Air Quality Assessment

Westminster House, Richmond

Presented to: Baden Prop Ltd

Issued: April 2024

Lucion Delta-Simons Project No: 104125.598454

Protecting people and planet

Report Details

Client	Baden Prop Ltd
Report Title	Air Quality Assessment
Site Address	Westminster House, Richmond
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Lucion Delta-Simons Contact	Dan Boote

Quality Assurance

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Executive Summary

Site and Report Context	Lucion Delta-Simons Ltd ("Lucion Delta-Simons") was instructed by Baden Prop Ltd (the 'Client') to undertake an Air Quality Assessment (AQA) in support of a planning application for the creation of two additional levels of Class C3 accommodation comprising 7no.units, conversion and excavation of the existing Class E basement and part conversion of existing floorspace at basement, ground, first, second, and third floor levels to provide internal access and ancillary residential floorspace with external alterations and associated development." (the 'Proposed Development') located at Westminster House, Richmond, TW9 2ND (the 'Site'). The Proposed Development may lead to the exposure of future residents to elevated pollutant levels, as well as adverse impacts to existing sensitive receptors. As such, an AQA was undertaken to determine baseline conditions at the Site and assess potential impacts associated with the Proposed Development, in accordance with the requirements of the National Planning Policy Framework (NPPF) (as revised 2023). This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational phases of the Proposed Development, as well as the potential exposure of future residents to elevated pollutant concentrations. For both phases, the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed.
Summary	The assessment of construction phase impacts associated with fugitive dust and fine particulate matter (PM) of an aerodynamic diameter of less than 10 microns (PM_{10}) emissions has been undertaken in line with the relevant Mayor of London guidance. This identified that there is a **low** risk of dust soiling impacts and a **low** risk of increases in PM concentrations due to unmitigated construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM releases would be significantly reduced. The residual effects of the construction phase on air quality are considered to be **not significant**. The Proposed Development is expected to experience pollutant levels below the relevant criteria across the development. As such, the residual effects are considered to be **not significant,** and the Site is suitable for the proposed end-use from an air quality perspective. Due to the Proposed Development being "car-free", operational phase road traffic exhaust emissions are considered to be **not significant**. Potential emissions from the development were assessed in order to determine compliance with the air quality neutral requirements of the London Plan. The plant to be installed as part of the building energy strategy does not produce emission to atmosphere. Additionally, the scheme is classified as 'car-free'. As such, the development was considered too be air quality neutral.
Conclusions and Recommendations	Based on the results of the assessment and the implementation of the proposed mitigation measures, it is considered that the Proposed Development complies with national and local planning policies and there are no air quality constraints considered to restrict planning consent.
This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.	

Table of Contents

Figures

Appendices

1.0 Introduction

1.1 Appointment

1.1.1 Lucion Delta-Simons Ltd was instructed by Baden Prop Ltd (the 'Client') to undertake an AQA in support of a two-storey upwards extension of the existing property to provide seven residential units (the 'Proposed Development') located at Westminster House, Richmond, TW9 2ND (the 'Site').

1.1.2 Reference should be made to **Figure 1** for a map of the Site and surrounding area.

1.2 Site Location and Context

1.2.1 The Proposed Development may lead to the exposure of future residents to elevated pollutant levels, as well as adverse impacts to existing pollution levels at nearby sensitive receptors. As such, an AQA was undertaken to determine baseline conditions at the Site and assess potential impacts associated with the Proposed Development, in accordance with the requirements of the National Planning Policy Framework (NPPF) (as revised 2023).

1.2.2 The main potential sources of air pollution were identified as emissions from road transport using the local road network.

1.2.3 The report presents the findings of an assessment of the potential air quality impacts of the Proposed Development during both the construction and operational phases, as well as the potential exposure of future residents to elevated pollutant concentrations. For both phases, the type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these described.

1.2.4 The standard limitations associated with this assessment are presented in **Appendix A**.

1.2.5 A glossary of terms used in this report is provided in **Appendix B**.

1.3 Report Amendments

1.3.1 Following submission of the original AQA, a number of comments was raised from the Planning Officer at London Borough of Richmond (LBoR) in relation to the report. The analysis has therefore been updated to address the relevant issues. The original comments and associated response are summarised in Table 1.

Table 1 - Comments and Response

Comment	Response
Modelling calculations to illustrate the difference of modelled to monitored NO_2 data as a percentage as required by Defra LAQM TG22. "To determine whether the unadjusted modelled NO_x concentrations are suitable, the percentage difference between the total modelled NO_2 and total monitored NO_2 at each monitoring site is required to be within 25% or ideally within 10%". A correction factor of 3.46 has been applied, so was necessary to address this but the report has omitted a verification percentage comparison of monitored v modelled. This is useful on many levels and should be included	The verification year has been updated from 2019 to 2022 to reflect more recent emissions. This has reduced the verification factor from 3.46 to 2.778. As there is only verification point included within the model, the adjusted difference between monitored and modelled annual mean nitrogen dioxide (NO2) concentration is 0%. Reference should be made to **Appendix E**
We have concerns for input data and in particular speed, which is input as 20kph. This is rarely true and does not represent the average speed at these locations between traffic lights, roundabout on A316, bus stops and Richmond town centre. Traffic along this section of the A307 and Church Rd for much of the day and evening (7:00 - 22:00) is very slow moving/idling/queuing	Model inputs have been updated to account for the slow-moving traffic. This has included amended speeds from 20kph to 10kph throughout the day. Reference should be made to **Section 4.4** and **Appendix E**.

Comment	**Response**
Fleet mix – this area has a much larger than average number of buses and coaches, is sited next to the main public transport hub in LBoR, 3 x bus stops line it's frontage with 16 x bus routes	Fleet mix was obtained from the London Atmospheric Emissions Inventory (LAEI) which is an established source of data for Air Quality Assessments. It is noted that the bus and coach proportion of total vehicle flow on the A307 was 13.5%, which is significantly higher than most roads and represents the bus routes referenced in the comment Notwithstanding the above, the model has been updated to include emissions associated with the 3 bus stops adjacent to the site. Reference should be made to **Section 4.4** and **Appendix E**
LBoR has robust data for 20 years for this location. Westminster House is a roadside location, sited approx. 2.00m from the kerb. We know that in 2022, when LBoR recorded the lowest levels in the last 20 years for NO_2, at 0.7m back from the road at monitoring location 42, annual raw NO_2 data measured 51µg/m^3 and an annual bias adjusted level (using a national rather than local bias adjustment figure) was calculated at 41µg/m^3. This exceeds UK limit values. This would likely be higher in the middle of the road. The whole area is shown as white on the map with no green or blue shading. This applies to both NO_2 and PM_{10}, not $PM_{2.5}$ – see below. Is that correct? If so, we have little confidence in modelling data – we know monitoring data is robust and relevant	The Figures provided in the original report showed predicted concentrations at 4th floor level. As such, levels are not directly comparable with the monitoring data. Nevertheless, modelling of conditions at the ground floor of the development, alongside the 4th and 5th residential floors, has now been undertaken. Reference should be made to **Figure 1** for a representation of the annual mean NO_2 concentrations at ground floor level. These indicate exceedences of the Air Quality Objective (AQO), as suggested by the monitoring results, at ground level
Adding 2 x levels to a 4-storey building in a congested street canyon is likely to further hinder dispersion. Dispersion at height in street canyons is difficult to predict with any degree of certainty	Dispersion modelling was undertaken using ADMS-Roads, which has been validated against monitoring undertaken in street canyons. The results are therefore considered reliable. Notwithstanding the above, the development will provide two additional storeys on top of the existing building. This will increase the height of the building by approximately 6m. However, the additional height will not be matched on the opposite side of the road and therefore the actual street canyon height will be unaffected. As such, pollutant concentrations at 4th and 5th floor level benefit from relatively unrestricted dispersion

2.0 Legislation and Policy

2.1 Air Quality Legislation & Policy

2.1.1 A summary of the relevant air quality legislation and policy is provided below.

Air Quality Strategy (2023)

2.1.2 The Government's policy on air quality within England is set out in the Air Quality Strategy: Framework for Local Authority Delivery (AQS)[1]. The AQS provides a framework for reducing air pollution in England.

2.1.3 The AQS sets standards and objectives for nine key air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Appendix C**.

2.1.4 The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.

2.1.5 The air quality objectives are medium-term policy-based targets set by the Government, which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

2.1.6 For the pollutants considered in this assessment, there are both long-term (annual mean) and short-term standards. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

2.1.7 The AQS contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}. Local authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area. However, there is no statutory objective given in the AQS for $PM_{2.5}$ at this time.

Environmental Improvement Plan (2023)

2.1.8 The Environmental Improvement Plan[2] was published in January 2023, providing long term and Interim Targets in order to reduce population exposure to $PM_{2.5}$. The concentration target for 2040 was subsequently adopted in the Environmental Targets (Fine Particulate Matter) (England) Regulations (2023).

Air Quality Regulations (2016)

2.1.9 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] for the purpose of Local Air Quality Management (LAQM).

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1 Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2).
2 Defra (2023). Environmental Improvement Plan.
3 The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928.
4 The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043.

2.1.10 These Regulations require that likely exceedances of the AQS objectives are assessed in relation to:

> '[…] the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present […]'

2.1.11 The Air Quality Standards (Amendment) Regulations 2016[5] amends the Air Quality Standards Regulations 2010 that transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The limit values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS objectives and the limit value for $PM_{2.5}$ is a concentration of 20µg/m^3.

Environmental Protection Act 1990 - Control of Dust and Particulates Associated with Construction

2.1.12 Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

> 'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance'; and
>
> 'Any accumulation or deposit which is prejudicial to health or a nuisance'.

2.1.13 Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.1.14 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

Environment Act 1995

2.1.15 Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

Clean Air Strategy (2019)

2.1.16 In 2019, the UK government released its Clean Air Strategy 2019[6], part of its 25 Year Environment Plan[7]. The Strategy sets out the comprehensive action that is considered to be required from across all parts of government and society.

2.1.17 The primary focus of air quality management has primarily related to NO_2, and its principal source in the UK, road traffic. The 2019 Strategy aims to broaden the focus to other areas, including actions on clean growth, and emissions from domestic wood burning stoves, industry and agriculture.

2.2 Planning Policy

2.2.1 A summary of the national and local planning policy relevant to the Proposed Development and air quality is provided below.

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5 The Air Quality Standards (Amendment) Regulations 2016 - Statutory Instrument 2016 No. 1184.
6 Department of Environment, Food and Rural Affairs (Defra) (2019). Clean Air Strategy 2019.
7 Department for Environment Food and Rural Affairs (Defra), (2018); A Green Future: Our 25 Year Plan to Improve the Environment.

National Planning Policy

National Planning Policy Framework (NPPF) (as revised 2023)

2.2.2 The Government's overall planning policies for England are described in the NPPF[8]. The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as:

> '[…] meeting the needs of the present without compromising the ability of future generations to meet their own needs.'

2.2.3 One of the three overarching objectives of the NPPF is that planning should 'contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'

2.2.4 In relation to air quality, the following paragraphs in the document are relevant:

- Paragraph 54, which states 'Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.';
- Paragraph 103, which states 'Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.';
- Paragraph 170, which states '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 180, which states 'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.';
- Paragraph 181, which states '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.'; and
- Paragraph 183, which states 'The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities'.

[8] Ministry of Housing, Communities & Local Government (2023) NPPF.

Regional Planning Policy

2.2.5 A summary of relevant regional policies is outlined below, however their compliance and soundness in relation to national policy has not been assessed in this instance.

The London Plan

2.2.6 The London Plan 2021[9] is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth. Review of this document indicated the following of relevance to this report:

"Policy SI 1 - Improving Air Quality

A. Development plan, through relevant strategic, site specific and are-based policies should seek opportunities to identify and deliver further improvements too 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 of 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-fitting mitigation measures

c) major development proposals must be submitted with an AQA. 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, should demonstrate that design measures have been used to minimise exposure.

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 aur 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

[9] The London Plan March 2021, Greater London Authority (GLA), 2021.

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."

2.2.7 The requirements of these policies have been considered throughout this AQA.

Local Planning Policy

Local Plan (2018)

2.2.8 The Local Plan[10] was adopted by LBoR on 3rd July 2018. The document sets out policies and guidance for development within the brough over the next 15 years.

2.2.9 Review of the document indicated the following policies of relevance to the report:

"Policy LP8

Amenity and Living Conditions

All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:

[…]

4. ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects."

"Policy LP10

Local Environmental Impacts, Pollution and Contamination

[…]

Air Quality

B. The Council promotes good air quality design and new technologies,

Developers should secure at least 'Emissions Neutral' development. To consider the impact of introducing new developments in area already subject to poor air quality, the following will be required.

1. An air quality impact assessment, including where necessary, modelled data;
2. Mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology;
3. Measures to protect the occupiers of new developments from existing sources;
4. Strict mitigation for developments to be used by sensitive receptors such as school, hospitals and care homes in areas of existing poor air quality; this also applies to proposals close to development used by sensitive receptors.

[…]"

2.2.10 In addition, LBoR has adopted a Supplementary Planning Document (SPD)[11] relating to air quality. This has also been considered throughout the assessment.

[10] Local Pla, LBoR, 2018.
[11] SPD Air Quality, LBoR, 2020.

2.3 Guidance

2.3.1 A summary of the publications referred to in the undertaking of this assessment is provided below.

Local Air Quality Management Review and Assessment Technical Guidance (2022)

2.3.2 The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their review and assessment work[12]. This guidance, referred to in this document as LAQM.TG22, has been used where appropriate in the assessment presented herein.

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

2.3.3 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance[13] that offers comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures that may be implemented to minimise these impacts.

The Control of Dust and Emissions During Construction and Demolition Supplementary Planning Guidance (2014)

2.3.4 This document[14] published by the Mayor of London was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

National Planning Practice Guidance - Air Quality (2019)

2.3.5 This guidance[15] provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, it explains how much detail air quality assessments need to include for proposed developments, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by local authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

Air Quality Neutral London Plan Guidance (2023)

2.3.6 This guidance[16] published by the Mayor of London was produced to offer advice on whether a development can be considered "Air Quality Neutral". The document provides benchmarks that describe the maximum allowable emissions of NO_x and PM based on the size and use class of the proposed development.

London Borough of Richmond upon Thames Supplementary Planning Document Air Quality (2023)

2.3.7 This document[17] has been produced by LBoR to address common air quality issues affecting the borough and assist in providing a consistent approach to new development. The primary aim of the SPD is to supplement existing Local Plan Policies which seek to improve air quality in the borough.

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12 Defra (2022) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG22.
13 Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). Land Use Planning & Development Control: Planning for Air Quality.
14 The Control of Dust and Emissions During Construction and Demolition Supplementary Planning Guidance, The Mayor of London, 2014.
15 Department of Communities and Local Government (DCLG) (updated November 2019). National Planning Practice Guidance.
16 London Plan Guidance: Air Quality Neutral, Greater London Authority (GLA), 2023.
17 SPD Air Quality, LBoR, 2023.

3.0 Scope & Methodology

3.1 Scope

3.1.1 The scope of the assessment has been determined in the following way:

- Review of LBoR's latest available review and assessment report[18] and air quality data for the area surrounding the Site, including data from the Council and Defra[19];
- Review of LBoR SPD Air Quality[20];
- Desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality; and
- Review of the traffic data provided by the Project Transport Consultant (PTC).

3.1.2 The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:

- Dust and particulate matter generated by on-site activities during the construction phase;
- Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant; and
- Increases in pollutant concentrations as a result of exhaust emissions arising from traffic generated by the Proposed Development once operational.

3.2 Methodology

Construction Phase

3.2.1 Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity to the source of emission. Dust, therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

3.2.2 The smaller particles of dust, are known as particulate matter (PM), with less than 10µm in aerodynamic diameter (PM_{10}) representing only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5µm). As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, they can therefore be transported by wind over a wider area. PM_{10} and $PM_{2.5}$ are small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health. However, it is worth noting that, according to the Mayor of London's guidance, the majority of fugitive particulate emissions arising from construction sites are expected to relate to the coarser fractions (i.e. $PM_{2.5\text{-}10}$) with just 10-15% expected to comprise $PM_{2.5}$. The Mayor of London's guidance therefore focusses on PM_{10} for the purposes of assessment.

[18] Telford & Wrekin Council (2022) 2023 Air Quality Annual Status Report (ASR).
[19] Defra Local Air Quality Management (LAQM) Support Pages. Available at: http://laqm.defra.gov.uk/ [Accessed on 21/11/2023].
[20] SPD Air Quality, LBoR, 2023.

3.2.3 An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the Mayor of London's; the available information for this phase of the Proposed Development provided by the Client and Project Team; and professional judgement.

3.2.4 The Mayor of London's methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition; earthworks; general construction activities and track-out. It takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined. A summary of the Mayor of London's assessment methodology is provided in **Appendix D**.

3.2.5 In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the application Site and in the vicinity of the Application Site itself. As information on the number of vehicles and plant associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:

- The number and type of construction traffic and plant likely to be generated by this phase of the Development;
- The number and proximity of sensitive receptors to the application Site and along the likely routes to be used by construction vehicles; and
- The likely duration of the construction phase and the nature of the construction activities undertaken.

Operational Phase Assessment

Potential Future Exposure

3.2.6 Of the pollutants included in the AQS, concentrations of NO_2 and PM (PM_{10} and $PM_{2.5}$) have been considered in this assessment as road traffic is a major source of these pollutants and their concentrations tend to be close to, or in exceedance of, the objectives in urban locations.

3.2.7 In order to predict NO_2 and PM concentrations across the Site, the advanced dispersion model ADMS-Roads (version 5.0.0.1) has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness and local meteorological conditions to predict pollutant concentrations. Details of the model input parameters are presented in **Appendix E**.

Meteorological Data

3.2.8 Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the observing station at Heathrow in 2022. This station is considered to provide representative data for the assessment. A wind rose generated from the meteorological data used for the dispersion modelling of operational phase impacts is provided in **Appendix F.**

Traffic Data

Traffic Flows

3.2.9 A summary of traffic data and pollutant emission factors used in the assessment can be found in **Appendix E**. It includes details of the Annual Average Daily Traffic (AADT) flows, vehicle speeds (km/h) and fleet composition for the local road network in all assessment years considered. Traffic speeds were reduced at junctions in line with the comments from the Principal Environmental Health Pollution Practitioner (Air Quality).

3.2.10 Reference should be made to **Figure 2** for a graphical representation of the modelled road link locations.

Bus Stops

3.2.11 A summary of the pollutant emission factors associated with the three bus stops adjacent to the development site can be found in **Appendix E**.

3.2.12 Reference should be made to **Figure 2** for a geographical representation of the modelled bus stops.

Vehicle Emission Factors

3.2.13 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (EFT) (version12.0.1). This has been produced by Defra and incorporates COPERT 5.6 vehicle emission factors and fleet information.

3.2.14 There is current uncertainty over NO_2 concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2022 emission factors were utilised in preference to the development opening year in order to provide robust model outputs. As predictions for 2022 were verified, it is considered the results are a robust indication of worst case concentrations for the future year.

Selection of Background Concentrations

3.2.15 Background pollutant data for the operational phase assessment have been taken from the national maps provided on the Defra website[21], where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK. Estimated background concentrations are available for all years between 2017 and 2030. The maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions, and emissions from other sources. Due to the uncertainty discussed above, and in line with the findings of many local authorities that measured concentrations have not reduced as anticipated.

3.2.16 Background NO_2, PM_{10} and $PM_{2.5}$ concentrations for use in the assessment were obtained from the Defra mapping study for the grid square containing the development site, this is detailed in **Section 4.6** in **Table 4**.

Model Verification and Result Processing

3.2.17 The ADMS Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. Model validation undertaken by the software developer will not have included validation in the vicinity of the Proposed Development.

3.2.18 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results and was carried out following the methodology specified in Chapter 7, Section 4, of LAQM.TG22.

[21] Defra, 2022. Background Concentrations. [Online]
Available at https://uk-air.defra.gov.uk/data/laqm-background-home [accessed 23.11.2023]

3.2.19 Details of the verification factor calculations are presented in **Appendix E**. A factor of **2.227** was obtained during the verification process, which indicated that the model was under-predicting. This factor was applied to the model road-NO_x (oxides of nitrogen) outputs prior to conversion to annual mean NO_2 concentrations utilising the NO_x to NO_2 calculator (version 8.1) provided by Defra[22]. The NO_2 diffusion tube monitoring results recorded by LBoR were subsequently used to derive an indicative baseline annual mean NO_2 concentration for each site in the vicinity of the Proposed Development. Reference should be made to **Figure 2**, which shows the diffusion tube monitoring locations within the assessment extents.

3.2.20 As local roadside monitoring data within the assessment extents are not available for PM_{10} or $PM_{2.5}$, the modelled road-PM_{10} and road-$PM_{2.5}$ components have been adjusted by the verification factor obtained for NO_x before adding to the appropriate background concentration. The number of days with PM_{10} concentrations greater than 50µg/m^3 was then estimated using the relationship with the annual mean concentration described in LAQM.TG22.

3.2.21 Once processed, the predicted concentrations were compared against the relevant AQS objective levels for NO_2, PM_{10} and $PM_{2.5}$ set out in **Appendix C**.

3.2.22 Air quality modelling generates pollutant estimates of road source contributed NO_x, PM_{10} and $PM_{2.5}$ at specified receptors. To permit comparison with the relevant air quality objectives for NO_2, PM_{10} and $PM_{2.5}$ it has been necessary to combine the model output data with the background concentrations.

3.2.23 To consider compliance with the 1-hour mean air quality objective for NO_2, Defra's guidance suggests that in locations where the annual mean NO_2 concentration exceeds 60µg/m^3 then the 1-hour mean objective may be exceeded. Where annual mean concentrations are less than 60µg/m^3 then exceedance of the 1-hour mean objective is considered unlikely. The risk of non-compliance with the 1-hour mean objective, where up to 18 exceedances of a 1-hour mean concentration of 200µg/m^3 are allowed in a calendar year, is therefore considered likely when the annual mean concentration is greater than 60µg/m^3 but unlikely when not. This approach has been adopted for this assessment.

3.2.24 To estimate total annual mean concentrations for PM_{10} and $PM_{2.5}$, for comparison with the annual mean and Interim Target air quality objectives (40 and 12µg/m^3 respectively) the model output concentrations are simply added to the background concentrations for these pollutants.

3.2.25 To consider compliance with the 24-hour mean air quality objective for PM_{10}, Defra's guidance gives the following equation that relates the annual mean concentration to the number of exceedances of the 24-hour mean concentration of 50µg/m^3, where up to 35 exceedances are allowed:

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

3.2.27 This approach has been adopted for 24-hour mean PM_{10} for this assessment.

Potential Future Impacts

3.2.28 The Proposed Development has the potential to increase concentrations of NO_2, PM_{10} and $PM_{2.5}$ as a result of road traffic exhaust emissions associated with vehicles travelling to and from the Site during the operational phase. A screening assessment was therefore undertaken using the criteria contained within the IAQM 'Land-Use Planning & Development Control: Planning for Air Quality' guidance to determine the potential for trips generated by the development to affect local air quality.

3.2.29 The following criteria are provided to help establish when an assessment of potential impacts on the local area is likely to be considered necessary:

A. If any of the following apply:

- 10 or more residential units or a site area of more than 0.5ha; or,

[22] Defra NOx to NO2 Calculator. 15/04/2019.
Available at https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v7.1.xlsm [Accessed on 23/11/2023].

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

B. Couples with any of the following:

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

3.2.30 Should these criteria not be met, then the IAQM guidance considers air quality impacts associated with a scheme to be **not significant** and no further assessment is required.

3.2.31 Should screening of the relevant data indicate that any of the above criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the change in pollutant concentrations as a result of the Proposed Development. The significant of predicted impacts can then be determined in accordance with the methodology outlines in the IAQM guidance.

3.3 Selection of Sensitive Receptors

Construction Phase

3.3.1 Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Proposed Development. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure as a result of on-site construction activities.

3.3.2 The Mayor of London's assessment is undertaken where there are: 'human receptors' within 250m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s); and/or 'ecological receptors' within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s). It is within these distances that the impacts of dust soiling and increased PM in the ambient air will have the greatest impact on local air quality at sensitive receptors.

Operational Phase - Potential Future Exposure

3.3.3 Sensitive locations within the Proposed Development where potential exposure of future residents to poor air quality may occur were determined from review of the layout plans.

3.4 Significance Criteria

Construction Phase

3.4.1 The Mayor of London's assessment methodology recommends that significance criteria is only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

3.4.2 For the assessment of the impact of exhaust emissions from plant used on-site and construction vehicles accessing and leaving the Site on local concentrations of NO_2 and PM, the significance of residual effects has been determined using professional judgement and the principles outlined in the EPUK/IAQM guidance.

Operational Phase - Potential Future Exposure

3.4.3 The results of the future exposure assessment were compared to the Air Pollution Exposure Criteria (APEC) contained within the London Councils Air Quality and Planning Guidance. These are outlined in Table 2 and allow determination of the significance of predicted pollution levels and associated exposure.

Table 2 - Future Exposure Assessment Criteria

Category	Applicable Range		Recommendation
	Annual Mean NO_2, PM_{10} or $PM_{2.5}$	**24-hour PM10**	
APEC - A	Below 5% of the annual mean AQO	> 1-day less than AQO	No air quality grounds for refusal; however, mitigation of any emissions should be considered
APEC - B	Between 5% below or above the annual mean AQO	Between 1-day above or below AQO	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	Above 5% of the annual mean AQO	> 1-day more than AQO	Refusal on air quality grounds should be anticipated, unless the LA has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures

3.4.4 It should be noted that a significant area of London would fall under APEC - C due to high NO_2 concentrations throughout the city. As such, a presumption against planning consent in these locations may result in large areas of land becoming undevelopable and prevent urban regeneration. The inclusion of suitable mitigation measures to protect future site users is therefore considered an appropriate way to progress sustainable schemes in these locations and has been considered within this assessment.

4.0 Baseline

4.1 Introduction

4.1.1 Existing air quality conditions in the vicinity of the Site were identified in order to provide a baseline for consideration. These are detailed in the following sections.

4.2 Local Air Quality Management

4.2.1 As required by the Environment Act (1995), as amended by the Environment Act (2021), LBoR has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO_2 and annual and 24-hour mean concentrations of PM_{10} are above the relevant AQOs within the borough. As such, one AQMA has been declared. This is described as follows:

"The whole borough."

4.2.2 The development is located within the AQMA. As such, there is the potential for the exposure of future occupants to poor air quality, as well as vehicles travelling to and from the Site to increase pollution levels in this sensitive area. This has been considered throughout the assessment.

4.2.3 LBoR has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

4.3 Air Quality Focus Areas

4.3.1 Air Quality Focus Areas (AQFAs) have been designated throughout London in locations where the annual mean AQO for NO_2 is exceeded and there is a high level of human exposure. They were defined to address concerns raised by boroughs within the LAQM review process and forecasted air pollution trends.

4.3.2 Review of the LAEI indicated the Site is located within the AQFA with ID number "127". This covers the area of Richmond Town Centre including Bridge Street.

4.4 Local Emission Sources

4.4.1 The Site is located in an area where air quality is mainly influenced by emissions from road transport using the local road network. As such, this has been considered within the modelling of the local emissions. The three local bus stops adjacent to the development site have been included within the model alongside the road traffic emissions at a reduce speed to highlight the slow-moving traffic along the link roads.

4.5 Air Quality Monitoring

4.5.1 Monitoring of pollutant concentrations is undertaken by the Council throughout their area of jurisdiction utilising passive methods. Recent diffusion tube monitoring results recorded in the vicinity of the development are shown in **Table 3**.

Table 3 - Diffusion Tube Monitoring Results

Monitoring Site			**Monitored NO_2 Concentration (µg/m³)***			
ID	**Location**	**Type**	**2019**	**2020**	**2021**	**2022**
42	The Quadrant/Kew Road, Richmond	Roadside	**62**	**60**	**54**	**41**
Rut 02	George Street, Richmond	Kerbside	**72**	**63**	**52**	**43**

*Exceedances of the AQO are highlighted in **bold.**

4.5.2 As shown in **Table 3**, the annual mean NO_2 concentration was above the AQO of 40µg/m^3 at both monitoring locations in recent years. As the monitors are positioned at roadside locations within an AQMA, elevated concentrations are to be expected. Reference should be made to **Figure 2** for a map of the diffusion tube positions.

4.5.3 It should be noted that pollutant concentrations during 2020 and 2021 were lower than previous years due to a reduction in road traffic and associated emissions caused by the COVID-19 pandemic. The results should therefore be viewed with caution.

4.5.4 LBoR do not undertake monitoring of PM_{10} or $M_{2.5}$ concentrations within the vicinity of the Site.

4.6 Background Pollutant Concentrations

4.6.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by Defra for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. Data for the assessment extents was downloaded from the Defra website[23] for the purpose of the project. This data is summarised in **Table 4** below.

Table 4 - Predicted Background Pollutant Concentrations

OS Grid Reference (X, Y; m)	Year	NO_x	NO_2	PM_{10}	$PM_{2.5}$
518500, 175500	2022	29.82	20.52	17.00	11.48
	2024	27.61	19.19	16.61	11.19
	2025	26.59	18.56	16.42	11.05

4.6.2 As shown in **Table 4**, predicted background NO_2, PM_{10}, and $PM_{2.5}$ concentrations are below the relevant AQOs and Interim Target at the Site.

[23] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

5.0 Assessment

5.1 Introduction

5.1.1 There is the potential for air quality impacts as a result of the construction and operation of the Proposed Development. These are assessed in the following sections.

5.2 Construction Phase Assessment

Dust and PM_{10} Arising from On-Site Activities

5.2.1 Construction activities that have the potential to generate and/or re-suspend dust and PM_{10} include:

- Site clearance and preparation including demolition activities;
- Preparation of temporary access/egress to the Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Site (including excavators and dumper trucks);
- Use of crushing and screening equipment/plant;
- Exhaust emissions from plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment;
- Trackout, whereby earth is carried from the Site on vehicle tyres, deposited on roads and may later become suspended in the air as a result of vehicle movements; and
- Site landscaping after completion.

5.2.2 The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Assessment of Potential Dust Emission Magnitude

5.2.3 The Mayor of London's assessment methodology has been used to determine the potential dust emission magnitude for the following different dust and PM_{10} sources: demolition, earthworks; construction; and trackout. The findings of the assessment are presented below.

Demolition

5.2.4 The Proposed Development does not include any demolition activities. As such, the potential dust emission magnitude for demolition activities is not considered further within this assessment.

Earthworks

5.2.5 The Proposed Development does not include any earthworks activities. As such, the potential dust emission magnitude for earthworks activities is not considered further within this assessment.

Construction

5.2.6 The total volume of buildings to be constructed on the Site is less than 25,000m^3, as such potential dust emission magnitude is considered to be **small** for construction activities.

Trackout

5.2.7 The Proposed Development does not include any trackout activities. As such, the potential dust emission magnitude for trackout activities is not considered further within this assessment.

5.2.8 **Table 5** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 5 - Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	N/A
Earthworks	N/A
Construction Activities	Small
Trackout	N/A

Assessment of Sensitivity of the Study Area

5.2.9 A wind rose generated using meteorological data recorded at Heathrow Airport Meteorological station during 2022 is provided in **Appendix F**. This shows that the prevailing wind direction is predominantly from the south-west. Therefore, receptors located to the north-east of the Site are more likely to be affected by dust and PM emitted and re-suspended during the construction phase.

5.2.10 Under low wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. Receptors north-east of the Site are expected to be affected the most as a result of the prevailing wind direction.

5.2.11 There are no ecological receptors within 50m of the development boundary or the access route within 500m of the site entrance. As such, ecological impacts have not been assessed further within this report.

5.2.12 Taking the above into account and following the Mayor of London's assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in **Table 6**.

Table 6 - Sensitivity of the Study Area

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

Risk of Impacts

5.2.13 The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 7** below provides a summary of the risk of dust impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 7 - Summary Dust Risk Table to Define Site Specific Mitigation

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

Construction Vehicles & Plant

5.2.14 The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the Site access. Construction traffic will access the Site via the local road network. Due to the size of the Site, it is considered likely that the construction traffic will be low in comparison to the existing traffic flows on these roads.

5.2.15 Final details of the exact plant and equipment likely to be used on-site will be determined by the appointed contractor. The number of plant and their location within the Site are likely to be variable over the construction period.

5.2.16 Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, and the likely numbers of construction vehicles and plant that will be used, the impacts are therefore considered to be **not significant** according to the assessment significance criteria.

5.3 Operational Phase Assessment

Potential Future Exposure

5.3.1 The Proposed Development has the potential to exposure future residents to elevated pollution levels. Dispersion modelling was therefore undertaken with the inputs described in **Appendix E** to quantify air quality conditions at the Site. Reference should be made to **Figures 3**, **4**, **5** and **6** for graphical representations of predicted annual mean NO_2, annual mean PM_{10}, 24-hour mean PM_{10} and annual mean $PM_{2.5}$ concentrations.

5.3.2 It should be noted that the Site includes commercial space to the third-floor level. This is not considered a sensitive land use for annual mean AQOs in accordance with the GLA guidance. As such, the exposure assessment focused on concentrations at the residential apartments, which are to be located at the fourth-floor level and above.

5.3.3 Predicted concentrations above 5% of the annual mean AQO are shown in blue on the contour plots. These relate to areas defined as APEC - C within the London Councils Air Quality and Planning Guidance. Predicted concentrations between 5% below and 5% above the annual mean AQO are shown in green. These relate to areas defined as APEC - B within the guidance. Predicted concentrations below 5% of the annual mean AQO are shown in white on the contour plots. These relate to areas defined as APEC - A within the guidance.

Nitrogen Dioxide

5.3.4 As shown in **Figure 3**, annual mean NO_2 concentrations were predicted to be below the AQO of 40µg/m^3 at both the 4th and 5th floor of the development building. The maximum concentration at the façade was 33.6µg/m^3, which is classified as APEC - A within the guidance.

5.3.5 It is proposed to include amenity areas on the building façade. These are considered as outdoor amenity areas and, as such, short-term averaging periods are more applicable than annual means, as outlined in DEFRA guidance LAQM.TG(22). Measurements across the UK have shown that the 1-hour mean AQO for NO_2 is unlikely to be exceeded unless the annual mean NO_2 concentration is greater than 60µg/m^3. Therefore, predicted annual mean NO_2 concentrations have been used as an indicator of potential exceedences of the 1-hour mean AQO for NO_2. As annual mean NO_2 concentrations were not predicted to be greater than 60µg/m^3 at any location within the modelling domain at 4th floor height, exceedences of the 1-hour mean AQO are unlikely. As such, air quality in the proposed amenity areas is considered acceptable.

Particulate Matter (PM_{10})

5.3.6 As shown in **Figure 4**, annual mean PM_{10} concentrations were predicted to be below the AQO of 40µg/m^3 at both the 4th and 5th floor of the development building. The maximum concentration at the façade was 19.6µg/m^3, which is classified s APEC - A in accordance with the London Councils Air Quality and Planning Guidance.

5.3.7 As shown in **Figure 5**, the total number of days with PM_{10} concentration above 50µg/m^3 was predicted to be below the AQO of 35 at both the 4th and 5th floor of the development building. The maximum number of days with the concentration above 50µg/m^3 at the façade was 3, which is classified as APEC - A in accordance with the London Councils Air Quality and Planning Guidance.

Particulate Matte ($PM_{2.5}$)

5.3.8 As shown in **Figure 6**, annual mean $PM_{2.5}$ concentrations were predicted to be below the AQLV of 20µg/m^3 at both the 4th and 5th floor of the development building. The maximum concentration at the façade was 12.2µg/m^3. This is above the Interim Target of 12µg/m^3. However, it is anticipated that vehicle exhaust emissions rates and background concentrations will improve in future years through local and national policy initiatives. Therefore, annual mean $PM_{2.5}$ concentrations are likely to be below the Interim Target across the Proposed Development by 2028.

Summary

5.3.9 Based on the assessment results, the Site has been classified as APEC - A. It is therefore considered suitable for the proposed end-use from an air quality perspective without the inclusion of mitigation.

Potential Future Impacts

5.3.10 Any vehicle movements associated with the Proposed Development will generate exhaust emissions on the local and regional road networks. The development has been assessed against the IAQM screening criteria as detailed in **Section 3.2.27**. The proposals will provide:

- Less than 10 residential units;
- No additional floorspace of non-residential land use;
- No car parking, as such the development can be considered 'car-free'; and,
- No centralised combustion processes. The development will utilise Air Source Heat Pumps (ASHPs) for heating and hot water.

5.3.11 As such, the Screening Criteria have not been met and air quality impacts associated with the scheme are considered to be **not significant**, with no further assessment is required.

6.0 Mitigation and Residual Effects

6.1 Construction Phase

Mitigation

6.1.1 Based on the assessment results, mitigation will be required during the construction phase of the Proposed Development. Recommended mitigation measures are given below.

General Communication

- Develop and implement a Dust Management Plan
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary.
- Display the head or regional office contact information.
- Record and respond to all dust and air quality pollutant emissions complaints.
- Make the complaints log available to the LA when asked.
- Carry out regular site inspections, record inspection results, and make an inspection log available to the LA upon request.
- Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust are being carried out, and during prolonged dry or windy conditions.
- Record any exceptional incidents, either on or off the site, and the action taken to resolve the situation is recorded in the log book.

Preparing and maintaining the Site

- Plan the Site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Avoid Site runoff of water or mud.
- Keep Site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from Site as soon as possible, unless being re-used on-site. If they are being re-used on-site cover appropriately.
- 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.
- Ensure all Non-Road Mobile Machinery comply with the relevant standards.
- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

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
- Use enclosed chutes and conveyors and covered skips.

- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on-site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

- Reuse and recycle waste to reduce dust from waste materials.
- Avoid bonfires and burning of waste materials.

Measures Specific to Construction

- 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.
- Avoid scabbing (roughening of concrete surfaces) if possible.

6.1.2 Detailed mitigation measures to control construction traffic should be discussed with the Local Authority to establish the most suitable access and haul routes for the site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that vehicles are kept clean and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

Residual Effects

6.1.3 The residual effects of fugitive dust emissions on local air quality following implementation of the above mitigation is considered to be **not significant** according to the Mayor of London guidance.

6.2 Operational Phase

Mitigation

6.2.1 As there are no anticipated vehicle trips associated with the Proposed Development, road traffic exhaust emission impacts are considered to be **not significant** and therefore in accordance with the assessment criteria, mitigation is not required.

Residual Effects

6.2.2 The residual effects of emissions to air from vehicle movements associated with the operation of the Proposed Development on local air quality is considered to be **not significant** for NO_2, PM_{10} and $PM_{2.5}$ according to the EPUK/IAQM assessment criteria.

7.0 Air Quality Neutral Assessment

7.1 Introduction

7.1.1 The London Plan required that all developments are 'air quality neutral' to ensure proposals do not lead to further deterioration of existing poor air quality. In order to support the policy, guidance[24] has been produced on behalf of the GLA. The document provides a methodology for determining potential emissions from a development and benchmark values for comparison purposes. Where the benchmark is exceeded then action is required, either locally or by way of off-setting.

7.1.2 The Air Quality Neutral Assessment for the Proposed Development is outlined below.

7.2 Building Emissions

7.2.1 Heating and hot water for the development will be provides by ASHPs. These do not produce emissions to atmosphere. As such, the Proposed Development is considered air quality neutral from a building emissions perspective.

7.3 Transport Emissions

7.3.1 As outlined previously, the Proposed Development is classified as 'car-free'. As such, the development is air quality neutral from a transport emissions perspective.

7.4 Summary

7.4.1 Potential emissions from the Proposed Development were assessed in order to determine compliance with the air quality neutral requirements of the London Plan. The building energy strategy includes the use of ASHPs which do not produce emissions to atmosphere. Additionally, the scheme is classified as 'car-free'. As such, the Proposed Development is considered to be air quality neutral.

[24] London Plan Guidance: Air Quality Neutral, GLA, 2023.

8.0 Summary and Conclusions

8.1.1 Lucion Delta-Simons, has been appointed to prepare this AQA in support of the planning application for a two-storey extension of an existing property to provide seven residential units located at Westminster House, Richmond, TW9 2ND.

8.1.2 A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Proposed Development using the Mayor of London methodology. This identified that there is a **low** risk of dust soiling impacts and a **low** risk of increases in PM concentrations due to unmitigated construction activities. However, through good site practice and the implementation of the identified mitigation measures, the effect of dust and PM_{10} releases would be significantly reduced. The residual effects of dust and PM_{10} generated by construction activities on air quality are therefore considered to be **not significant**. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **not significant**.

8.1.3 The Site lies within an area where air quality is mainly influenced by emissions associated with traffic along the local road network. Pollutants considered in this assessment were NO_2 and PM (PM_{10} and $PM_{2.5}$).

8.1.4 The proposal has the potential to expose future residents to elevated pollution levels. Dispersion modelling was therefore undertaken using ADMS-Roads in order to predict concentrations as a result of emissions from the local highway network. Results were subsequently verified using local monitoring data.

8.1.5 The results of the dispersion modelling assessment indicated that predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ concentrations were below the relevant AQOs and AQLV at all locations across the development. Pollutant levels were categorised as APEC - A in accordance with the London Councils Air Quality and Planning Guidance. As such, the residual effects are considered to be **not significant** and the Site is suitable for the proposed end-use from an air quality perspective.

8.1.6 Potential impacts during the operational phase of the Proposed Development may occur due to road traffic exhaust emissions associated with vehicles travelling to and from the Site. These were assessed against screening criteria provided within the EPUK/IAQM guidance. As there are no anticipated vehicle trips associated with the Proposed Development, operational phase road traffic exhaust emissions are considered to be **not significant**.

8.1.7 Based on the assessment significance criteria, the residual effects of the Proposed Development are considered to be **not significant** for all pollutants assessed.

8.1.8 Furthermore, it is considered that the Proposed Development complies with national and local policy for air quality.

8.1.9 Based on the assessment results, air quality issues are not considered a constraint to planning consent.

Figures

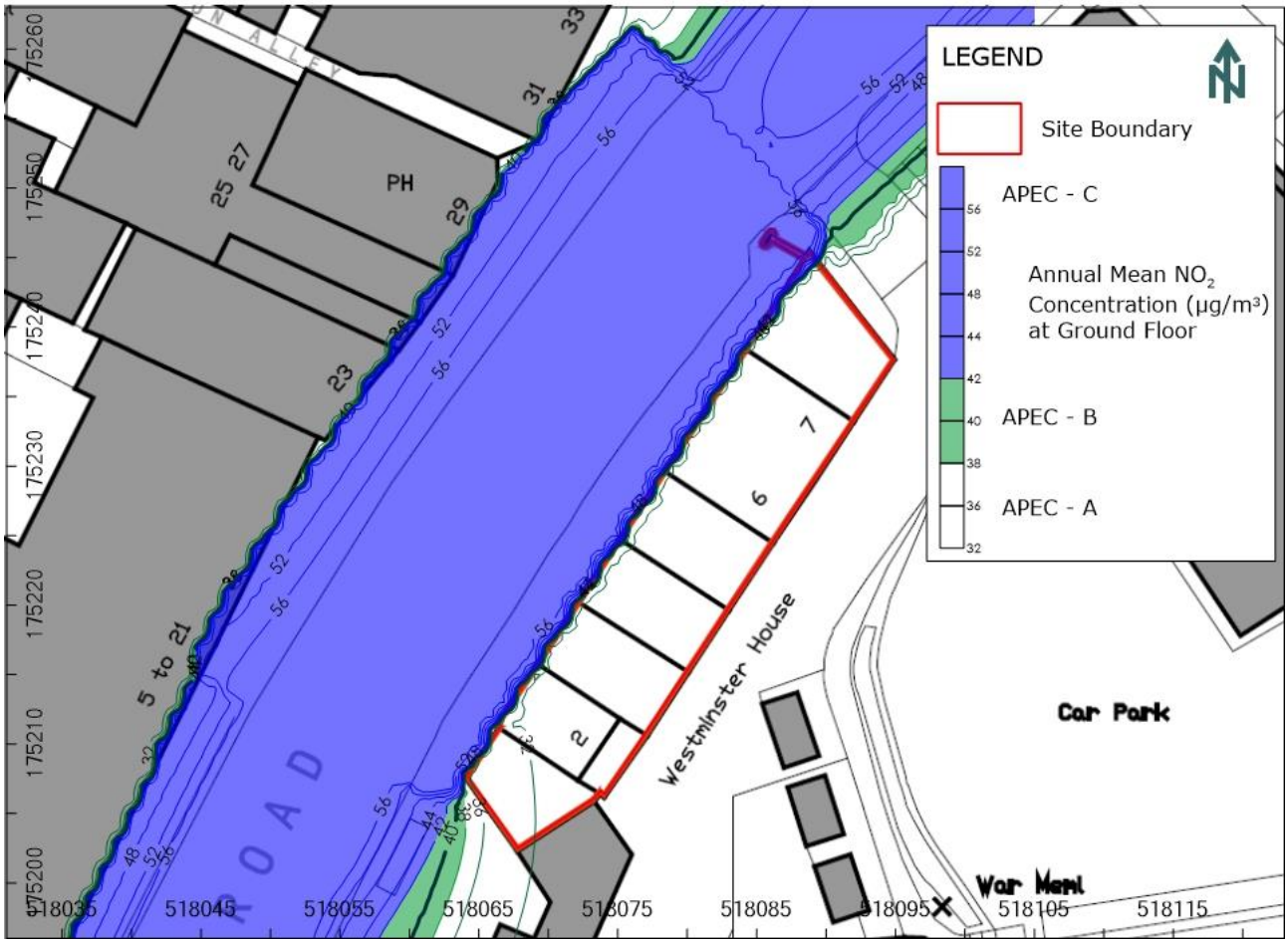

Figure 1: Predicted Annual Mean NO_2 Concentrations (µg/m³) at Ground Floor

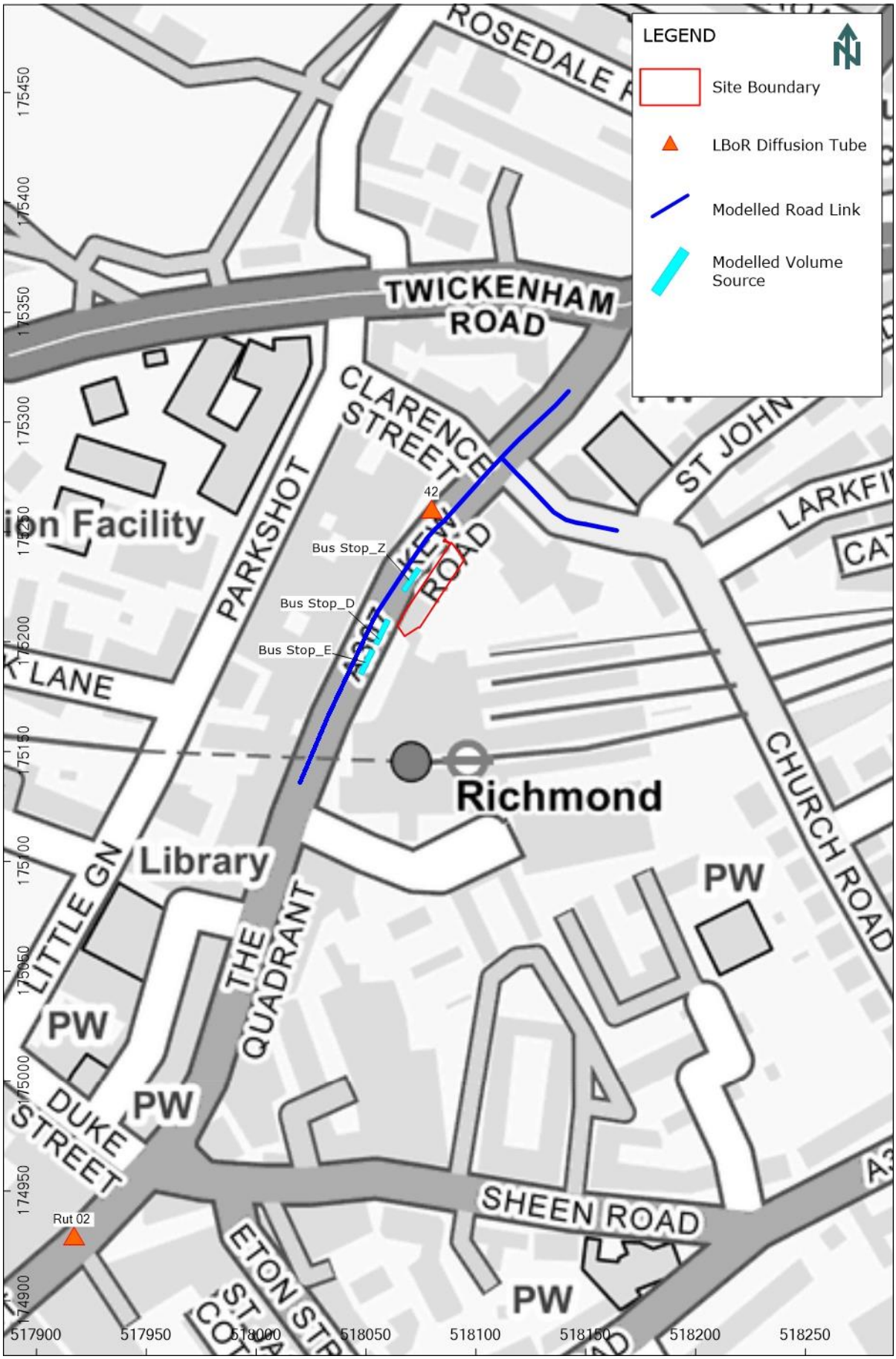

Figure 2 - Site Location Plan, Monitoring Locations and ADMS-Roads Inputs

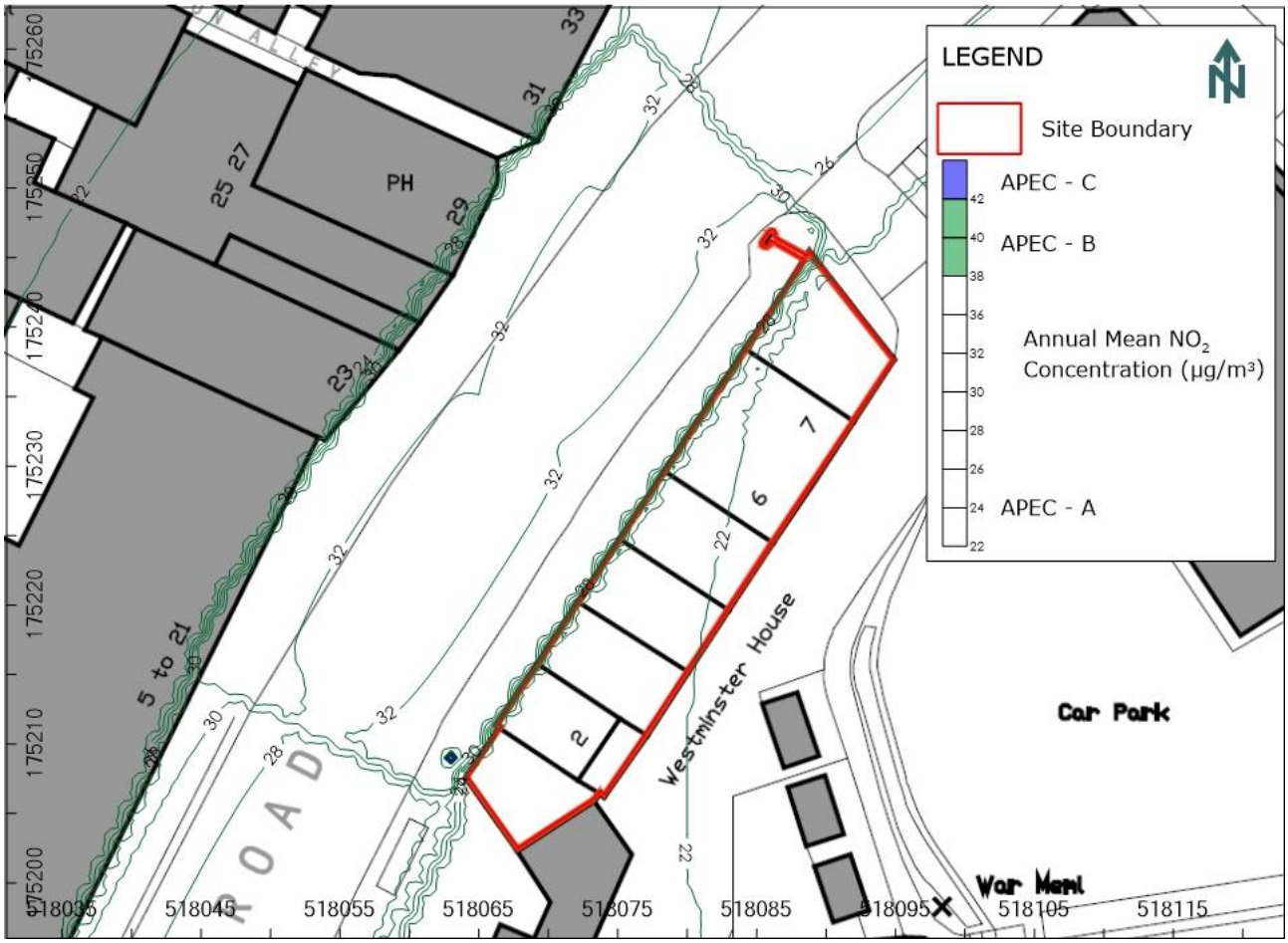

Figure 3 - Predicted Annual Mean NO_2 Concentrations (µg/m³) at 4th Floor

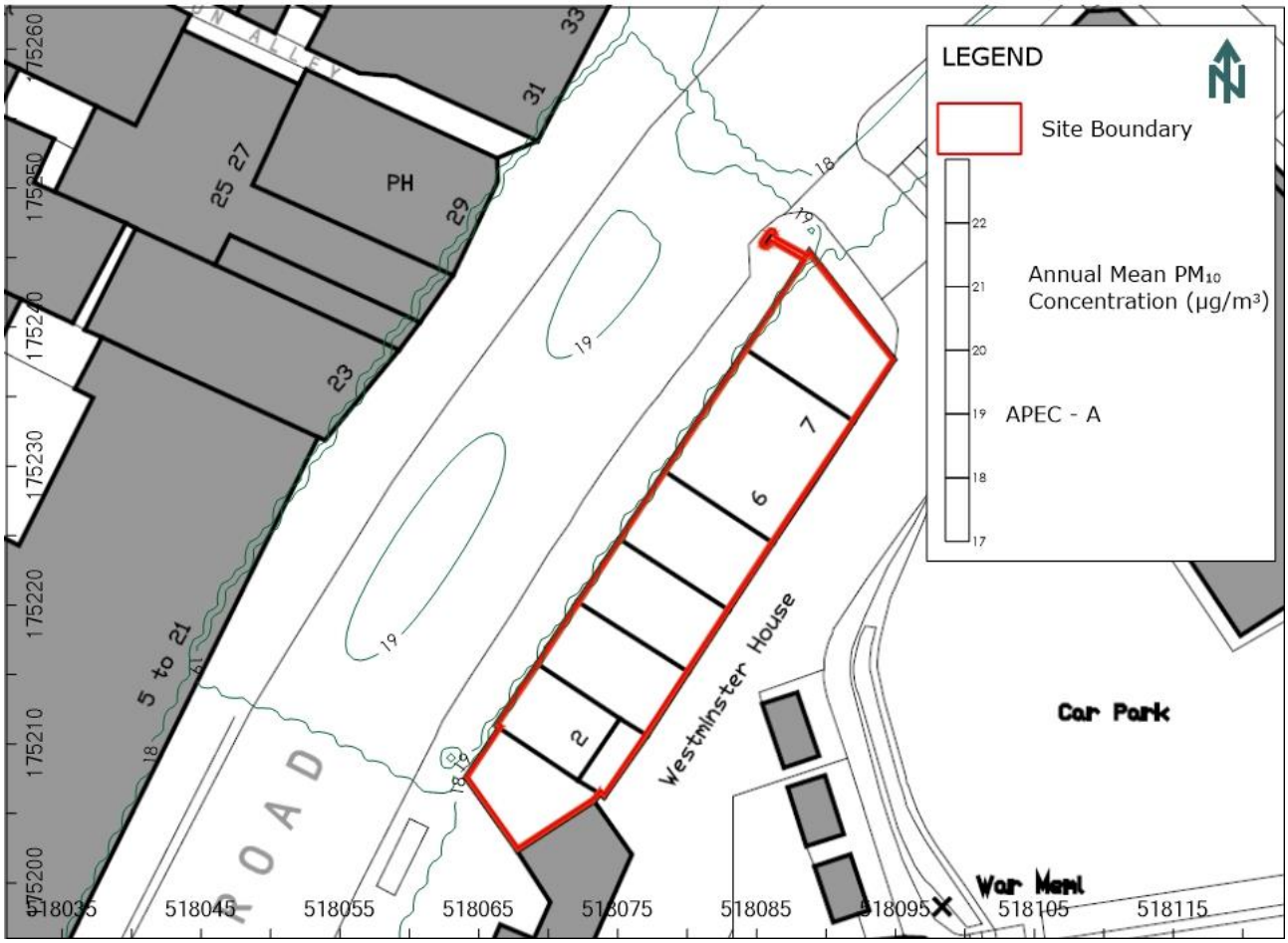

Figure 4 - Predicted Annual Mean PM_{10} Concentrations (µg/m^3) at 4th Floor

Contains OS data ©, Crown Copyright and Database Right (2022)

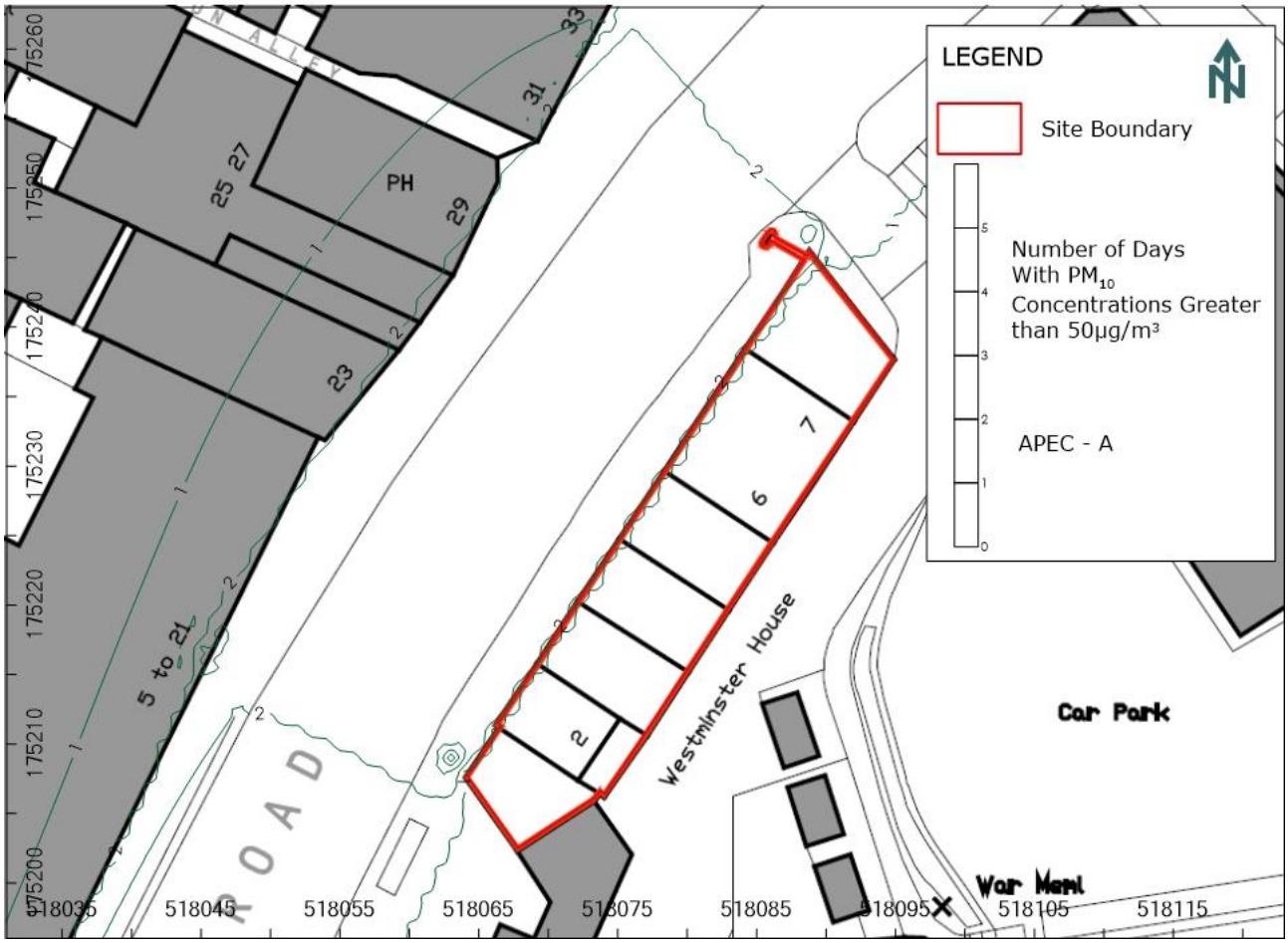

Figure 5 - Predicted Number of Days With PM_{10} Concentrations greater than 50µg/m³ at 4th Floor

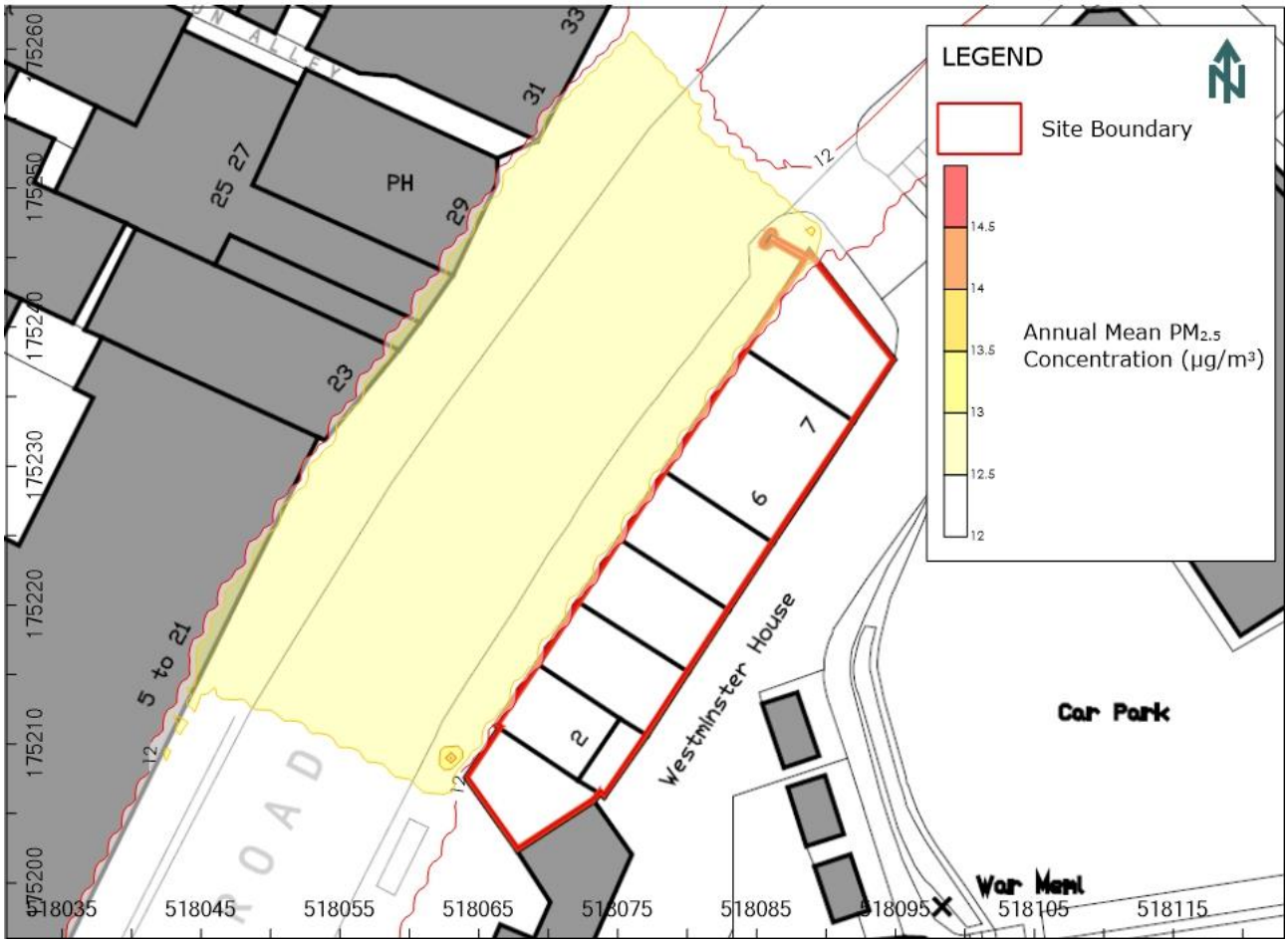

Figure 6 - Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³) at 4th Floor

Appendix A - Limitations

Limitations

The recommendations contained in this Report represent Lucion Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Lucion Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Lucion Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Lucion Delta-Simons conclusions, opinions and recommendations has been determined using this information. Lucion Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Lucion Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Lucion Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Lucion Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Lucion Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Lucion Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Lucion Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B - Glossary

Glossary

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model.
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	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 the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
APEC	Air Pollution Exposure Criteria
AQA	Air Quality Assessment
AQMA	Air Quality Management Area.
AQAP	Air Quality Action Plan.
AQO	Air Quality Objective.
ASHP	Air Source Heat Pumps
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of Defra.
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
DEFRA	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport
EFT	Emissions Factor Toolkit.
Emission rate	The quantity of a pollutant released from a source over a given period of time.
EPUK	Environmental Protection (UK).
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
GLA	Greater London Authority

Term	Definition
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management.
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management.
LBoR	London Borough of Richmond
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM	Particulate matter
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
PTC	Project Transport Consultant.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
SP	Slow Phase
SPD	Supplementary Planning Document
$\mu g/m^3$ microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.
Z_0	Roughness Length

Appendix C - Relevant UK Air Quality Strategy Objectives

Relevant UK Air Quality Strategy Objectives

Pollutant	Applies To	Objective	Measured As	Date to be achieved by and maintained thereafter
Nitrogen dioxide (NO_2)	UK	40µg/m^3	annual mean	31.12.2005
	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
Particulate Matter (PM_{10}) (gravimetric)[A]	UK (except Scotland)	40µg/m^3	annual mean	31.12.2005
	UK (except Scotland)	50µg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
Particulate Matter ($PM_{2.5}$)	UK (except Scotland)	20µg/m^3	annual mean	2020
	England	12µg/m^3	annual mean	31.01.2028

[A] Measured using the European gravimetric transfer sampler or equivalent

µg/m^3 = microgram per cubic metre

Appendix D - Mayor of London Construction Assessment Methodology

Mayor of London Construction Assessment Methodology

Step 1 - Screening the Need for a Detailed Assessment

An assessment will normally be required where there are:

- 'human receptors' within 20m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- 'ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

Step 2a - Define the Potential Dust Emission Magnitude

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment.

Table D1 - Examples of Potential Dust Emission Magnitude

Magnitude	Activity	Criteria
Large	Demolition	>50,000m^3 building demolished Dusty material (e.g. concrete) On-site crushing/screening Demolition >20m above ground level
	Earthworks	Total site area >10,000m^2 Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) >10 heavy earth moving vehicles active at any one time Formation of bunds >8m in height Total material moved >100,000 tonne
	Construction	Total building volume >100,000m^3 On-site concrete batching Sandblasting
	Trackout	>50 Heavy Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g. high clay content) Unpaved road length >100m
Medium	Demolition	20,000 - 50,000m^3 building demolished Dusty material (e.g. concrete) 10-20m above ground level
	Earthworks	Total site area 2,500m^2 to 11,000m^2; Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one times Formation of bunds 4m to 8m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	Total building volume 25,000m^3 to 100,000m^3 Potentially dusty construction material (e.g. concrete) On-site concrete batching
	Trackout	10 to 50 HDV trips per day Moderately dusty surface material (e.g. high clay content)

Magnitude	Activity	Criteria
		Unpaved road length 50m to 100m
Small	Demolition	<20,000m^3 building demolished Non-dusty material (e.g. metal cladding) <10m above ground level Work during wetter months
	Earthworks	Total site area <2,500m^2 Soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one time Formation of bunds <4m in height Total material moved <10,000 tonnes
	Construction	Total building volume <25,000m^3 Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	Less than 20 HDV trips per day Surface material with low potential for dust release Unpaved road length less than 50m

Step 2b - Define the Sensitivity of the Area

The tables below present the Mayor of London assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The Mayor of London guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table D2- Sensitivity of the Area to Dust Soiling Effects

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

Table D3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table D4 - Sensitivity of the Area to Ecological Impacts

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

Step 2c - Define the Risk of Impacts

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table D5 - Risk of Dust Impacts

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk

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

Step 3 - Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high-risk site. The Mayor of London guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

Step 4 - Determine Significant Effects

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

Appendix E - Dispersion Model Details

Model Input Parameters

Traffic Flow Data

Baseline traffic data for use in the assessment was obtained from the LAEI. This was produced by the GLA and provides traffic flows throughout London for a number of scenarios. It should be noted that the LAEI is referenced in GLA guidance[25] as being a suitable source of data for air quality assessments and is therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the Site.

The baseline traffic data was converted to the assessment year utilising a factor obtained from TEMPro (Version 8.0). This software package has been developed by the Department for Transport (DfT) to calculate future traffic growth throughout the UK.

Table E1 - 2022 Verification/Baseline Traffic Data

Road Link	Name	AADT (Total vehicles)	Speed (km/h)	NO_X Emission Factor (g/km/s)
L1	A307 south of Site Boundary	19,846	10	0.13637
L2	A307 adjacent to Site Boundary	19,846	10	0.13637
L3	A307 south of Larence Street Slow Phase (SP)	19,846	10	0.13637
L4	A307 north of Larence Street SP	19,846	10	0.13637
L5	A307 north of Larence Street	19,846	10	0.13637
L6	Church Road SP	10,310	10	0.04329
L7	Church Road	10,310	10	0.04329

Table E2 - 2025 Opening Year Traffic Data

Road Link	Name	AADT (Total vehicles)	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L1	A307 south of Site Boundary	20,771	10	0.13934	0.01244	0.00662
L2	A307 adjacent to Site Boundary	20,771	10	0.13934	0.01244	0.00662
L3	A307 south of Larence Street SP	20,771	10	0.13934	0.01244	0.00662
L4	A307 north of Larence Street SP	20,771	10	0.13934	0.01244	0.00662
L5	A307 north of Larence Street	20,771	10	0.13934	0.01244	0.00662
L6	Church Road SP	10,791	10	0.04423	0.00501	0.00266
L7	Church Road	10,791	10	0.04423	0.00501	0.00266

[25] London Local Air Quality Management (LLAQM)), Technical Guidance 2019 (LLAQM.TG (19)), GLA, 2019.

Table E3 - Fleet Composition Data

Link	Proportion of Fleet (%)						
	Car	Taxi	LGV	Rigid HGV	Artic HGV	Bus and Coach	Motorcycle
L1	71.1	1.1	10.8	1.3	0.5	13.5	1.6
L2	71.1	1.1	10.8	1.3	0.5	13.5	1.6
L3	71.1	1.1	10.8	1.3	0.5	13.5	1.6
L4	71.1	1.1	10.8	1.3	0.5	13.5	1.6
L5	71.1	1.1	10.8	1.3	0.5	13.5	1.6
L6	82.5	1.3	14.2	0.3	0.0	0.4	1.2
L7	82.5	1.3	14.2	0.3	0.0	0.4	1.2

Canyons

Where buildings or walls surround roads, pollutant dispersion patterns are altered which can lead to high pollutant concentrations. These street canyons can significantly influence air quality along a road and therefore it is important to take consideration of their effects when undertaking dispersion modelling.

The release of ADMS-Roads version 4.0.1.0 in December 2015 incorporated a number of new features including an advanced street canyon module, which have been retained in version

Advanced street canyon modelling allows a number of parameters to be included in the dispersion model in order to predict pollutant dispersion patterns which better reflect air flow within complex urban geometries.

Canyons have five principal effects on dispersion which can influence pollutant concentrations. These are:

- Pollutants are channelled along street canyons;
- Pollutants are dispersed across street canyons by circulating flow at road height;
- Pollutants are trapped in recirculation regions;
- Pollutants leave the canyon through gaps between buildings - as if there was no canyon; and,
- Pollutants leave the canyon from the canyon top.

The combined modelling of these effects will result in concentration patterns unique to each canyon. It should be noted that where buildings are only present on one side of the road, parameters were purposely included at 0m.

Table E4 - Canyon Parameters - Baseline

Link	Parameter (m)					
	Canyon width to Left	**Average Height of Building to Left**	**Building Length Left**	**Canyon Width Right**	**Average Height of Building to the Right**	**Building Length Right**
L1	10.3	13.0	8.1	0.0	0.0	0.0
L2	11.0	11.0	49.1	10.3	12.0	45.3
L3	0.0	0.0	0.0	11.7	14.0	18..9
L6	6.2	14.0	42.0	0.0	0.0	0.0

The proposals will alter the street geometry along the A307. As such, the canyon parameters were altered in the future year model.

Table E5 - Canyon Parameters - Future Year

Link	Parameter (m)					
	Canyon width to Left	**Average Height of Building to Left**	**Building Length Left**	**Canyon Width Right**	**Average Height of Building to the Right**	**Building Length Right**
L1	10.3	13.0	8.1	0.0	0.0	0.0
L2	11.0	11.0	49.1	10.3	18.5	45.3
L3	0.0	0.0	0.0	11.7	14.0	18..9
L6	6.2	14.0	42.0	0.0	0.0	0.0

A choice of two modes is provided for use in the advanced canyon module. Standard mode assumes that each road is part of a continuous network of roads with similar canyon properties. Network mode analyses the road network to determine transport of pollutants between adjoining street canyons, allows for varying concentrations along the canyon and accounts for transport of pollutants out of the end of a canyon. Network mode is considered most accurate for detailed local analysis and as such was selected for use in the model.

Bus Stop Emissions

The development site is situated adjacent to Richmond Station (Zone E), Richmond Station (Zone D) and Richmond Station (Zone E) bus stops on the A307. This was included in the model using a volume source and an emission rate calculated using the following formula obtained from CERC guidance[26]:

$$\text{Emission rate (g/s)} = \frac{\text{Emission factor (g/km) x speed (km/h)}}{60 \times 60}$$

Emission factor inputs for the bus stops are shown in **Table E6**.

[26] Modelling bus stops, CERC, 2004.

Table E6 - Bus Stop Emission Factor Inputs

Parameter	Unit	Bus Stop		
		Zone E	Zone D	Zone Z
Emission Factor NO_x	g/km	6.5673	6.5673	6.5673
Emission Factor PM_{10}	g/km	0.1150	0.1150	0.1150
Emission Factor $PM_{2.5}$	g/km	0.0591	0.0591	0.0591
Speed	km/h	5	5	5
Volume of Source	m^3	133.96	133.96	133.96
Emission Rate NO_x	$g/m^3/s$	0.0000681	0.0000681	0.0000681
Emission Rate PM_{10}	$g/m^3/s$	0.0000012	0.0000012	0.0000012
Emission Rate $PM_{2.5}$	$g/m^3/s$	0.0000006	0.0000006	0.0000006

The values shown in **Table E6** were attributed to a volume source within the ADMS-Roads model interface. A time-varying file was subsequently created to represent the number of buses using the stops per hour on a typical weekday, Saturday and Sunday. This information was obtained from the relevant bus timetables using the Transport for London website[27].

Reference should be made to **Figure 2** for the geographical location of the bus stops.

Roughness Length

The roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 1.0m was used to describe the modelling extents. This value of z_0 is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

A z_0 of 0.3m was used to describe the meteorological site. This value is considered appropriate for the morphology of the area due to the large expanse of surrounding flat land use, such as runways and grasslands is suggested within the ADMS-Roads as being suitable for 'agricultural areas'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 100m was used to describe both the modelling extents and the meteorological station site. This value is considered appropriate for the nature of both areas and is suggested within ADMS-Roads as being suitable for 'large conurbations > 1 million'.

Model Verification

Introduction

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;

[27] Tfl.gov.uk/modes/buses.

- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters, such as 'roughness length'; and,
- Overall limitations of the dispersion model.

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2), in line with the guidance provided within LAQM.TG22.

For the purpose of the assessment, model verification was undertaken for 2022 using traffic data, meteorological data and monitoring results from this year.

The model has been run to predict the 2022 annual mean road-NO_x contribution at one roadside diffusion tube within the modelled road network at the verification location with suitable monitoring data and traffic data. The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentration measured using the diffusion tube at the monitoring location, utilising the NO_x from NO_2 calculator provided by Defra and the NO_2 background concentration (from the Defra background map).

Table E7 - Model Verification

Site ID	2022 Monitored Total NO_2 ($\mu g/m^3$)	2022 Background NO_2 ($\mu g/m^3$)	2022 Monitored Road Contribution NO_x ($\mu g/m^3$)	2022 Modelled Road Contribution NO_x ($\mu g/m^3$)	Ratio
42	41.00	20.52	42.29	18.99	2.227

This resulted in a factor of **2.227**, indicating that the model was under-predicting. This road-NO_x adjustment factor was applied to the modelled road-NO_x concentration for the monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentration was then determined by inputting the adjusted modelled road-NO_x concentration and the background NO_2 concentration into the NO_x to NO_2 calculator.

PM_{10} and $PM_{2.5}$

There are no local PM_{10} or $PM_{2.5}$ monitoring data against which the model could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG22.

Appendix F - Wind Rose for Heathrow (2022)

Wind Rose for Heathrow (2022)