Hawkins environmental

Air Quality Assessment:

112a Great Russell Street

Central London Investments Limited

1st May 2020

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1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Central London Investments Limited to undertake an air quality assessment for the proposed redevelopment of 112a Great Russell Street, situated in the Bloomsbury District of the London Borough of Camden.

During the planning process, it has been identified that the site may require an air quality assessment to determine whether the site is suitable for hotel use and to determine whether the proposed development would have an adverse impact on the surrounding environment. Consequently, this assessment has been completed in order to determine whether the proposed development achieves compliance with the National Air Quality Objectives, as well as national, regional and local planning policy.

This assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG16)* and the Institute for Air Quality Management and Environmental Protection UK's *Land-Use Planning & Development Control: Planning for Air Quality* (January 2017).

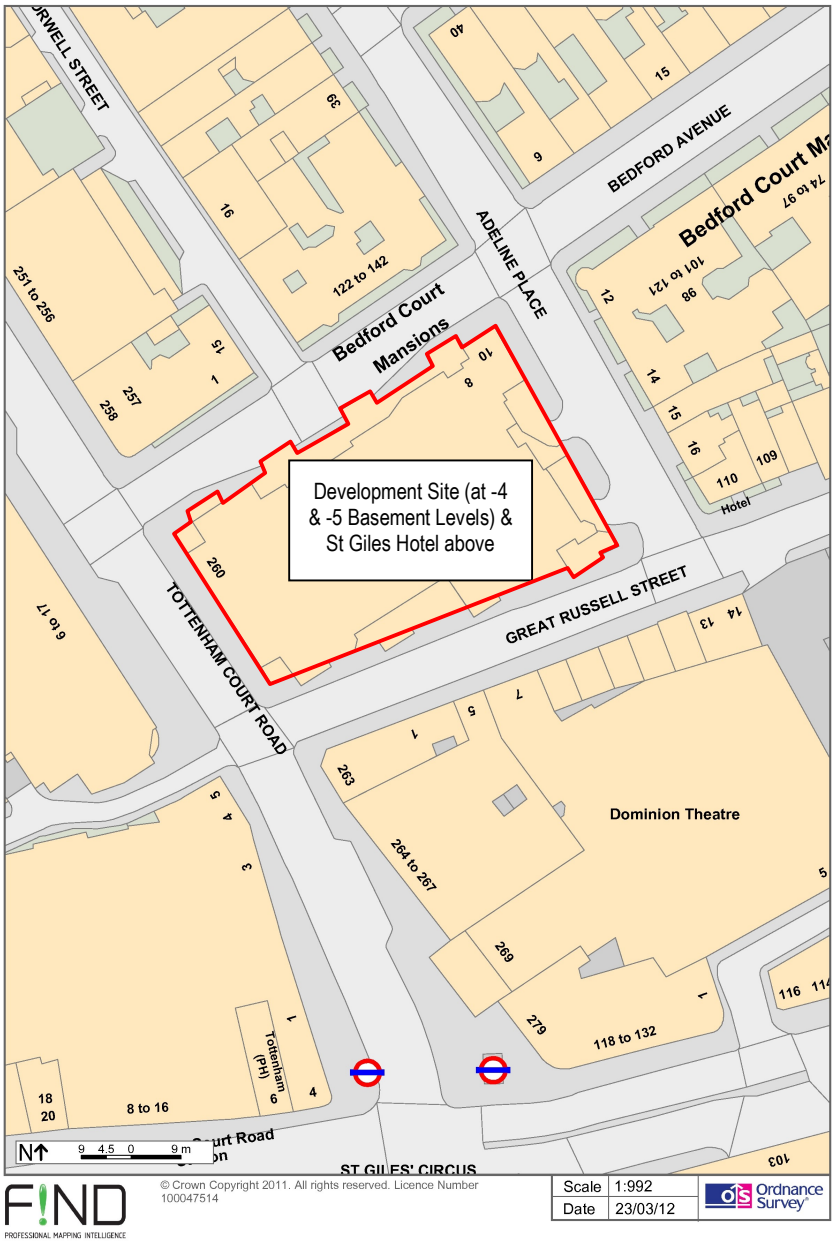
The assessment addresses the effects of air pollutant emissions from traffic using the adjacent roads and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction.*

This report assesses the overall levels of nitrogen dioxide (NO_2) and particulates (PM_{10} and $PM_{2.5}$) in the vicinity of the site. A glossary of terms is detailed in **Appendix 1.** The constraints which existing air quality may have on the proposed development have been considered and forms part of this assessment. However, the impacts of the development on the air quality of surrounding properties have also been considered.

1.2. Site Description

The proposed development site is situated in Bloomsbury in the London Borough of Camden, enclosed by Tottenham Court Road to the west, Great Russell Street to the south, Adeline Place to the east and Bedford Avenue to the north. The part of the site that forms the proposed development is a former car park at the 4th and 5th levels below ground. The proposed development will see conversion of these existing floors into a hotel. A location plan of the proposed site can be seen in **Figure 1.1**.

Figure 1.1: Site Location Plan



2. LEGISLATION, PLANNING POLICY & GUIDANCE

2.1. National Legislation

Part IV of the Environment Act (1995), requires the UK government to produce a national Air Quality Strategy which contains standards, objectives and measures for improving ambient air quality. The National Air Quality Strategy sets out National Air Quality Objectives (NAQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale.

The Clean Air for Europe (CA FE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC, its associated Daughter Directives 1999/30/EC, 2000/69/EC, 2002/3/EC, and the Council Decision 97/101/EC, with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC.

Directive 2008/50/EC is currently transcribed into UK legislation by the Air Quality Standards Regulations 2010, which came into force on 11th June 2010. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole. These limit values are the basis of the NAQOs.

The National Air Quality Objectives (NAQOs) and their Limit Values will form the basis of this air quality assessment of the proposed development. The NAQOs are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether, under normal circumstances, the air quality in the vicinity of a development is likely to be detrimental to human health. In determining whether air pollutant levels may constrain development, the results of studies are compared against the acceptability criteria. The Air Quality Standards are displayed in **Table 2.1**.

Table 2.1: Air Quality Standards

Pollutant	Average Period	NAQO Limit Value
Sulphur Dioxide	One Hour	350 µg/m^3 Not to be exceeded more than 24 times per calendar year
	One Day	150 µg/m^3 Not to be exceeded more than 3 times per calendar year
Nitrogen Dioxide	One Hour	200 µg/m^3 Not to be exceeded more than 18 times per calendar year
	Calendar Year	40 µg/m^3
Benzene	Calendar Year	5 µg/m^3
Lead	Calendar Year	0.5 µg/m^3

Pollutant	Average Period	NAQO Limit Value
PM_{10}	One Day	50 µg/m^3 Not to be exceeded more than 35 times per calendar year
	Calendar Year	40 µg/m^3
$PM_{2.5}$	Calendar Year	25 µg/m^3
Carbon Monoxide	Maximum daily running 8-hour mean	10 mg/m^3

2.2. Clean Air Strategy (2019)

The Government's Clean Air Strategy was launched on the 14th January 2019 and sets out a range of initiatives that will help reduce air pollution, providing healthier air to breathe, enhancing the economy and protecting nature. The Clean Air Strategy highlights action to be taken to reduce emissions across all sectors, including transport, the home, farming, and industrial sources. This includes actions to reduce particulate matter from domestic emissions, by introducing new legislation to prohibit the sales of the most polluting fuels and ensuring only the cleanest stoves are available for sale by 2022. In addition, the Clean Air Strategy sets out proposals to halve the population living in areas with concentrations of fine particulate matter ($PM_{2.5}$) above the World Health Organisation (WHO) guideline levels of 10 µg/m^3 by 2025.

2.3. National Planning Policy Framework (2019)

The National Planning Policy Framework (NPPF) was first published on the 27th March 2012 and revised July 2018 and again on the 20th February 2019. The NPPF outlines the Government's environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 7, 8 10 and 11). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

The NPPF states that in the planning system *"Planning policies and decisions should contribute to and enhance the natural and local environment by… e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"* (Paragraph 170).

The NPPF also states 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" (Paragraph 181).

2.4. Planning Practice Guidance (2019)

The Planning Practice Guidance (PPG) was launched on 6th March 2014 and last updated in November 2019 and provides additional guidance and interpretation to the Government's strategic policies, outlined within the NPPF, in a web-based resource. This is updated regularly.

Matters of relevance to the air quality assessment include:

- The provision of *"guidance on how planning can take account of the impact of new development on air quality".* The PPG provides signposts as to how to address air quality in planning applications and highlights the importance of local plans.
- The statement that *"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit"* (Reference ID: 32-001-20191101). The PPG goes on to say that *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species)"* (Reference ID: 32-005-20191101).
- The identification of the content of an air quality assessment, stating clearly that *"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific"* (Reference ID: 32-007-20191101).

2.5. The London Plan (2016)

The London Plan – Spatial Development Strategy for London Consolidated with Alterations since 2011 (2016) provides an overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. The London Plan brings together the Mayor's strategies, including policy on a range of environmental issues, such as climate change, air quality, noise and waste. London Boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

Policy 7.14: Improving Air Quality specifically relates to air quality and states:

"Development proposals should:

- *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...;

- *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';*
- *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);*
- *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;*
- *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."*

Regarding the appropriateness of new developments in areas of poor air quality, the London Plan states that *"increased exposure to existing poor air quality should be minimised by avoiding introduction of potentially new sensitive receptors in locations where they will be affected by existing sources of air pollution (such as road traffic and industrial processes). Particular attention should be paid to development proposals such as housing, homes for elderly people, schools and nurseries." The guidance goes on to state that "where it can be clearly shown that onsite mitigation measures are impractical or inappropriate, and where measures having clearly demonstrated equivalent air quality benefits could be taken elsewhere, local planning authorities should use their planning powers to ensure this."*

2.6. The New London Plan (2019 – Draft)

The New London Plan takes an even tougher approach to air quality and when adopted, will replace the existing London Plan. The Examination in Public (EiP) on the London Plan was held between 15th January and 22nd May 2019. The Panel of Inspectors appointed by the Secretary of State issued their report and recommendations to the Mayor on 8th October 2019. The Mayor has considered the Inspectors' recommendations and, on the 9th December 2019, issued to the Secretary of State his intention to publish the London Plan along with a clean and tracked version of the Intend to Publish London Plan, a statement of reasons for any of the Inspectors' recommendations that the Mayor does not wish to accept and a note that sets out a range of interventions that will help achieve the housing delivery set out in the Plan.

The Plan notes that *"Poor air quality is a major issue for London which is failing to meet requirements under legislation. Poor air quality has direct impacts on the health, quality of life and life expectancy of Londoners. The impacts tend to be most heavily felt in some of London's most deprived neighbourhoods, and by people who are most vulnerable to the impacts such as children and older people. London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced.*

The Mayor is committed to making air quality in London the best of any major world city, which means not only achieving compliance with legal limits for Nitrogen Dioxide as soon as possible and maintaining compliance where it is already achieved but also achieving World Health Organisation targets for other pollutants such as Particulate Matter".

Policy SI1 – Improving Air Quality states that:

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) 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".

2.7. 'Clearing the Air' – The Mayor's Air Quality Strategy (2010)

In December 2010, the Mayor of London's Air Quality Strategy was published by the Greater London Authority (GLA). The strategy sets out a framework for delivering improvements to London's air quality and includes measures aimed at reducing emissions from all types of new development, as well as raising awareness of air quality issues and its impacts on health.

2.8. Housing Supplementary Planning Guidance (2016)

The Housing Supplementary Planning Guidance (SPG), published in March 2016 highlights the elements of the London Plan that are relevant to housing development, and where applicable, provides more detail. The SPG states:

"Air Quality - Standard 5.6.1 (and policy 7.14) – Minimise increased exposure to existing poor air quality and make provision to address local problems of air quality : 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).

LP Policy 7.14 seeks to minimise increased exposure to existing poor air quality and to prevent deterioration of existing poor air quality, including by seeking that new developments are 'air quality neutral'. Developers should focus on reducing nitrogen oxides (NO_x) and particulates (PM_{10}) from their schemes. During the demolition and construction phase emissions primarily come from the operation of construction vehicles and plant and the generation of dust. During the occupation of residential schemes emissions includes those from vehicles and boilers. Exposure to poor air quality can result from the materials used within the dwelling and poor ventilation as well as external sources such as busy roads and industrial uses. Further guidance will be provided in a revision to the Sustainable Design & Construction SPG.

Where schemes cannot have openable windows due to poor air quality, careful consideration needs to be given to the location of air intake units and any increased potential for overheating in the summer due to the reduced opportunities for natural ventilation."

2.9. Sustainable Design & Construction Supplementary Planning Guidance (2014)

Published in April 2014, Section 4.3 of the Sustainable Design and Construction SPG provides additional guidance on the application of Policy 7.14 of the London Plan. The SPG identifies that the Mayor's priorities regarding air quality are:

"*Developers are to design their schemes so that they are at least 'air quality neutral'.*

Developments should be designed to minimise the generation of air pollution.

Developments should be designed to minimise and mitigate against increased exposure to poor air quality.

Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7.

Developers and contractors should follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development."

The SPG suggests that the above areas should be addressed in an air quality assessment, which should be provided for all major developments.

Regarding exposure to poor air quality, the SPG states that *"the location and design of a development has a direct influence on exposure to elevated air pollution levels... an air tight building (as required by energy policy – see section 2.4) with any air intakes located away from the main source of air pollution will help minimise increased exposure to poor air quality. It is recommended that developers adhere to European standard EN 13779 to ensure that air filters are fitted and regularly maintained." The SPG goes on to state that "Developers should also consider the location of outside space including gardens, balconies and roof terraces proposed in areas of particular poor air quality. These should be screened where practical with exposure minimised through appropriate positioning and design. The latest evidence suggests that green infrastructure, especially mature trees can have a small but beneficial effect, absorbing air pollution to reduce local concentrations and/or acting as a protective screen. The location of equipment should not result in flues and exhaust vents being in close proximity to recreational areas."*

In order to assess air quality neutrality, emission benchmarks have been produced for both a buildings' operation and its associated transport impacts. Provided a development meets these benchmarks, it will be considered that the development avoids any increases in NO_x or PM emissions across London and, therefore, is considered to be air quality neutral.

The policy of air quality neutrality applies to all major new developments, which the London Plan defines as being 10 or more dwellings, or being greater than 1,000m^2 of floor space for developments other than dwellings. For major developments, developers will have to calculate the NO_x and/or PM_{10} emissions from the buildings and transport elements of their developments and compare them to adopted benchmarks. For smaller developments, combustion plant must adhere to emission standards set out in the SPG.

Where developments do not meet the air quality neutral benchmark after appropriate on-site mitigation measures have been incorporated, developers *"will be required to off-set any excess in emissions. The developer should investigate options for providing NO_x and PM abatement measures offsite in the vicinity of the development. This will involve working with the relevant planning authority or nearby property owners to identify suitable mitigation measures. Measures could include:*

- *green planting/walls and screens, with special consideration given to planting that absorbs or suppresses pollutants;*
- *upgrade or abatement work to combustion plant;*
- *retro-fitting abatement technology for vehicles and flues; and*
- *exposure reduction".*

2.10. Control of Dust and Emissions from Construction and Demolition Supplementary Planning Guidance (2014)

Published in July 2014, this SPG provides guidance on preparing an Air Quality Statement for construction and demolition activities, specifically in relation to dust risk assessments and helps identify the potential scale of dust emissions for each stage of work. The SPG also provides best practice methods for controlling dust on-site and preventing 'trackout', as well as recommendations for dust monitoring.

The SPG also tries to manage emissions of nitrogen oxides (NO_x) from construction and demolition machinery by means of a new non-road mobile machinery (NRMM) ultra-low emissions zone (ULEZ). For certain types of NRMM, the SPG sets emission standards which must be achieved.

2.11. Air Quality and Planning Guidance (2007)

Written by the London Air Pollution Planning and the Local Environment (APPLE) working group of the London Councils, an umbrella organisation comprising all 32 London Borough and the City of London, the Air Quality and Planning Guidance provides technical advice on how to conduct air quality assessments for planning applications. Whilst some of this guidance is now out of date, as it has not been updated in line with changes in other guidance documents or policy, the document does still provide useful guidance, especially in relation to detailed dispersion modelling. The guidance also offers advice in relation to determining the significance of exposure to air pollution and the levels of mitigation required.

2.12. Land-Use Planning & Development Control: Planning for Air Quality (2017)

Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, provides general guidance on air quality and planning. Specifically, the guidance provides details on the scoping of effects, how to assess the impacts in relation to air quality, as well as details on how to assess the significance of impacts.

2.13. London Local Air Quality Management Technical Guidance TG16 - (2016)

Specifically designed to provide technical guidance to Local Planning Authorities (LPAs) in relation to their review and assessment of air quality, TG(16) provides useful guidance in relation to the appropriate methods of air quality modelling and monitoring, which can be as equally useful to the assessment of air quality impacts.

2.14. Guidance on the Assessment of Dust from Demolition and Construction (2014)

Published in 2014, the IAQM's Guidance on the Assessment of Dust from Demolition and Construction provides guidance on preparing an Air Quality Statement for construction and demolition activities, specifically in relation to dust risk assessments, as well as providing details on how best to mitigate the impacts of construction dust. Much of the detail within the IAQM's Guidance was adopted within the Control of Dust and Emissions from Construction and Demolition SPG.

2.15. Air Quality Neutral Planning Support Update: GLA 80371 (2014)

The Air Quality Neutral Planning Support Update document GLA 80371 provides a detailed methodology in support of Policy 7.14 of the London Plan in relation to how to assess air quality neutrality and what constitutes an air quality neutral development.

The document provides useful guidance in relation to the appropriate methods of air quality modelling and monitoring, which can be as equally useful to the environmental impact assessment of air quality.

2.16. London Atmospheric Emissions Inventory (2016)

The London Atmospheric Emissions Inventory (LAEI), published in 2013 and update in 2016, includes maps of the Air Quality Focus Areas in London. Air Quality Focus Areas were defined across London in locations where the EU annual mean limit value for NO_2 was exceeded, coupled with a high level of human exposure. These were not designed to be an exhaustive list of London's air pollution hotspots, but locations where the problem was the most acute. The Focus Areas were defined to address concerns raised by boroughs within the LAQM review process and forecasted air pollution trends. There are currently 187 Air Quality Focus Areas across London.

The Focus Areas have been used by GLA, TfL and the Boroughs to inform local air quality management, the development of air quality interventions and the planning process. Under London Local Air Quality Management guidelines, Boroughs are required to have regard to the focus areas in their Borough when devising their Air Quality Action Plans.

3. ASSESSMENT METHODOLOGY

3.1. Methodology Overview

The assessment of air quality considered several different areas, specifically:

1. The constraints that the existing air quality has on the Proposed Development;
2. The impact of the changes in road traffic flows on air pollutant concentrations, at nearby sensitive receptors;
3. The impact of emissions from the Proposed Development's plant (such as biomass boilers or combined heat and power (CHP) plants) on air pollutant concentrations at nearby sensitive receptors; and
4. The impact of construction and demolition dust at nearby sensitive receptors.

Land-Use Planning & Development Control: Planning for Air Quality states with respect to the identification of local receptors, they should include *"residential and other properties close to and within the proposed development, as well as alongside roads significantly affected by the development, even if well away from the development site, and especially if within AQMAs. These receptors will represent locations where people are likely to be exposed for the appropriate averaging time (dependent on the air quality objective being assessed against)"*. The last point is critical as this identifies that sensitivity in relation to air quality is directly related to the amount of time one spends in a location. For example, when considering annual mean objectives (such as that of NO_2), any area where one might spend large parts of the year might be considered a sensitive receptor. An example could be a dwelling, where one might expect to spend at least half of their time during one day. Health centres, hospitals, schools and nurseries could all expect to be considered sensitive receptors, partially due to the length of exposure spent in these locations, but also due to vulnerable members of society (e.g. the very young, the very old, or the ill) spending significant amounts of time at these locations. Offices would not normally be considered to be a highly sensitive receptor since most visitors would be healthy adults and would only spend around 8 hours per day, 5 days per week there (i.e. less than 25% of the year), whereas people could spend over 50% of their time within a dwelling. Hotels would not be considered sensitive receptors in terms of the annual mean since residents would only normally expect to spend a small number of nights in that location; however, hostels, sheltered accommodation and student accommodation would be considered as sensitive as dwellings, as residents could be expected to stay for several months.

The baseline scenario will consider two separate sets of site conditions, specifically the existing 2018 baseline conditions (the latest date for which data is available) and the future 2020 baseline site conditions, which represents the opening year of the proposed development. The consideration of a future baseline for air quality is important as it takes into account future changes in both traffic flow, but also pollutant concentrations, which could vary.

To determine the baseline conditions, the following was undertaken:

- A review of the most recent progress reports on air quality carried out by the local planning authority, as submitted to the Department for the Environment, Food and Rural Affairs (Defra);

- Determination of whether the site is situated within a designated Air Quality Management Area (AQMA);
- A review of local air quality monitoring within the area of the site;
- A review of the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) to determine whether industrial sources of air pollution could be affecting the site;
- Review of the list of registered Part A2 and Part B permitted premises under the PPC Regulations to determine whether any other sources of air pollution could be affecting the site;
- Using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**), predict concentrations of air pollutants on-site within the current baseline year and the future baseline year.

3.2. Methodology for Determining Demolition and Construction Effects

The determination of demolition and construction effects of the Proposed Development was based on the IAQM's Guidance on the Assessment of Dust from Demolition and Construction, which provides a risk-based assessment methodology to determine the significance of an air quality impact arising from the construction of a new development, based on the magnitude of change. The methodology provides a five-step approach to determining the significance:

*"**STEP 1** is to screen the requirement for a more detailed assessment. No further assessment is required if there are no receptors within a certain distance of the works.*

***STEP 2** is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:*

the scale and nature of the works, which determines the potential dust emission magnitude (STEP 2A); and

the sensitivity of the area (STEP 2B).

These factors are combined in STEP 2C to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

***STEP 3** is to determine the site-specific mitigation for each of the four potential activities in STEP 2. This will be based on the risk of dust impacts identified in STEP 2. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account.*

***STEP 4** is to examine the residual effects and to determine whether or not these are significant.*

***STEP 5** is to prepare the dust assessment report."*

3.3. Methodology for Determining Operational Effects

To determine the operational effects of the Proposed Development, the change in traffic flow at sensitive receptors in the future opening year of the proposed development, both with and without development related traffic, was modelled using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**).

To determine the impact of the proposed development on surrounding local sensitive receptors, the impact magnitude has been derived from Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the IAQM and EPUK. **Table 3.1** identifies the advice given in the IAQM / EPUK Guidance regarding impact descriptors upon individual receptors.

Table 3.1: Impact Descriptors for Individual Receptors

Long-Term Average Concentration at Receptor in Assessment Year	% Change in Concentrations Relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Source: Table 6.3 of the IAQM Guidance

The guidance goes on to offer the following explanation (taken from the footnotes of Table 6.3 of the IAQM Guidance):

"AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e.. less than 0.5% will be described as Negligible.

The Table is only designed to be used with annual mean concentrations.

Descriptors for individual receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.

The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it."

To determine whether exposure to air pollution is an overriding consideration in new residential developments, it is common to use the Air Pollution Exposure Criteria (APEC) categories, as see in **Table 3.2**, which are derived from the London Councils' *Air Quality and Planning Guidance*.

Table 3.2: Air Pollution Exposure Categories

	Applicable Range Nitrogen Dioxide Annual Mean	Applicable Range PM_{10}	Recommendation
APEC A	> 5% below national objective	**Annual Mean:** > 5% below national objective **24 hr:** > 1-day less than national objective	No air quality grounds for refusal; however; mitigation of any emissions should be considered.
APEC B	Between 5% below or above national objective	**Annual Mean:** Between 5% above or below national objective **24 hr:** Between 1-day above or below national objective.	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., Maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised.
APEC C	> 5% above national objective	**Annual Mean:** > 5% above national objective **24 hr:** > 1-day more than national 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.

3.4. Significance Criteria

Land-Use Planning & Development Control: Planning for Air Quality provides a framework to assess significance in air quality assessments. As described in the guidance, the *"assessment framework for describing impacts can be used as a starting point to make a judgement on significance of effect, but there will be other influences that might need to be accounted for. The impact descriptors set out in Table 6.3* [Replicated in **Table 3.1** of this chapter] *are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances (Paragraph 7.4)".*

The Land-Use Planning & Development Control guidance goes on to state that any significance needs to be assessed using a certain amount of professional judgement and should take into account *"the existing and future air quality in the absence of the development; the extent of current and future population exposure to the*

impacts; and the influence and validity of any assumptions adopted when undertaking the prediction of impacts" (Paragraph 7.7). For example, for a large development, a major adverse impact on a single dwelling might be considered insignificant; however, a minor impact to 100,000 dwellings might be considered to be highly significant. Furthermore, the absolute level of pollutant concentrations are also important in determining significance; for example, a moderate impact to a small group of dwellings might be considered highly significant if the concentrations of NO_2 were well in excess of the NAQO level, however, that same moderate impact might be considered insignificant if concentrations were well below the NAQO.

4. SCOPING

4.1. Overview

The National Planning Practice Guidance on Air Quality is explicit in stating that *"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific"* (Reference ID: 32-007-20191101). This is reiterated in *Land-Use Planning & Development Control: Planning for Air Quality*, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, which provided guidance on screening as to whether an air quality assessment is required and what needs to be assessed.

4.2. Impacts of the Local Area on the Development

The IAQM/EPUK Guidance suggests that whether an assessment of the impacts of the local area on the proposed development is required is a matter of judgement, but should take into account:

- *"the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular NO_2), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development."*

4.3. Impacts of the Development on the Local Area

To determine whether an assessment of the impacts of the development on the local environment is required, the IAQM/EPUK Guidance suggests a two-stage approach. The guidance states that *"The **first stage** is intended to screen out smaller development and/or developments where impacts can be considered to have insignificant effects. The **second stage** relates to specific details regarding the proposed development and the likelihood of air quality impacts."*

Figure 4.1 reproduces Stage 1 of the IAQM/EPUK Guidance' two-stage approach. In order to proceed to Stage 2, development needs to meet both one of the criteria in "A", and one of the criteria in "B". If the development fails to meet these criteria, then an air quality assessment looking at the impacts of the development on the local area will not be required.

Figure 4.2 reproduces Stage 2 of the IAQM/EPUK Guidance' two-stage approach. If the development meets the criteria contained within Stage 1, *"more specific guidance as to when an air quality assessment is likely to be required to assess the impacts of the proposed development on the local area."* If the development then meets any of the eight criteria in Stage 2, an assessment of the impacts of the proposed development on the surrounding environment will be required.

Figure 4.1: IAQM/EPUK Guidance – Stage 1 Criteria

Criteria to Proceed to Stage 2

A. If any of the following apply:

- 10 or more residential units or a site area of more than 0.5ha
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1ha

B. Coupled with any of the following:

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

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

Figure 4.2: IAQM/EPUK Guidance – Stage 2 Criteria

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment [a]
1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA.
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts.
5. Introduce or change a bus station.	Where bus flows will change by: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20 m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec[a] is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

[a] As a guide, the 5 mg/s criterion equates to a 450 kW ultra low NO_x gas boiler **or** a 30kW CHP unit operating at <95mg/Nm^3. Users of this guidance should quantify the NO_x mass emission rate from the proposed plant, based on manufacturers' specifications and operational conditions.

4.4. Site Specific Scoping Assessment

The proposed development is located in an Air Quality Management Area and is located adjacent to Tottenham Court Road, which is known to be a highly trafficked road, where exceedances of the National Air Quality Objective for NO_2 often occur; therefore **an assessment of the impacts of the local area on the development is required**.

The proposed development will be car free with no provision for on-site car parking, and does not meet any of the other Stage 1 "B" criteria outlined in **Figure 4.2**. Therefore, **an assessment of the impacts of the development on the local area is not required**.

5. BASELINE CONDITIONS

5.1. Air Quality Review and Assessment

Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the NAQO's. Where these objectives are unlikely to be achieved, local authorities must designate these areas as Air Quality Management Areas (AQMA's) and prepare a written action plan to achieve the NAQO's.

The review of air quality takes on several prescribed stages, of which each stage is reported. The review of historic Air Quality Assessment reports for the London Borough of Camden indicates that exceedances of the annual mean objective for NO_2 has been experienced across the Borough, primarily centred on the main roads, and these exceedances are predicted to continue. It is understood that exceedances of the annual mean objectives for both PM_{10} and $PM_{2.5}$ are not expected within the Borough in future years.

As a consequence of the exceedances of the NAQOs, the London Borough of Camden have declared an Air Quality Management Area (AQMA) encompassing the entire Borough.

The London Atmospheric Emissions Inventory (LAEI) notes that the site is located adjacent to one of the London Borough of Camden's Air Quality Focus Areas, specifically Area 184, which encompasses a large part of Oxford Street and New Oxford Street one junction to the south of the proposed development site.

Concentrations of SO_2, Benzene, Lead and CO are not considered to be significant within the Borough. Consequently, no further consideration is given to these pollutants as it is highly unlikely that they would be of concern on the proposed development site.

5.2. Local Air Quality Monitoring

The London Borough of Camden has conducted air quality monitoring, including at two sites in the vicinity of the proposed development site. Both sites are designated to be roadside monitoring locations and therefore would be suitable for verification of the air quality model. **Table 5.1** summarises the air quality monitoring data.

Table 5.1: Air Quality Monitoring

Location	Annual Mean Concentrations of NO_2 (µg/m^3)				
	2014	2015	2016	2017	2018
CA11 - Tottenham Court Road	86.75	85.61	83.57	No Data	65.7
CA21 - Bloomsbury Street	80.82	71.43	72.20	80.67	59.4

5.3. Industrial Emissions

Both the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) and the Local Authority's list of registered Part A2 and Part B permitted premises under the Pollution, Prevention and Control Act 1999 and the Environmental Permitting (England and Wales)

Regulations 2010 have shown that there are no sites within close proximity of the development site that could be affecting air pollutant levels.

5.4. Baseline Onsite Pollution Concentrations

To characterise the air quality at the development site at present, predictions of air pollutant concentrations at the development site have been made using the air quality model for the baseline year (2018). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO_2 from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for a single receptor, representative of the air inlet from which air will be drawn for all rooms of the proposed development. A location of this receptor location can be seen on the site plan in **Appendix 3**. The results of these predictions can be seen in **Table 5.2**.

Table 5.2: Baseline Air Quality Concentrations 2018 – Development Site

Receptor	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		$PM_{2.5}$ (µg/m^3)
	Annual Mean	Annual Mean	Days >50 µg/m^3	Annual Mean
Air Inlet	42.47	20.00	3.40	10.61
NAQO	**40**	**40**	**35**	**25**

If pollutant concentrations in **Table 5.2** are compared to the National Air Quality Objectives, it can be seen that on the development site at present, concentrations of NO_2 are in excess of the National Air Quality Objectives.

6. IMPACTS OF THE LOCAL AREA ON THE DEVELOPMENT

6.1. Annual Mean Concentrations

To characterise the air quality at the development site when constructed, predictions of air pollutant concentrations at the development site have been made using the air quality model for the proposed year of occupation (2020). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO_2 from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for a single receptor, representative of the air inlet from which air will be drawn for all rooms of the proposed development. A location of this receptor location can be seen on the site plan in **Appendix 3**. The results of these predictions can be seen in **Table 6.1**.

Table 6.1: Predicted Future Air Quality Concentrations 2020 – Development Site

Receptor	NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
	Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
Air Inlet	39.49	19.93	3.32	10.53
NAQO	**40**	**40**	**35**	**25**

If pollutant concentrations in **Table 6.1** are compared to the National Air Quality Objectives, it can be seen that on the development site during the opening year, concentrations of NO_2 are below the National Air Quality Objectives.

It is known that NO_X and NO_2 concentrations are not declining as predicted, especially in Greater London. Consequently, it is now commonplace to consider future concentrations of air pollutants without future reductions in emissions rates, as was predicted, alongside future concentrations of air pollutants with future reductions in emissions rates, with the likely onsite future pollutant concentrations considered to be somewhere between the two.

Table 6.1 shows the future concentrations of air pollutants with future reductions in emissions rates, with **Table 5.2** effectively showing future concentrations of air pollutants without future reductions in emissions rates. At the south façade at ground-floor level (the worst affected area of the proposed development), the annual mean concentration of NO_2 will be somewhere between 39.49 µg/m³ and 42.47 µg/m³.

To more accurately predict future baseline concentrations in light of the fact that NO_X and NO_2 concentrations are not declining as predicted, Air Quality Consultants Ltd have developed the CURED (Calculator Using Realistic Emissions for Diesel) emissions factor dataset for predicting future NO_x and NO_2 concentrations. The model uses the same COPERT (V5.0) emissions factors and fleet compositions as Defra's Emissions Factors

Toolkit (EFT) V9.0 as used in the modelled predictions above, however it takes a more pessimistic view than the EFT regarding the efficacy of forthcoming phases on the Euro 6 standard for diesel cars and vans. Modelling future baseline pollutant concentrations with the CURED emissions factor dataset should provide a more accurate representation of future concentrations of NO_2.

Concentrations have been calculated for the same two representative points at the same floor levels across the development site as per the above, this time using the CURED emissions factor dataset that take into account the models adjusted expectations for contributions from diesel vehicles. The results of these predictions can be seen in **Table 6.2**.

Table 6.2: Predicted Future Air Quality Concentrations 2020 – Using CURED Emissions Factors

Receptor	NO_2 (µg/m^3)
	Annual Mean
Front Ground Floor	39.54
NAQO	**40**

Pollutant concentrations in **Table 6.2** are higher than their respective concentrations calculated without the CURED emissions factors, albeit still closer in absolute value to the 2020 concentrations than the 2018 concentrations. Regardless of whether expectations of diesel emissions are adjusted or not, it can be seen that on the development site during the opening year, concentrations of NO_2 are marginally below the National Air Quality Objectives.

In accordance with the London Councils' *Air Quality and Planning Guidance*, the predicted annual mean concentrations of both NO_2 and PM_{10} are between 5% above and below the National Air Quality Objective level; therefore the site is considered to be within Air Pollution Exposure Criteria (APEC) category APEC B, i.e. "*there may not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised*".

6.2. NO_2 1-hour Exposure

In order to meet the hourly Air Quality Standard on NO_2, the average hourly concentration of NO_2 must not exceed the hourly objective level of 200 µg/m^3 more than 18 times in one calendar year. If this standard is not met, there would be concern that even short duration exposure to pollutant concentrations could be prejudicial to health, which could be a concern for gardens, balconies and other outdoor amenity spaces associated with the development.

According to research conducted in 2003[1], there is only a risk that the NO_2 1-hour objective (200 µg/m^3) could be exceeded if the annual mean nitrogen dioxide concentration is greater than 60 µg/m^3. At the development site, the worst-case future annual mean is 39.54 µg/m^3, therefore hourly exceedances are not expected to occur. Consequently, local short duration pollutant concentrations would not be considered a cause for concern in gardens, balconies and other outdoor amenity spaces associated with the development.

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

7. IMPACTS OF THE DEVELOPMENT ON THE LOCAL AREA

The scoping assessment contained within **Section 4** of this report identifies that the impact of the proposed development on the local environment is likely to be insignificant and therefore no further assessment is required.

8. AIR QUALITY NEUTRALITY

8.1. Overview

Section 7.14 of the London Plan requires that major developments should be at least air quality neutral in terms of its overall impact on air quality, not just in terms of the local impact on the environment. The London Plan's Sustainable Design and Construction SPG and complimentary *Air Quality Neutral Planning Support Update: GLA 80371* (April 2014) provides benchmarks against which the transport and building emissions for developments should be assessed against.

The above guidance is used to assess:

- The onsite emissions of NO_X and PM_{10} associated with building use calculated from energy use and default or site-specific emission factors; and
- The emissions of NO_X and PM_{10} associated with transport from the development, calculated from traffic generation and default or site-specific emission factors.

The proposed development can be deemed to be *Air Quality Neutral* without the need for detailed calculations as described in described in *Air Quality Neutral Planning Support Update: GLA 80371*. Details of plant for the proposed development indicate that the building will be heated and cooled electrically and therefore no plant that produce on-site emissions are planned. The proposed development will therefore be *Air Quality Neutral* from a buildings perspective regardless of the Buildings Emissions Benchmark as the buildings emissions will be zero. From a transport perspective, the proposed development will be car-free with no provision for on-site parking. The only likely transport generation for a development of this type would be a small amount of service/maintenance and delivery vehicles, the emissions from which would fall well below a calculated Transport Emissions Benchmark for a development of this size.

9. CONSTRUCTION DUST IMPACT ASSESSMENT

9.1. Overview

The main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes; and
- An increase in concentrations of airborne particles (e.g. PM_{10}, $PM_{2.5}$) and nitrogen dioxide due to exhaust emissions from site plant and traffic that can impact adversely on human health.

The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from the site. Most of this PM_{10} is likely to be in the $PM_{2.5-10}$ fraction, known as coarse particles.

It is very difficult to quantify emissions of dust from construction activities. It is, therefore, common practice to provide a qualitative assessment of potential impacts. The Institute of Air Quality Management's *Guidance on the assessment of dust from demolition and construction (February 2014)* contains a complex methodology for determining the significance of construction impacts on air quality. The following sections outline the steps outlined in the IAQM methodology.

9.2. Step 1 – Screening the Need for a Detailed Assessment

The IAQM guidance states that:

"An assessment will normally be required where there is:

- *a 'human receptor' within:*
    - *350 m of the boundary of the site; or*
    - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).*
- *an 'ecological receptor' within:*
    - *50 m of the boundary of the site; or*
    - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)."*

There are existing receptors within 350m of the boundary of the development site and within 50m of the route used by construction vehicles on the public highway. Therefore, a detailed assessment is required to determine potential dust impacts.

Step 1 Summary:

A detailed assessment is required to determine potential dust impacts.

9.3. Step 2 – Assess the Risks of Dust Impacts

The IAQM guidance states that:

"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 site 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 (STEP 2A); and*
- *the sensitivity of the area to dust impacts (STEP 2B), which is defined as low, medium or high sensitivity.*

These two factors are combined in STEP 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time."

9.3.1. Step 2a – Dust Emission Magnitude

The first step (Step 2a) is therefore to assess the magnitude of the anticipated works. **Table 9.1** summarises the dust emission magnitude for each activity.

Table 9.1: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Justification
Demolition	**Small**	*Minor alterations to street-facing features at ground level. All other demolition will be internal reconfiguration underground.*
Earthworks	**N/A**	*No earthworks required.*
Construction	**Small**	*Minor alterations to street-facing features at ground level. All other construction will be internal reconfiguration underground.*
Trackout	**Small**	*Less than 10 outward HGV movements per day are expected and the sections of unpaved roads will be less than 50 m.*

9.3.2. Step 2b – Sensitivity of the Area

The next step (Step 2b) is therefore to assess the sensitivity of the area that could be affected by the anticipated works. **Figure 9.1** shows the distance bands into which receptors fall as described in the guidance, both from the site (20, 50, 100 and 350 metres) and **Figure 9.2** shows the relevant bands for the associated haul routes (20 and 50 metres).

Figure 9.1: Receptor distance bands from proposed development site

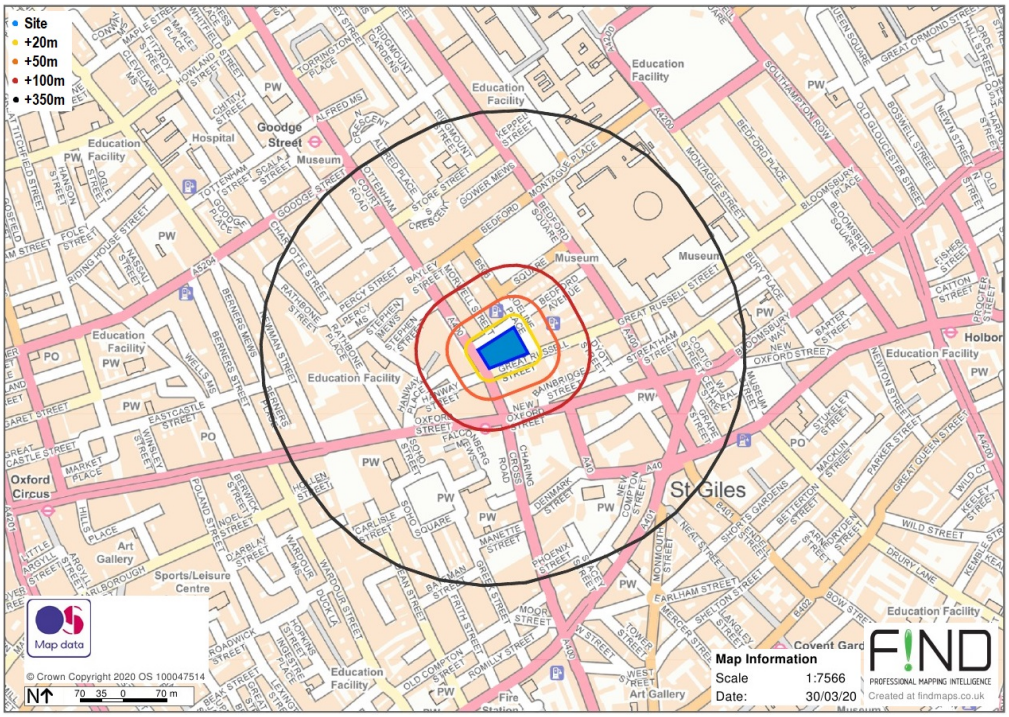
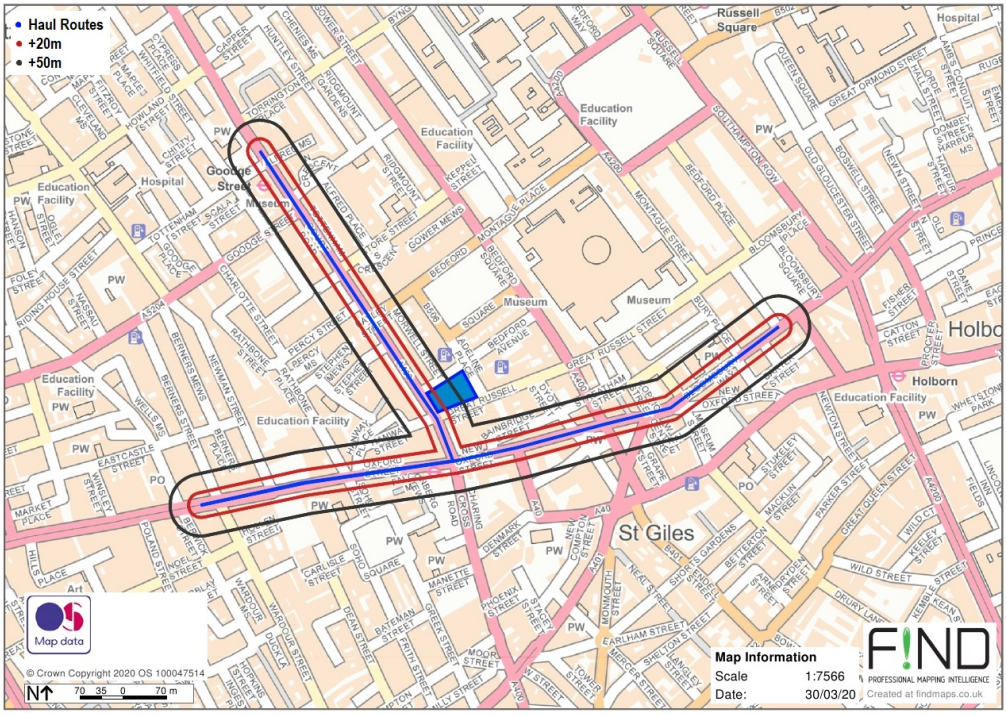


Figure 9.2: Receptor distance bands from proposed haul routes



There are a number of existing dwellings in the area that are considered to be high sensitivity receptors. There are between 10 and 100 high sensitivity receptors within 20m of the site boundary; therefore, the sensitivity to dust soiling effects on people and property is *"high"* for all activities.

The annual mean concentration of PM_{10} is less than 24 µg/m^3; despite the number of high sensitivity receptors outlined above, this results in a *"low"* sensitivity of the area to human health impacts for all activities.

There are no ecological receptors that are considered to be anything greater than low sensitivity receptors within 50m of the site; this results in a *"low"* sensitivity of the area to ecological impacts for all activities.

Table 9.2 summarises the sensitivity of the area for each activity.

Table 9.2: Outcome of Defining the Sensitivity of the Area

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

9.3.3. Step 2c – Define the Risks

The next step (Step 2c) is to assign the level of risk for each activity, based on the receptor sensitivity and the dust emission magnitude. **Table 9.3** summarises the dust risk for each activity.

Table 9.3: Summary Dust Risk Table to Define Site-Specific Mitigation

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

Step 2 Summary:

- *Dust Emission Magnitude is "Small" for demolition, construction and trackout.*
- *The Sensitivity of the area of is "High" for dust soiling and "Low" for human health and ecological impacts.*

- *The site is considered a "Medium Risk Site" in respect of demolition and a "Low Risk Site" in respect of construction and trackout. It is therefore considered a "Medium Risk Site" overall.*

9.4. Step 3 – Site Specific Mitigation

Stage 2 determines that the site is considered a "*Medium Risk Site*" in respect of demolition and a "*Low Risk Site*" in respect of construction and trackout. It is therefore considered a "*Medium Risk Site*" overall.

The IAQM guidance provides a list of potential mitigation measures and suggests where these measures are highly recommended, desirable or not required based upon the risk of the site. For all sites that are a *"Medium Risk Site*" or higher, a Dust Management Plan is highly recommended and should incorporate the mitigation measures recommended based on the site risk.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all medium risk sites:

- Communications: Develop and implement a stakeholder communications plan that includes community engagement before work commences.
- Communications: Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary.
- Communications: Display the head or regional office contact information.
- Communications: Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LPA. 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. In London, additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.
- Site management: Record all dust and air quality complaints, identify the cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Site management: Make the complaints log available to the local authority when asked.
- Site management: Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.
- Monitoring: Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the LPA when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of Site boundary, with cleaning to be provided if necessary.
- Monitoring: 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.

- Monitoring: 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.
- Monitoring: Agree on dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on-site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
- Preparing and maintaining the Site: Plan Site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Preparing and maintaining the Site: Erect solid screens or barriers around dusty activities (or the Site boundary) that are at least as high as any stockpiles on-site.
- Preparing and maintaining the 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.
- Preparing and maintaining the Site: Avoid Site runoff of water or mud.
- Preparing and maintaining the Site: Keep Site fencing, barriers and scaffolding clean using wet methods.
- Preparing and maintaining the Site: 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.
- Preparing and maintaining the Site: Cover, seed or fence stockpiles to prevent wind whipping.
- Operating vehicle/machinery and sustainable travel: Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable.
- Operating vehicle/machinery and sustainable travel: Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Operating vehicle/machinery and sustainable travel: Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Operating vehicle / machinery and sustainable travel: Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long-haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)
- Operating vehicle/machinery and sustainable travel: Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Operating vehicle/machinery and sustainable travel: 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.
- Operations: Ensure an adequate water supply on the Site for effective dust / particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Operations: Use enclosed chutes and conveyors and covered skips.
- Operations: Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Operations: 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: Avoid bonfires and burning of waste materials.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all medium risk sites in relation to demolition:

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all low risk sites in relation to construction:

- Avoid scabbing (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all low risk sites in relation to trackout:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.

- Record all inspections of haul routes and any subsequent action in a site log book.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

In addition to the mitigation contained within the IAQM Guidance, the Control of Dust and Emissions from Construction and Demolition SPG contains more specific detailed mitigation measures with regards to precise construction processes, which should be incorporated into the DMP as appropriate.

The Control of Dust and Emissions from Construction and Demolition SPG also includes details on construction dust site monitoring.

Step 3 Summary:

The site is considered a "Medium Risk Site" overall and a Dust Management Plan is recommended incorporating a number of specific mitigation measures based on the site-specific risks.

9.5. Step 4 – Determining Significant Effects

The site is considered a *"Medium Risk Site"* overall and if appropriate mitigation measures are put in place, as identified in Step 3, significant effects on receptors are unlikely to occur. Considering both the construction details and the specific characteristics of the site, it is anticipated that effective mitigation will be possible and residual effects will not be considered significant.

Step 4 Summary:

With risk appropriate mitigation, residual effects will not be considered significant.

9.6. Step 5 – Dust Assessment Report

Step 5 Summary:

Dust and other pollutant emissions from the construction, demolition, earthworks and trackout phases of the construction of the proposed development will see the site designated a "Medium Risk Site". However, with risk-appropriate mitigation, residual effects will not be considered significant.

10. MITIGATION

As a consequence of the proposed development, there will not be a significant increase in pollutant concentrations and therefore mitigation is not seen to be necessary, other than those routinely used to control construction dust, as detailed in the previous section. However, the concentration of NO_2 at the proposed development site is in close proximity to the NAQO with a predicted worst-case future annual mean of 39.35 µg/m^3. This falls into APEC Band B under the London Councils' *Air Quality and Planning Guidance* and therefore, whenever possible, mitigation should be implemented to reduce the exposure from NO_2 to future occupiers of the proposed development, especially given inherent uncertainties in the model.

It is understood that the mechanical ventilation system that has been proposed will be drawing air from a position on the southern façade of the development facing Great Russell Street (see **Appendix 3**) above the YMCA entrance at an approximate second-floor height, which is understood to be the most appropriate location that can be used. However, it should be noted that with a background NO_2 concentration of 36 µg/m^3, the location of the air inlet will make only a small difference, i.e. even if it were possible to place the inlet at the top of the existing building on the opposite façade to Tottenham Court Road (the busiest of the four roads surrounding the site), the predicted concentrations would still not be below 36 µg/m^3. Indeed, if background concentrations were to increase even slightly between now and the opening of the proposed development, NO_2 concentrations at the air inlet could be predicted to exceed the NAQO. It may therefore be appropriate to consider filtration technology.

Recent advancements in filtration technology mean it is now possible to fit air pollution filters to mechanical ventilation systems. Until recently, whilst it has been possible to filter dust (i.e. PM_{10} and $PM_{2.5}$) from mechanical ventilation systems using appropriate filters since NO_2 is a gas rather than a particle, commercially available gas filtration has not been widely available. However, a number of companies are now offering Type 1 Gas Filtration systems, offering specially formulated activated carbon chemical scrubbing media, which can significantly reduce NO_2 when passed through the media.

At this development site, it is proposed to install the Nitrosorb system supplied by AAC Eurovent which can be fitted to the central air handling units for whole building ventilation systems. These systems have been thoroughly tested and there are examples of their current usage in London and elsewhere in the UK.

The NO_2 filter media requires changing every two years (associated PM_{10} filters may require more frequent changes) and the provision for this will need to be taken into account in the future management of the building. The filtration media does not have any mechanical or electrical parts; therefore, they cannot fail, providing the media is changed at the recommended intervals. AAC Eurovent has conducted laboratory trials which suggest a removal efficiency of NO_2 of between 76% and 83%. Based on a maximum concentration at this site of 39.35 µg/m^3 in the opening year of the development, assuming a 76% efficiency (i.e. a worst-case), this would result in internal concentrations of NO_2 of around 9.44 µg/m^3, which would provide a significantly better level of protection when compared to naturally ventilated buildings.

When considering the ventilation strategy, one needs to consider the ventilation pathways to minimise pollutant ingress and build-up of air pollutants inside the building. BRE FB 30 *Ventilation for healthy buildings: Reducing the impact of urban air pollution* (2011) provides general advice on developing a ventilation strategy to minimise

pollutant ingress. The guidance recommends considering not just local air pollution concentrations, but also the location of ventilation inlets relative to local pollutant sources, such as boiler flues.

BRE IP 9/14 *Locating ventilation inlets to reduce ingress of external pollutants into buildings* (2014) provides a methodology to calculation the Pollutant Ingress Index, which can be used to determine the optimum location of ventilation inlets, openable windows, and trickle and background ventilators to reduce ingress of external pollutants into buildings.

As a general rule, fresh air intakes should be positioned at least 10 m of horizontal distance from sources of external pollution, including the location of any building-related exhausts, either from the development itself or from other buildings, plus the building's air intakes and exhausts should be at least 10m of horizontal distance apart, which has been noted on the plans for the proposed development.

11. CONCLUSIONS & SUMMARY

An air quality assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG16)* and addresses the effects of air pollutant emissions from traffic using the adjacent roads, and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction.*

Baseline pollutant concentrations on site have been investigated using both existing monitoring data and through predictions using the ADMS-Roads Detailed Dispersion Model methodology. At present, and in the opening year of the proposed development (2020), concentrations of all pollutants are below the Air Quality Objectives, although a precited NO_2 concentration of 39.54 µg/m^3 falls within APEC Band B under the London Councils' *Air Quality and Planning Guidance*.

In order to assess the impact of the proposed development on local air quality, the IAQM/EPUK Guidance *Land-Use Planning & Development Control: Planning for Air Quality* has been utilised. The scoping stage has determined that due to the car-free nature of the development, a full assessment of the impacts of the proposed development on local air quality is not required.

An air quality neutral assessment has been undertaken in line with Policy 7.14 of the London Plan and the guidance contained within Section 4.3 of the Sustainable Design and Construction SPG. It has been possible to determine that the proposed development will be Air Quality Neutral without need for the methodology contained within A*ir Quality Neutral Planning Support Update: GLA 80371,* as there are no building emissions and negligible transport emissions associated with the proposed development.

With regards to the impacts of construction on air quality, dust and other pollutant emissions from the construction and demolition phases of the construction of the proposed development, the site is designated as a "*Medium Risk Site"*. However, with risk-appropriate mitigation, residual effects will not be considered significant.

Since it has been shown that the proposed development meets the guidance contained within *Technical Guidance on Local Air Quality Management (LAQM) (TG16),* IAQM/EPUK's *Land-Use Planning & Development Control: Planning for Air Quality* and IAQM's *Guidance on the assessment of dust from demolition and construction*, it is considered that the proposed development adheres to the principles of the National Planning Policy Framework since the new development will not be *"put at risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution"*. Since it has been shown that in terms of air quality, the proposals adhere to local and national planning policy, it is considered that the air pollution should not be a constraint on the proposed development.

Appendix 1
Glossary of Terms

Appendix 1: Glossary of Terms

Air Quality Standard/Air Quality Objective: The concentrations of pollutants in the atmosphere, which can broadly be taken to achieve a certain level of environmental quality. The standards are based on an assessment of the effects of each pollutant on human health including the effects on sensitive subgroups.

Annual mean: The average of the concentrations measured for each pollutant for one year. In the case of the Air Quality Objectives, this is for a calendar year.

Air Quality Management Area (AQMA): An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.

Concentration: The amount of a (polluting) substance in a volume (of air), typically expressed as a mass of pollutant per unit volume of air (for example, microgrammes per cubic metre, µg/m^3) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).

Exceedance: A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.

Nitrogen Oxides: Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released into the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO_2), which is harmful to health. NO_2 and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).

Particulate Matter: Fine Particles are composed of a wide range of materials arising from a variety of sources including combustion sources (mainly road traffic), and coarse particles, suspended soils and dust from construction work. Particles are measured in a number of different size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM_{10} (less than 10 microns in diameter), but the finer fractions such as $PM_{2.5}$ (less than 2.5 microns in diameter) is becoming of increasing interest in terms of health effects.

µg/m^3 microgrammes per cubic metre of air: A measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

Appendix 2
Air Quality Model

Appendix 2: Air Quality Model

ADMS-Roads

In the UK, the Department for Environment, Food & Rural Affairs (Defra) provides guidance on the most appropriate methods to estimate pollutant concentrations for use in Local Air Quality Management (LAQM). Defra regularly updates its Technical Guidance, with the latest LAQM Technical Guidance TG16 published in 2016.

The methodology in TG16 directs air quality professionals to a number of tools published by Defra to predict and manage air quality. One of the main tools for modelling air pollutants is ADMS-Roads, which is a refined air dispersion model produced by Cambridge Environmental Research Consultants. ADMS-Roads has been specifically developed for use with UK roads and as such is considered to be one of the most appropriate tools for use in UK air quality modelling and therefore is widely used in the UK.

ADMS-Roads is an air dispersion modelling suite that predicts the air quality impacts of nitrogen dioxide, particulate matter and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roads and junctions.

The methodology utilised by ADMS-Roads is significantly more advanced than that of most other air dispersion models, such as CALINE, which Breeze Roads is based upon, which is the other commonly used detailed air dispersion model in the UK. ADMS-Roads incorporates the latest understanding of the boundary layer structure and goes beyond the simplistic Pasquill-Gifford stability categories method used in other dispersion models and utilises the Monin-Obukhov length for greater accuracy. The model also uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

Unlike the 'DMRB Screening Method', ADMS-Roads can take into account annualised meteorological data; it can take into account source, receiver and terrain heights; canyon effects can be modelled, and the model can calculate hourly concentrations.

TG16 provides detailed guidance on the modelling of air pollutants and in particular highlights a procedure to validate models. The procedure discusses the comparison of modelled results against measured levels, either from diffusion tubes (for NO_2) or continuous monitors (for NO_2 or PM_{10}).

Model verification and subsequent adjustment for oxides of nitrogen is undertaken based upon NO_X as most models (including ADMS-Roads) predict NO_2 based upon its relationship to NO_x. Consequently, the verification process requires conversion to NO_x of any measurements of NO_2 in order to compare against modelled levels of NO_x.

Defra has published in 2009 a methodology to calculate NO_x from NO_2 and as part of its LAQM toolkit[2]. The calculation method allows local authorities and air quality consultants to derive NO_2 and NO_x wherever NO_x is predicted by modelling emissions from roads. The calculation method incorporates the impact of expected changes in the fraction of NO_x emitted as NO_2 (f – NO_2) and changes in regional concentrations of NO_x, NO_2 and O_3.

[2] http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html

Background concentrations for various pollutants are published and updated regularly by Defra, so it is possible to calculate the contribution of NO_x from road traffic at a particular location. If the ratio of the monitored road traffic contribution to the modelled road traffic contribution of NO_x is calculated, this factor can be applied to the component derived from road traffic emissions for any predictions of NO_x in the area. Therefore, it is possible to validate the model such that predictions should be within 10% of air quality measurements.

Appendix 3
Modelling Procedure and Input Data

Appendix 3: Modelling Procedure and Input Data

The following Appendix summarises the input data and assumptions used in the modelling of air pollutants.

Model Input Data

Traffic flows in the vicinity of the site have been attained from the Department for Transport's traffic database for the year 2018. High traffic growth factors have been applied to this data to predict traffic flows for the proposed opening year (2020).

Since lower traffic speeds increase emissions from vehicles, it is necessary to take into account the reduction in traffic speeds around junctions. TG16 suggests that *"there is no simple factor that can be applied to the average speed to calculate a speed applicable to congested periods"* and that one should exercise professional judgement when taking into account congestion and decreasing speeds around junctions. However, in the absence of any more detailed site-specific information, TG16 does suggest that that *"For a busy junction, assume that traffic approaching the junction slows to an average of 20kph …(for) approach distances of approximately 25m"*. This is the approach adopted at this site.

Input road links, traffic flows, the percentage of Heavy Goods Vehicles (HGVs) and traffic speeds are shown below.

Model Input Data

Road	AADT 2018	AADT 2020	% HGV	Speed km/h
Goodge St 3	6226	6414	3.5	20
Goodge St 4	6226	6414	3.5	32
Goodge St 5	6226	6414	3.5	20
Goodge St 6	6226	6414	3.5	32
Goodge St 7	6226	6414	3.5	20
Tottenham Ct Rd 1	12248	12618	13.0	32
Tottenham Ct Rd 2	12248	12618	13.0	20
Tottenham Ct Rd 3	12248	12618	13.0	20
Tottenham Ct Rd 4	12248	12618	13.0	32
Tottenham Ct Rd 5	13943	14364	11.2	20
Tottenham Ct Rd 6	13943	14364	11.2	32
Tottenham Ct Rd 7	13943	14364	11.2	20
Tottenham Ct Rd 8	13943	14364	11.2	32

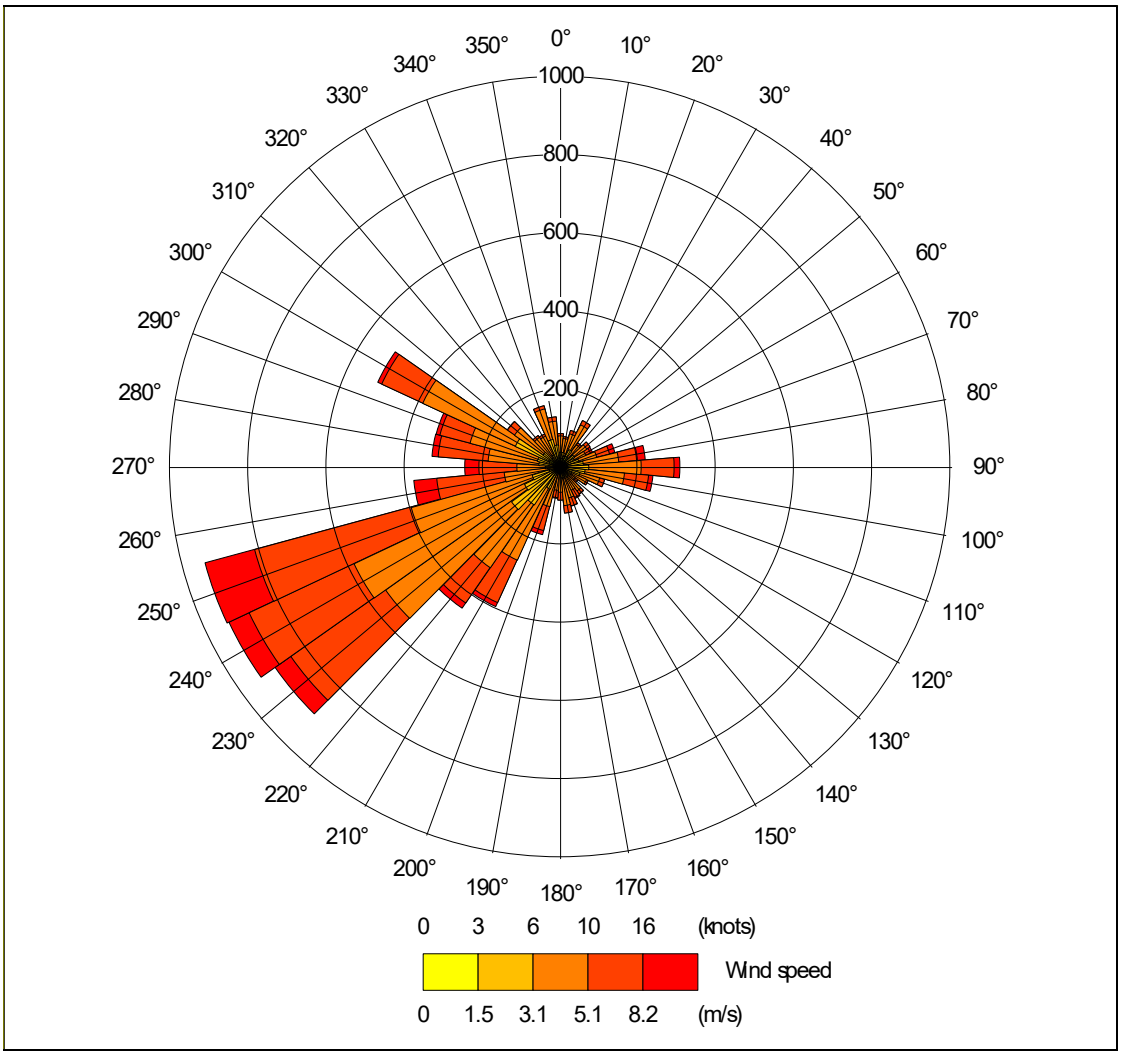
Road	AADT 2018	AADT 2020	% HGV	Speed km/h
Tottenham Ct Rd 9	13943	14364	11.2	20
Tottenham Ct Rd 10	13943	14364	11.2	32
Tottenham Ct Rd 11	13943	14364	11.2	48
Tottenham Ct Rd 12	13943	14364	11.2	20
Bloomsbury St 1	14191	14620	10.6	20
Bloomsbury St 2	14191	14620	10.6	32
Bloomsbury St 3	14191	14620	10.6	20
Bloomsbury St 4	14191	14620	10.6	32
Bloomsbury St 5	14191	14620	10.6	20
Bloomsbury St 6	14191	14620	10.6	32
Bloomsbury St 7	14191	14620	10.6	20
Bloomsbury St 8	14191	14620	10.6	32
Bloomsbury St 9	14191	14620	10.6	20
Oxford St 1	11321	11663	17.8	48
Oxford St 2	11321	11663	17.8	20
Charing Cross Rd 1	8502	8759	16.5	20
Charing Cross Rd 2	8502	8759	16.5	48
Charing Cross Rd 3	8502	8759	16.5	20
New Oxford St 1	4774	4918	48.1	20
New Oxford St 2	4774	4918	48.1	32
New Oxford St 3	4774	4918	48.1	20
New Oxford St 4	4774	4918	48.1	20
New Oxford St 5	4774	4918	48.1	32
New Oxford St 6	4774	4918	48.1	20
New Oxford St 7	4774	4918	48.1	20
New Oxford St 8	4774	4918	48.1	32

Road	AADT 2018	AADT 2020	% HGV	Speed km/h
New Oxford St 9	4774	4918	48.1	20
Bedford Av 1	1310	1350	7.1	20
Bedford Av 2	1310	1350	7.1	32
Bedford Av 3	1310	1350	7.1	20
Bedford Av 4	1310	1350	7.1	32
Bedford Av 5	1310	1350	7.1	20
Montague Place 1	9921	10221	4.3	20
Montague Place 2	9921	10221	4.3	32
Montague Place 3	9921	10221	4.3	20
Great Russell St 1	6023	6205	11.5	20
Great Russell St 2	6023	6205	11.5	32
Chenies St 1	4811	4956	3.3	20
Chenies St 2	4811	4956	3.3	32
Chenies St 3	4811	4956	3.3	20

Meteorological Data

TG16 suggests that a single year's meteorological data will be sufficient to predict air pollution concentrations. Meteorological data was obtained for the nearest meteorological station to the proposed development site, which is situated at London City Airport (Surface Station Number 3763). The meteorological data consists of hourly sequential data of wind speed, wind direction, surface temperature, precipitation rate and cloud cover data. This data was used for both model verification and future year scenarios. The figure below shows the wind rose data used in the modelling.

Wind Rose – London City Airport



Advanced Modelling Parameters

The following modelling parameters have been used in the ADMS-Roads Model:

Parameter	Value	Justification
Latitude	51.5°	Latitude of site
Surface Roughness Note 1	1.5 m	Recommended for large urban areas
Minimum Monin-Obukhov Length	100 m	Recommended for large urban areas
Surface Albedo	0.23	The default for non-snow-covered ground
Priestley-Taylor Parameter	1.0	Model default

Note 1: A surface roughness of 0.4 has been applied to the meteorological measurement site, as it is considered to be a less built up area than the proposed development site.

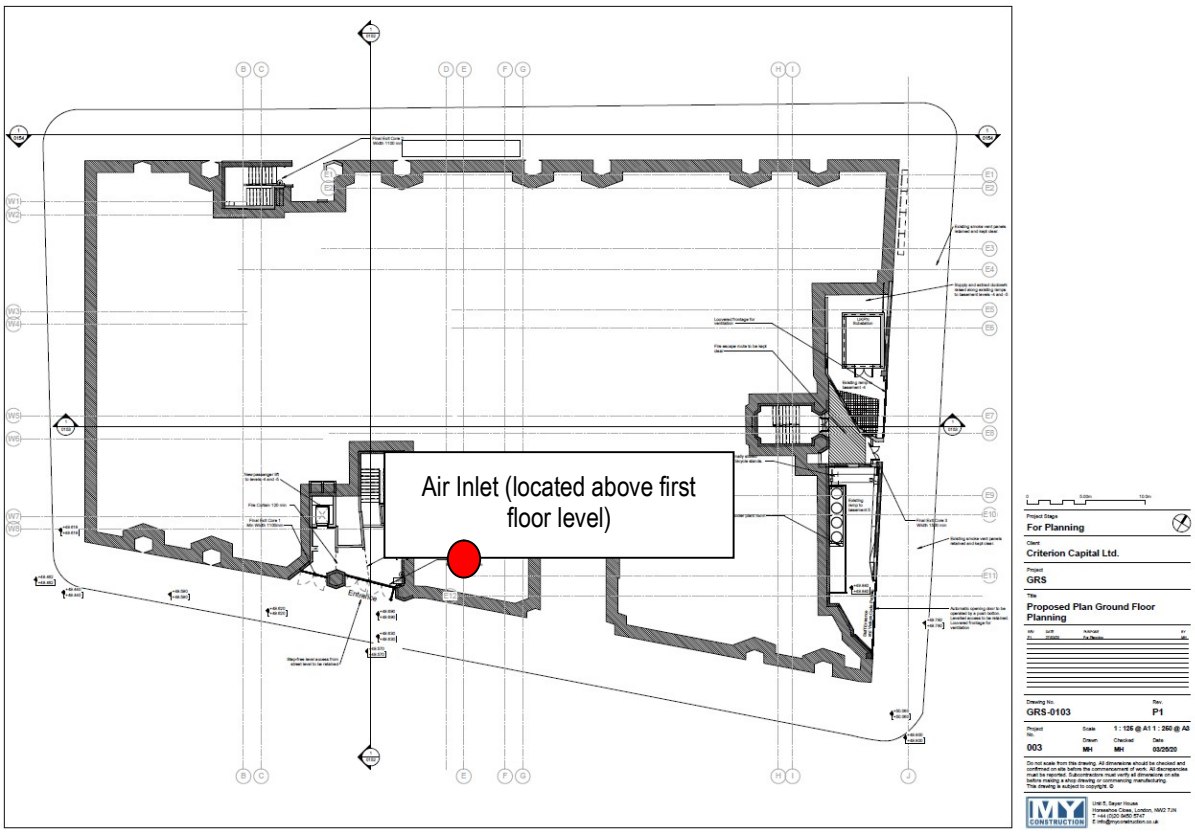
Background Concentration of Air Pollutants

At this location (as is typical in urban areas) the monitored background concentrations of NO_2 are higher than the background concentrations of NO_2 and PM_{10} contained within the background maps of the UK National Air Quality Information Archive, as recommended for use by the Local Air Quality Management Technical Guidance TG(16). Consequently, the background concentration of NO_2 from the nearby London Bloomsbury Background Monitoring Diffusion Tube (530123 182014) for 2018 has been utilised in all modelling, corresponding to an annual mean concentration of 36 $\mu g/m^3$ of NO_2. Background concentrations of PM_{10} and $PM_{2.5}$ are also monitored here and 2018 concentrations were recorded at 19 $\mu g/m^3$ and 10 $\mu g/m^3$, respectively.

The above background concentrations have been used in all modelling scenarios (current and future) in order to show a worst-case scenario, i.e. future concentrations assuming that background levels stay constant and do not decrease as expected.

Receptor Locations

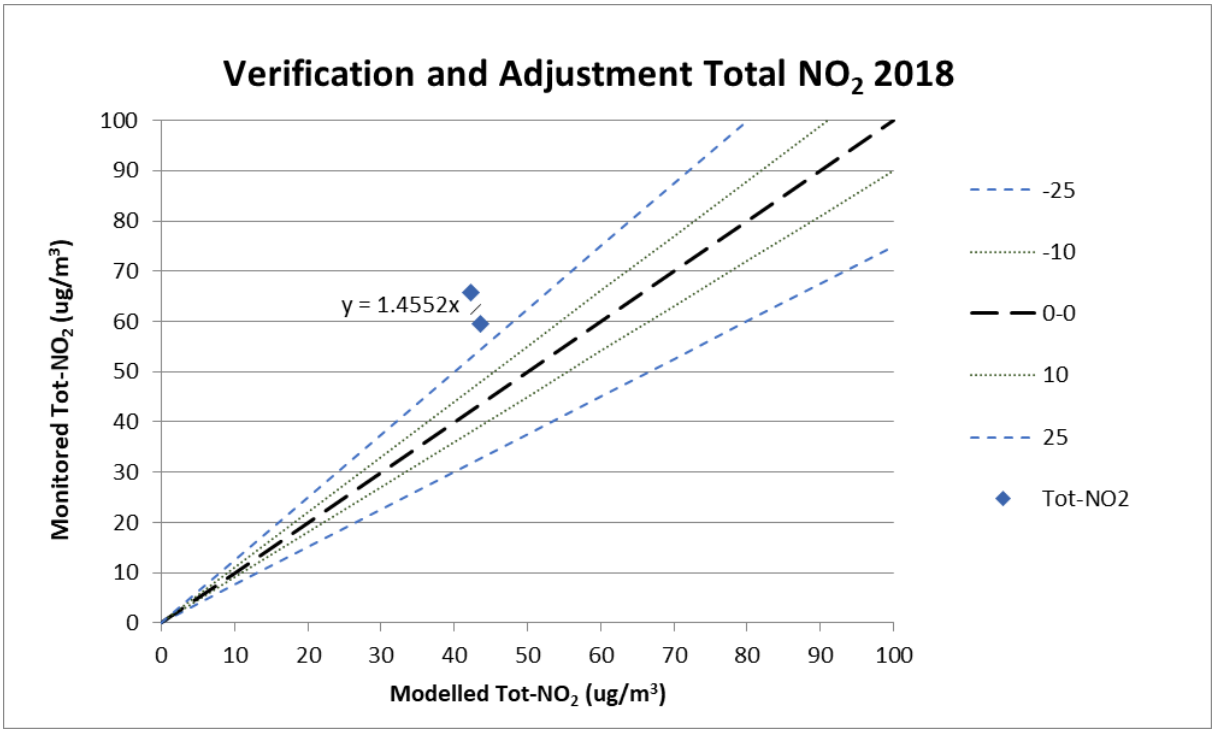
The site plan below shows the locations of the sample sensitive receptor locations used within the modelling:

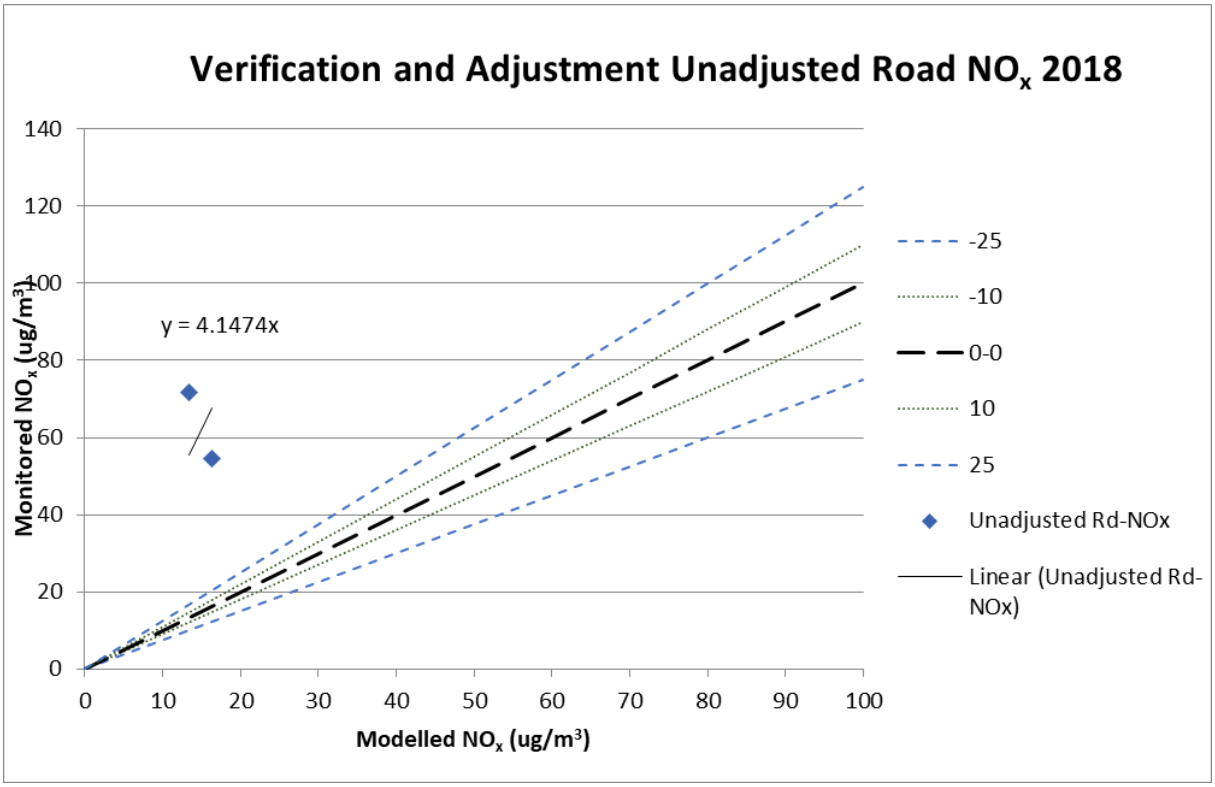


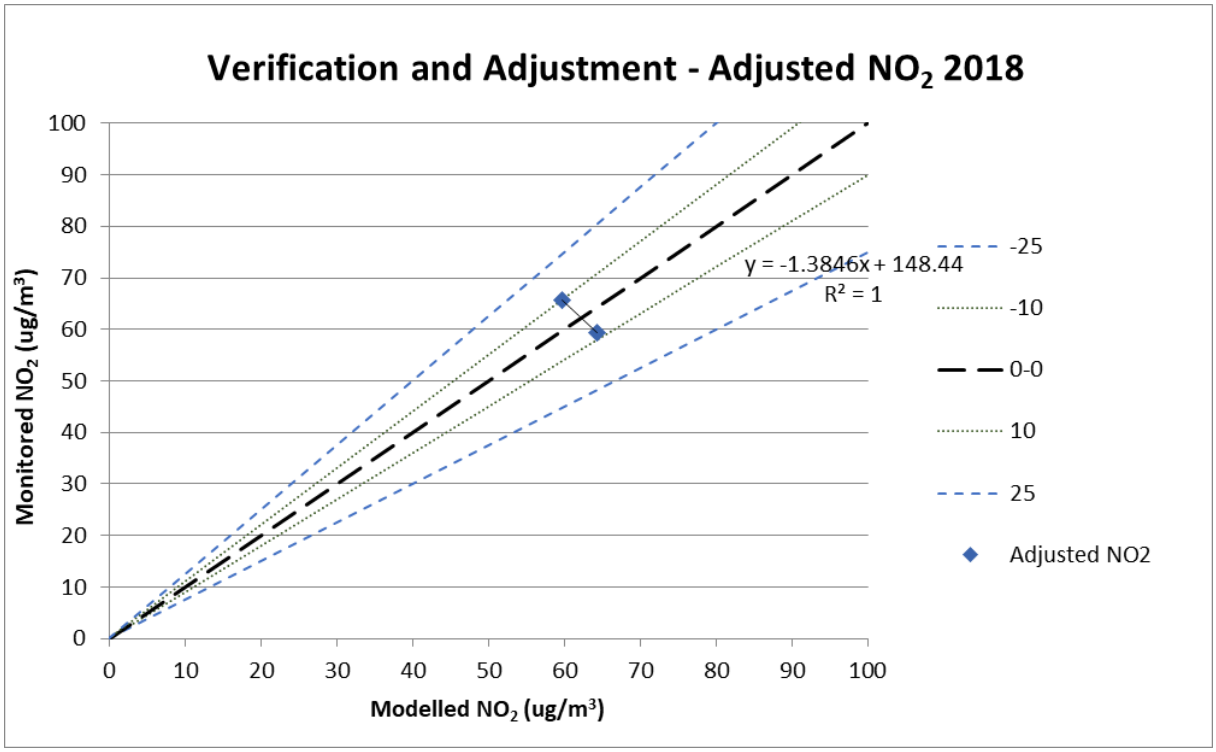
Verification and Adjustment

Verification of the air pollutant model was carried out in accordance with LAQM Technical Guidance TG16 using the data from the diffusion tube located in the vicinity of the site for 2018. The exercise required the modelling of the diffusion tube location for 2018 and comparing the modelled results with the monitoring results. The verification data is summarised below and shows that pollutant concentrations where underpredicted using the model; therefore, an adjustment factor of 4.1474 was applied to the model contribution of NO_x.

	Modelled Rds NO_x	Modelled Tot-NO_2	Monitored Tot-NO_2	%Diff Mod/Mon Tot-NO_2	Modelled Rd-NO_x	Monitored Rd-NO_x	NO_x ADJ Corr1	Adj Mod Rd-NO_x	Adj Mod Tot-NO_2	Monitored Tot-NO_2	%Diff Mod/Mon Adj Tot-NO_2
CA11 - Tottenham Court Road	13.40	42.28	65.7	-35.65	13.40	71.58	5.34	55.58	59.76	65.70	-9.04
CA21 - Bloomsbury Street	16.34	43.6	59.4	-26.60	16.34	54.63	3.34	67.75	64.31	59.40	8.27


Verification and Adjustment Total NO2 2018
Monitored Tot-NO2 (ug/m3)
Modelled Tot-NO2 (ug/m3)
y = 1.4552x
0
10
20
30
40
50
60
70
80
90
100
-25
-10
0-0
10
25
Tot-NO2


Verification and Adjustment Unadjusted Road NOx 2018
Monitored NOx (ug/m3)
Modelled NOx (ug/m3)
y = 4.1474x
0
20
40
60
80
100
120
140
-25
-10
0-0
10
25
Unadjusted Rd-NOx
Linear (Unadjusted Rd-NOx)


Verification and Adjustment - Adjusted NO2 2018
Monitored NO2 (ug/m3)
Modelled NO2 (ug/m3)
y = -1.3846x + 148.44
R² = 1
-25
-10
0-0
10
25
Adjusted NO2
0
10
20
30
40
50
60
70
80
90
100

Model Uncertainty

TG16 recommends the use of statistical parameters to assess uncertainty in the verified model. The table below describes the three parameters it recommends and the corresponding value for the verified model at this site.

Parameter	Value	Description
Correlation Coefficient	1.0	Used to measure the linear relationship between predicted an observed data. The ideal value (an absolute relationship) is 1.
Root Mean Square Coefficient	5.4	RMSE defines the average error/uncertainty of the model verification and is in the same units as the model outputs (µg/m^3). Values should be <10µg/m^3 or ideally <4µg/m^3 where concentrations are near the AQO. The ideal value is 0µg/m^3.
Fractional Bias	0.008	Identifies if the model shows a systematic tendency to over/under predict concentrations. The ideal value is 0 and range between +/- 2. Negative values suggest an over prediction whilst positive values suggest under prediction.

TG16 notes that the Correlation Coefficient is a less reliable indicator when validating with a small dataset; therefore, for sites such as this validated with smaller datasets, the Root Mean Square Coefficient is the main parameter used. The table above notes that the Root Mean Square Coefficient is 5.4, i.e. less than 10 and therefore the model can be used with a high level of confidence. The Fractional Bias is just greater than 0, indicating that on average, the validated model is likely to overpredict very marginally, but overall should be highly accurate.

PM_{10} Exceedances

The number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration has been calculated from the modelled total annual mean concentration following the relationship advised by Defra:

$A = -18.5 + 0.00145 B^3 + 206/B$

where A is the number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration and B is the annual mean PM_{10} concentration.