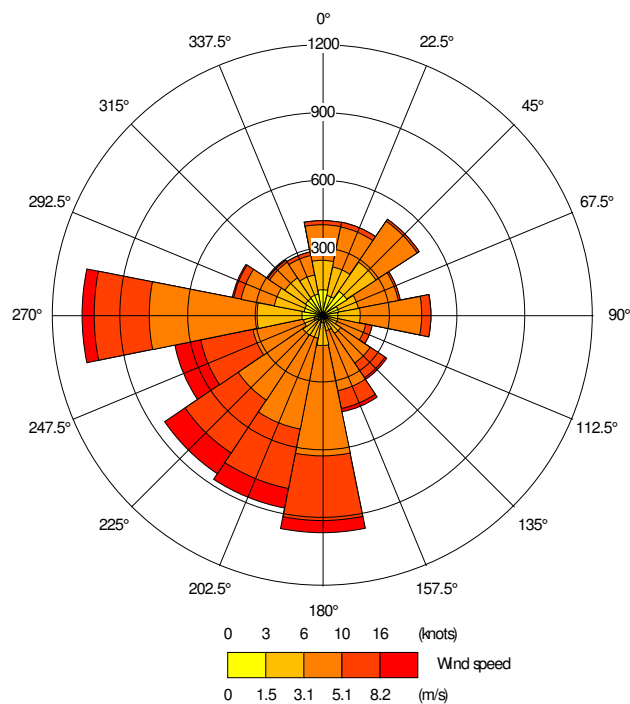
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4.5 Meteorological Data

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

Figure 2 – Wind Speed and Direction Data, Heathrow Airport (2015)



4.6 Model Output

4.6.1 NO_x/NO₂ Relationship

Following recent evidence that shows the proportion of primary NO₂ in vehicle exhaust has increased¹⁷. As such, a new NO_x to NO₂ calculator has been devised¹⁸. This new calculator has been used to determine NO₂ concentrations for this assessment, based on predicted NO_x concentrations using ADMS-Roads. Converted NO₂ concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NO_x concentrations are adjusted before conversion to NO₂.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short-term impacts of NO₂ and PM₁₀. Research undertaken in 2003¹⁹ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³.

For PM₁₀, 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 = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

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 operates a number of monitoring sites next to the modelled network. The monitored concentrations from the sites have been used for the purposes of model verification during the baseline year (2015). The location of these verification sites are provided in Table 5.

Table 5 – Modelled Verification Locations

Monitoring ID	Location	X	Y	Height (m)
HD55	Harold Avenue	509918	179015	1.5
HIL5	Hillingdon, Hayes	510303	178882	1.5

¹⁷ Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007

¹⁸ http://laqm.defra.gov.uk/documents/no2tonox9_ja-forweb_june2016.xls

¹⁹ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

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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 assessment has focused on the residential receptors on the first to fifth floors as these represent relevant exposure. The predicted concentrations on the fifth floor will provide a worst-case assessment of the concentrations on the sixth floor and above.

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	509922	179330	4.5, 7.5, 10.5, 13.5, 16.5	Proposed Receptors, First to Fifth Floors
R2	509920	179346		
R3	509906	179339		
R4	509908	179322		
R5	509880	179351	7.5, 10.5, 13.5, 16.5	Proposed Receptors, Second to Fifth Floors
R6	509879	179365		
R7	509866	179360		
R8	509867	179344		

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. These risk categories are defined in detail within Boxes 6 to 8 of the IAQM guidance.

These two factors are combined to determine the risk of dust impacts with no mitigation applied (see Table 8). 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 m ³ – 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.

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Table 8 – 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 group²⁰. 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.

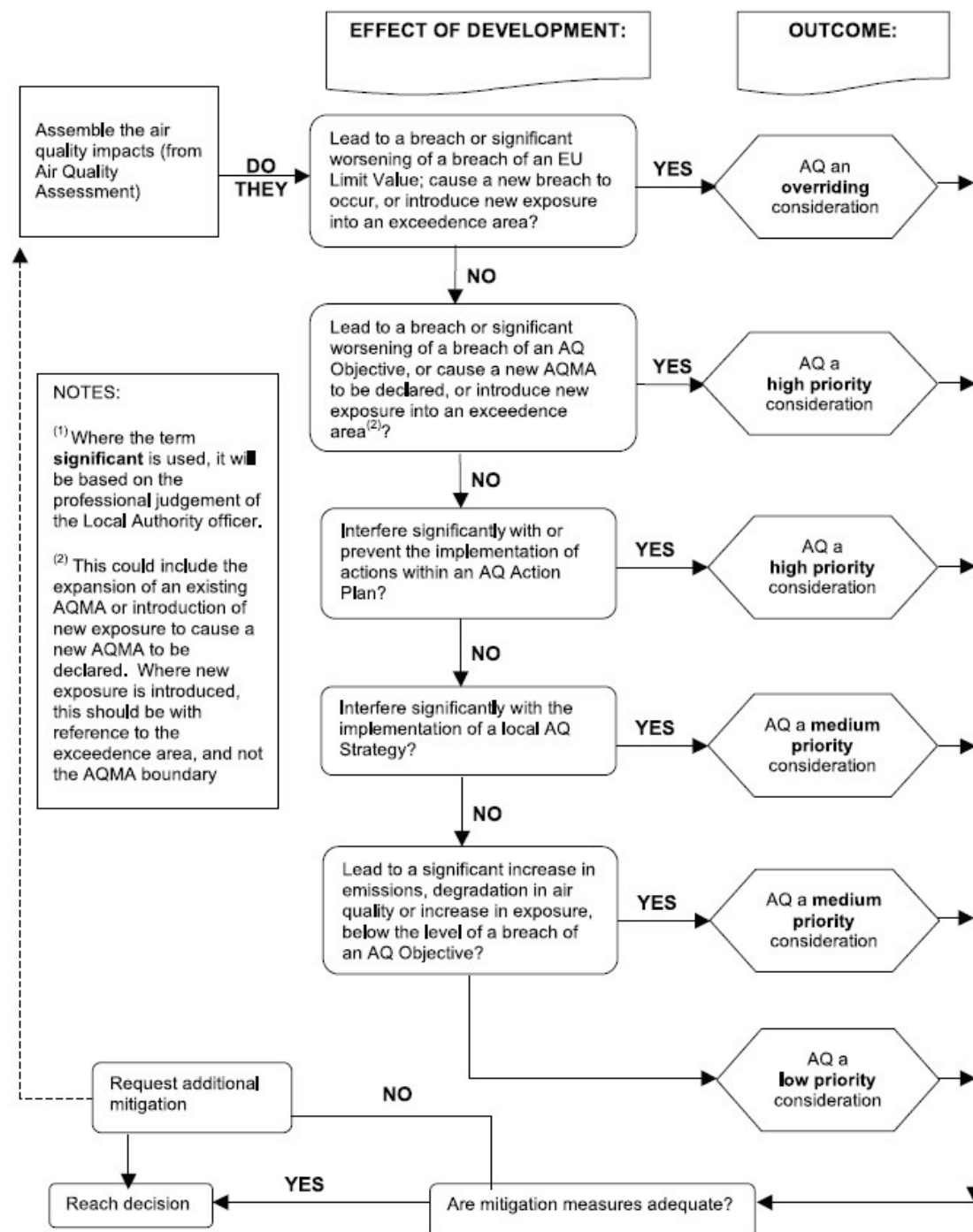
Table 9 – Air Pollution Exposure Criteria (APEC)

APEC Category	NO₂	PM₁₀	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.

²⁰ 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 8 the dust emission magnitude for each activity is as follows:

- Demolition = Small;
- Earthworks = Medium;
- Construction = Medium; and
- Track out = Small.

Based on the SPG guidance the sensitivity of the surrounding area is summarised in Table 10.

Table 10 – Sensitivity of the Surrounding Area

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

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 11.

Table 11 – Summary of Dust Risk

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

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.

5.2 Impact of Vehicle Emissions

5.2.1 Model Verification

Using the guidance provided within the 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 NO_x/NO₂ concentrations.

Table 12 – Comparison of Modelled and Monitored NO₂ and PM₁₀ Concentrations (µg/m³)

Verification Location	Modelled Concentration	Monitored Concentration ^(a)	Difference [(modelled - monitored)/monitored] x100
HD55 (NO ₂)	34.1	38.2	-10.9%
HIL5 (NO ₂)	35.2	48.7	-27.7%
HIL5 (PM ₁₀)	19.0	30.6	-37.8%
(a) Average concentration recorded between 2013 and 2015			

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.

5.2.2 Model Adjustment

In order to undertake model adjustment, it is first necessary to derive the monitored and modelled road contributions of NO_x (excluding background). The modelled road contribution NO_x is taken directly from the ADMS-Roads output before it has been converted to NO₂ using the NO_x to NO₂ calculator described in Section 4.6.1. The NO_x to NO₂ calculator can also be used to derive monitored road contributions of NO_x from NO₂ diffusion tube results. A summary of these calculations is provided in Table 13.

Once the monitored and modelled road contributions of NO_x (excluding background) have been derived the contributions of NO_x are compared and a ratio derived. In this case the ratio is 4.5 and this factor has been used to adjust the modelled road contribution of NO_x. This is shown in Table 14.

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Table 13 – Monitored NOx and NO₂ concentrations, 2015

Verification Location	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
HD55 (NO ₂)	38.2	32.1	6.1	13.5	4.2	3.2
HIL5 (NO ₂)	48.7	32.1	16.6	39.3	6.7	5.9
Average						4.5

Table 14 – Adjustment of Modelled NOx Contributions, 2015

Verification Location	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
HD55 (NO ₂)	4.5	18.9	40.5	38.2	6.1%
HIL5 (NO ₂)	4.5	30.2	45.2	48.7	-7.3%

Following adjustment of the modelled NOx concentrations by a factor of 4.5 the total NO₂ concentration at the model verification location has been calculated using the method described in Section 4.6.1. The revised NO₂ concentration, shown in Table 14, indicates a more acceptable model performance when compared against the monitored NO₂ concentrations. As such, an adjustment factor of 4.5 has been applied to all modelled NOx concentrations across the model domain before conversion to NO₂.

Modelled PM₁₀ concentrations have been adjusted by a factor of 1.6 across the modelled domain.

5.2.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO₂ in 2015 and 2020 are provided in Table 15. As mentioned in Section 4.6.1, NO₂ concentrations have been calculated from the predicted NO_x concentrations using the latest NO_x-NO₂ conversion spreadsheet available from the Air Quality Archive.

Table 15 – Predicted NO₂ Concentrations, Annual Mean (µg/m³)

Receptor ID	2015					2020				
	1 st	2 nd	3 rd	4 th	5 th	1 st	2 nd	3 rd	4 th	5 th
R1	33.6	33.6	33.5	33.5	33.4	33.8	33.7	33.7	33.6	33.5
R2	33.6	33.6	33.5	33.5	33.4	33.8	33.7	33.7	33.6	33.5
R3	33.7	33.7	33.6	33.5	33.4	33.9	33.8	33.8	33.7	33.5
R4	33.7	33.7	33.6	33.5	33.4	33.9	33.8	33.7	33.7	33.5
R5	N/A	33.9	33.8	33.7	33.5	N/A	34.0	33.9	33.8	33.7
R6	N/A	33.9	33.8	33.7	33.6	N/A	34.1	34.0	33.8	33.7
R7	N/A	34.0	33.9	33.8	33.6	N/A	34.2	34.1	33.9	33.8
R8	N/A	34.0	33.9	33.8	33.6	N/A	34.1	34.0	33.9	33.7
Objective	40.0									

The ADMS predictions for annual mean NO₂ concentrations in 2015 and 2020 indicate that the annual mean objective (40 µg/m³) would not be approached or exceeded at any of the modelled receptors.

Nitrogen dioxide also has an hourly objective of 200 µg/m³ 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 NO₂ concentrations was very weak. Nonetheless, research undertaken in 2003²¹ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³. Given that predicted NO₂ concentrations in 2015 and 2020 are well below 60 µg/m³ at all modelled receptors the likelihood of the short-term objective for NO₂ being exceeded is considered low.

²¹ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

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5.2.4 Particulate Matter

Predicted annual mean concentrations for PM₁₀ in 2015 and 2020 are provided in Table 16.

Table 16 – Predicted PM₁₀ Concentrations, Annual Mean (µg/m³)

Receptor ID	2015					2020				
	1 st	2 nd	3 rd	4 th	5 th	1 st	2 nd	3 rd	4 th	5 th
R1	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
R2	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
R3	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
R4	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8
R5	N/A	29.8	29.8	29.8	29.8	N/A	29.8	29.8	29.8	29.8
R6	N/A	29.8	29.8	29.8	29.8	N/A	29.8	29.8	29.8	29.8
R7	N/A	29.8	29.8	29.8	29.8	N/A	29.8	29.8	29.8	29.8
R8	N/A	29.8	29.8	29.8	29.8	N/A	29.8	29.8	29.8	29.8
Objective	40.0									

The ADMS predictions for annual mean PM₁₀ concentrations in 2015 and 2020 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 PM₁₀ concentrations are more than 50 µg/m³ is 27, less than the 35 exceedences allowed in the regulations.

6 AIR QUALITY NEUTRAL ASSESSMENT

6.1 Introduction

Policy 7.14 within the London Plan states that every “major” development in Greater London be at least “air quality neutral” and not lead to further deterioration of existing poor air quality. Within the London Plan, a “major” development is defined by the following criteria:

- 10 or more residential dwellings (or where the number is not given, an area of more than 0.5 ha); or
- For all other uses, where floor space is 1,000 sq m or more (or the site is 1 ha or more).

As such, the proposed development is classified as a “major” development with 10 or more residential dwellings and a floor space of more than 1,000 sq m.

The air quality neutral assessment has followed the methodology outlined in the Sustainable Design and Construction Supplementary Planning Guidance (SPG)²² and the Air Quality Neutral Planning Support Update²³. Within these documents, benchmarks have been provided in relation to building emissions, together with a methodology for calculating the building and transport related emissions for a particular development.

6.2 Building Emissions

The Building Emissions Benchmarks (BEBs) for the land use category applicable to residential properties are provided in Table 17. Emissions of PM₁₀ have not been considered as oil and/or solid fuel are not proposed to be used at the development.

Table 17 – Building Emissions Benchmarks (BEBs)

Land Use Class	NOx (g/m ² /annum)
B1	30.8
C3	26.2

Using the method described within the Air Quality Neutral Planning Support Update, the site specific benchmarked emissions have been calculated using the emission rate in Table 9. These are summarised in Table 18. The total building NOx emissions have then been calculated and are summarised in Table 19.

²² Sustainable Design and Construction Supplementary Planning Guidance (SPG), Mayor of London, April 2014

²³ Air Quality Neutral Planning Support Update: GLA 80371, April 2014

Table 18 – Calculation of Benchmarked NOx Emissions Using Building Emissions Benchmarks for Each Land Use Category

Land Use	GFA (m ²)	Building Emissions Benchmarks (g/m ² /annum)	Benchmarked Emissions (kg/annum)
B1	967	30.8	29.8
C3	6,238	26.2	163.4
Total			193.2

Table 19 – Calculation of Total Building NOx Emissions

Land Use	Gas Usage (kWh/annum)	Default Emission Factors (kg/kWh)	Total Building Emissions (kg/annum)
B1	12,207	0.000194	2.4
C3	344,291	0.0000785	27.0
Total			29.4

Based on the comparison between the total building emissions and Building Emissions Benchmarks (see Table 20) the proposed development meets the air quality neutral requirements and no mitigation is required.

Table 20 – Comparison of Total Building NOx Emissions and Building Emissions Benchmarks

Total Benchmarked Emissions (kg/annum)	Total Building Emissions (kg/annum)	Difference (kg/annum)
193.2	29.4	-163.8

6.3 Transport Emissions

As outlined in Table 5.5 of the Transport Assessment the development will generate 27 trips per day from the office element and 78 trips per day from the residential element. As such, the total trips per annum and associated emissions are as follows:

Residential (C3):

- Total trips per annum = 78 * 365 = 28,470
- The NOx emission factor is 0.353 g/veh-km and thus the **Residential Transport NOx Emission** is (28,470 * 0.353) = **10.0 kg/annum**

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- The PM₁₀ emission factor is 0.0606 g/veh-km and thus the **Residential Transport PM₁₀ Emissions** is $(28,470 * 0.0606) = 1.7 \text{ kg/annum}$

Commercial (B1):

- Total trips per annum = $27 * 365 = 9,855$
- The NOx emission factor is 0.370 g/veh-km and thus the **B1 Transport NOx Emission** is $(9,855 * 0.370) = 3.6 \text{ kg/annum}$
- The PM₁₀ emission factor is 0.0665 g/veh-km and thus the **B1 Transport PM₁₀ Emissions** is $(9,855 * 0.0665) = 0.7 \text{ kg/annum}$

Development Emissions:

- Total Transport NOx Emission = **13.6 kg/annum**
- Total Transport PM₁₀ Emission = **2.4 kg/annum**

The Transport Emissions Benchmarks (TEBs) are calculated by multiplying the relevant emission benchmarks by the number of properties for residential and or floor space for office use:

- TEB NOx = $1,553 \text{ g/dwelling/annum} * 88 \text{ units} = 136.7 \text{ kg/annum}$
- TEB NOx = $68.5 \text{ g/m}^2\text{/annum} * 934\text{m}^2 = 64.0 \text{ kg/annum}$
- TEB PM₁₀ = $267 \text{ g/dwelling/annum} * 88 \text{ units} = 23.5 \text{ kg/annum}$
- TEB PM₁₀ = $11.8 \text{ g/m}^2\text{/annum} * 934\text{m}^2 = 11.0 \text{ kg/annum}$

Based on the comparison between the total transport emissions and transport Emissions Benchmarks (see Table 21) the proposed development meets the air quality neutral requirements and no mitigation is required.

Table 21 – Comparison of Total Transport Emissions and Transport Emissions Benchmarks

Pollutant	Total Benchmarked Transport Emissions (kg/annum)	Total Transport Emissions (kg/annum)	Difference (kg/annum)
NOx	200.7	13.6	-187.1
PM ₁₀	34.5	2.4	-32.1

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Impact from Construction Activities

A qualitative assessment of dust levels associated with the proposed development has been carried out. The impact of dust soiling and PM₁₀ can be reduced to negligible through appropriate mitigation measures, which are listed in Table 22 and are applicable to a low to medium risk site²⁴. Implementation of these Best Practice Measures will help reduce the impact of the construction activities.

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.

²⁴ The Control of Dust and Emissions During Construction and Demolition – Draft Supplementary Planning Guidance, Mayor of London, September 2012

Table 22 – Mitigation of Construction Activities

Construction Activity	Mitigation Measures
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make a complaints log available to the local authority when asked.
	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.
Monitoring	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.
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.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period
	Avoid site runoff of water or mud.
	Keep site fencing, barriers and scaffolding clean using wet methods
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
	Cover, seed or fence stockpiles to prevent wind whipping
Operating vehicle/machinery	Ensure all non-road mobile machinery (NRMM) comply with standards.
	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.
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials
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.
	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
Waste Management	Reuse and recycle waste to reduce dust from waste materials
	Avoid bonfires and burning of waste materials.

7.2 Impact of Vehicle Emissions

The predicted concentrations of PM₁₀ and NO₂ 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] grounds for refusal, however, mitigation of any emissions should be considered”. Overall, using the flow chart presented in Figure 4, air quality is a low priority consideration at the modelled locations in each of the modelled years.

7.2.1 Building Mitigation

Based on the results and discussion above there is no need to consider building mitigation.

7.3 Air Quality Neutral Assessment

The air quality neutral assessment has concluded that the proposed development will meet building emissions benchmarks. As such, no mitigation measures are required to reduce these emissions.