AIR QUALITY ASSESSMENT

32 – 34 Avenue Road, Camden

Produced by XCO2 for Private Client

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EXECUTIVE SUMMARY

An assessment has been undertaken to quantify the potential impacts on local air quality associated with the construction and operation of the proposed development at 32-34 Avenue Road, in the London Borough of Camden. Based on the results of the assessment, it is considered that redevelopment of the site would not cause a significant impact on local air quality.

During the construction phase, the site has the potential to generate dust nuisance beyond the application boundary. However, through the implementation of a Dust Management Plan, the impacts will be effectively minimised and are unlikely to be significant.

Dispersion modelling of emissions from traffic on the local road network has been undertaken to ascertain the likely level of exposure of future users of the proposed development to elevated nitrogen dioxide and particulate concentrations. The assessment indicates that NO_2, PM_{10} and $PM_{2.5}$ concentrations will be well within the relevant long and short-term air quality standards and therefore site is suitable for residential development, as proposed.

INTRODUCTION

This report presents an assessment of the potential impact on local air quality of the construction and operation of a proposed development at 32-34 Avenue Road in the London Borough of Camden (LBC). The site location is presented in Figure 1.

The scheme comprises the demolition of the existing 1960's residence with attached garage and construction of a new single dwelling residence consisting of a basement and three above ground storeys. The proposed site layout is presented in Figure 2.

The site falls within the LBC Air Quality Management Area (AQMA) which is borough-wide designation due to measured and modelled exceedances of the air quality objectives for nitrogen dioxide (NO_2) and particulate matter (as PM_{10}). The primary source of emissions of these pollutants in the Borough is road traffic.

An assessment has been undertaken to determine the potential impact on local air quality during both the construction and operational phases of the development, with recommendations made for mitigation where appropriate.

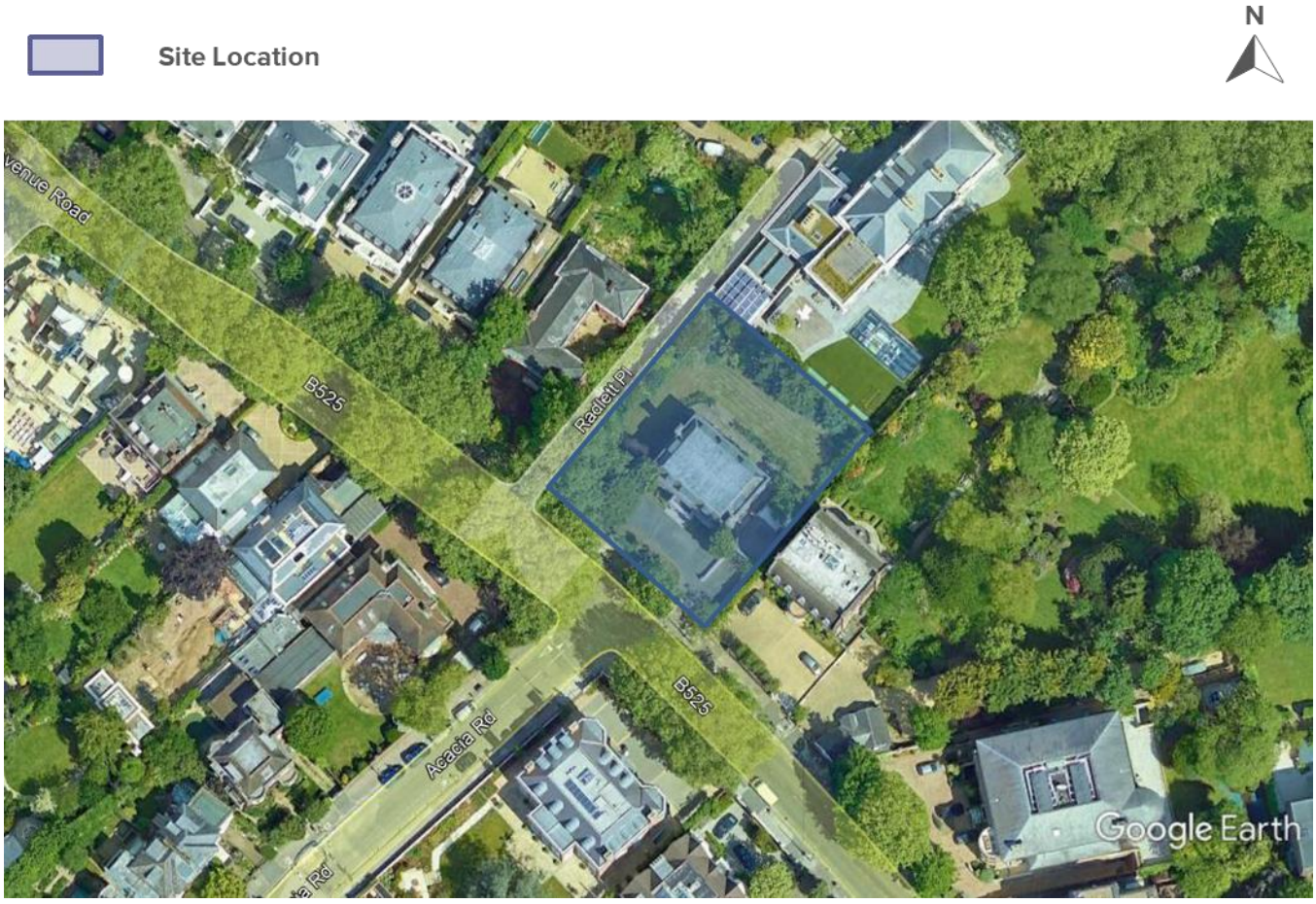

Figure 1: Site Location

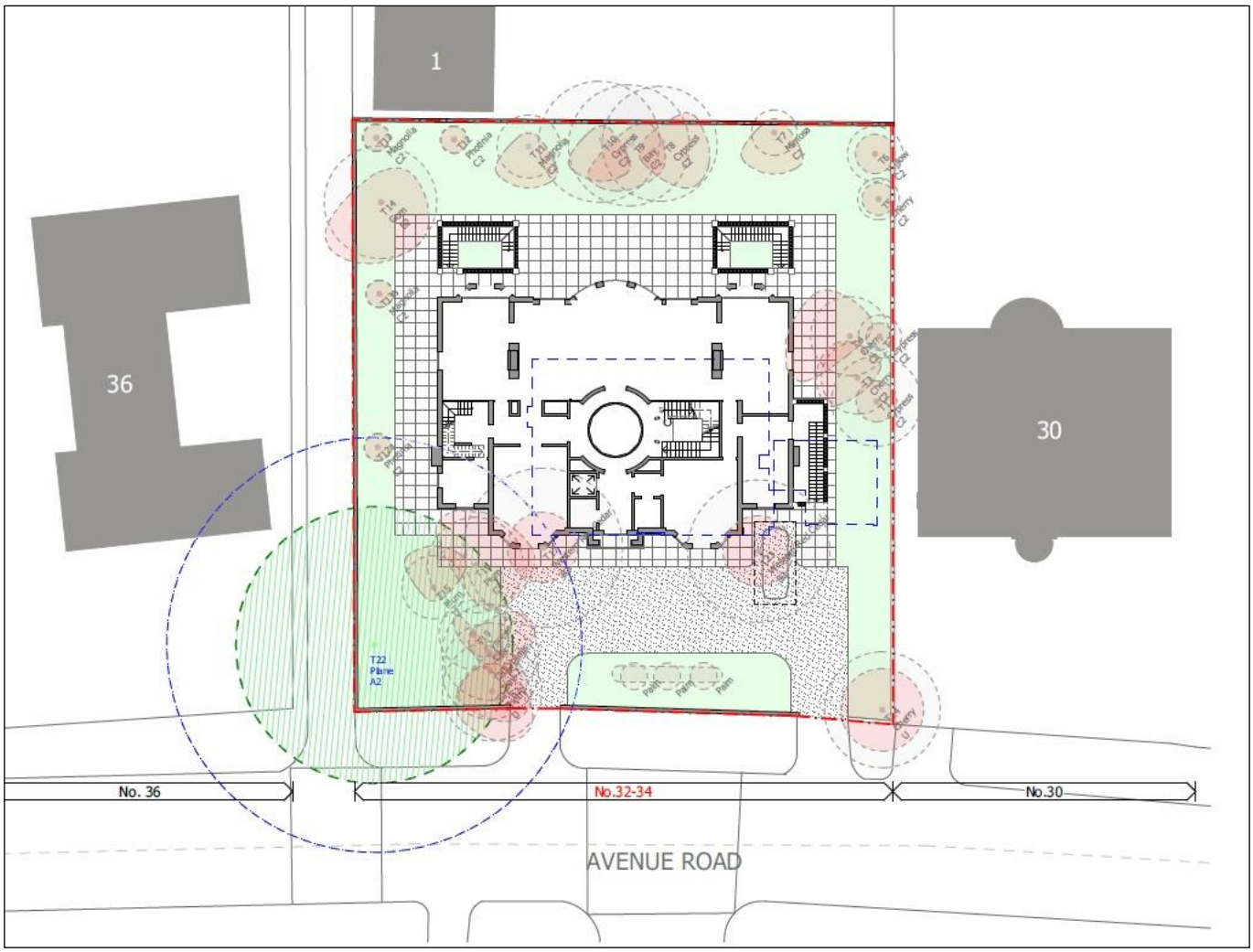

Figure 2: Proposed Site Layout

POLICY CONTEXT

An overview of the relevant policy drivers for the assessment is provided in the following section.

NATIONAL LEGISLATION

THE AIR QUALITY STRATEGY FOR ENGLAND, SCOTLAND, WALES AND NORTHERN IRELAND

The Air Quality Strategy for England, Wales and Northern Ireland[1] was published in 2007 and sets out policy targets (objectives) for sulphur dioxide (SO_2), nitrogen dioxide (NO_2), benzene (C_6H_6), carbon monoxide (CO), lead (Pb), particulate matter (PM_{10}, $PM_{2.5}$), 1,3-butadiene (C_4H_6) and polyaromatic hydrocarbons (PAH). The Standards are concentrations measured over a specified time period that are considered acceptable in terms of the effect on health and the environment. The Objectives are the target date on which exceedance of a Standard must not exceed a specified number.

In the context of the proposed development, the primary pollutants of concern are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The Air Quality Standards and Objectives for these pollutants, that are applicable in England, are presented in Table 1.

Table 1: National Air Quality Standards and Objectives

Pollutant	Averaging Period	Standard	Objective
NO_2	1-hour	200 µg/m^3, not to be exceeded more than 18 times per calendar year (a)	31 December 2005
	Annual	40 µg/m^3	
PM_{10}	24-hour	50 µg/m^3, not to be exceeded more than 35 times per calendar year (b)	31 December 2004
	Annual	40 µg/m^3	
$PM_{2.5}$	Annual	25 µg/m^3 (c)	2020
(a) Equivalent to the 99.8th percentile of 1-hour means. (b) Equivalent to the 90.4th percentile of 24-hour means. (c) National exposure reduction target			

In January 2019, the UK government published a Clean Air Strategy[2], which outlines measures to reduce emissions from a wide range of sources including transport, farming and industry. The Strategy proposes new local powers to implement Clean Air Zones in problem areas, backed up by clear enforcement mechanisms. Whilst the UK has already adopted legally binding international targets to reduce emissions of key pollutants such as nitrogen oxides and particulate matter (as PM_{10}), the Strategy aims to reduce fine particulate emissions ($PM_{2.5}$) to ensure that public exposure to concentrations above 10 µg/m^3 is halved by 2025.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007.
[2] Clean Air Strategy 2019, Defra, January 2019

It is widely accepted that there is no safe level for $PM_{2.5}$ and on this basis The Environment Act 2021[3] requires the Air Quality Regulations to be updated to include a more stringent long-term air quality target by the 31st of October 2022. A consultation on new environmental targets[4] was opened on 16th March 2022, which proposes an Annual Mean Concentration Target for England of 10 µg/m^3, to be met by 2040. This target is not as stringent as the latest World Health Organisation (WHO)[5] guideline of 5 µg/m^3. A Population Exposure Reduction Target of a 35% reduction in population exposure by 2024 (compared to a base year of 2018) has also been proposed.

LOCAL AIR QUALITY MANAGEMENT

The framework for Local Air Quality Management (LAQM) in the UK was introduced by the Environment Act 1995[6]. Local Authorities are required to regularly review and assess air quality to establish whether there are any locations where pollutant concentrations exceed the relevant air quality objectives or EU limit values. Where an exceedance is identified, the local authority is obliged to declare an Air Quality Management Area (AQMA) and prepare an Action Plan setting out measures to improve air quality and achieve compliance with the objective(s).

THE NATIONAL PLANNING POLICY FRAMEWORK

The National Planning Policy Framework NPPF[7] sets out the Government's policies for planning and how these should be applied. With regard to air quality, the NPPF states that "*planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas'. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*".

REGIONAL POLICY

THE LONDON PLAN

Policy SI1 (Improving Air Quality) of the London Plan[8] sets out the Greater London Authority's (GLA) commitment to improving air quality and public health and states:

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

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

[3] Environment Act 2021,
[4] Consultation on environmental targets, Defra, 16 March 2022
[5] WHO global air quality guidelines, Particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide, 2021
[6] Part IV of the Environment Act 1995
[7] Department for Communities and Local Government, National Planning Policy Framework, July 2021
[8] The London Plan 2021, The Spatial Development Strategy for Greater London, Greater London Authority, March 2021.

1. Development proposals should not:

a) lead to further deterioration of existing poor air quality.
b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits.
c) create unacceptable risk of high levels of exposure to poor air quality.

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

a) Development proposals must be at least air quality neutral.
b) Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures.
c) Major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1.
d) Development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people, which do not demonstrate that design measures have been used to minimise exposure should be refused.

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

a) How proposals have considered ways to maximise benefits to local air quality, and
What measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

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

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

New London Plan Air Quality Positive Guidance[9] has been published by the GLA, however this is currently in draft format and has not been adopted within this assessment.

LONDON ENVIRONMENT STRATEGY (2018)

Chapter 4 of the London Environment Strategy[10] outlines the Mayor's commitment to improving air quality in London. The strategy aims plan to significantly reduce NO_2 and particulate (PM_{10}, $PM_{2.5}$ and black carbon) concentrations through a number of key objectives and policies:

[9] London Plan Guidance Air Quality Positive, Consultation draft, November 2021
[10] London Environment Strategy, The Mayor of London, May 2018

Objective 4.1 support and empower London and its communities, particularly the most disadvantaged and those in priority locations, to reduce their exposure to poor air quality.

- Policy 4.1.1 Make sure that London and its communities, particularly the most disadvantaged and those in priority locations, are empowered to reduce their exposure to poor air quality.
- Policy 4.1.2 Improve the understanding of air quality health impacts to better target policies and action.

Objective 4.2 achieve legal compliance with UK and EU limits as soon as possible, including by mobilising action from London boroughs, government and other partners.

- Policy 4.2.1 Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport.
- Policy 4.2.2 Reduce emissions from non-road transport sources, including by phasing out fossil fuels.
- Policy 4.2.3 Reduce emissions from non-transport sources, including by phasing out fossil fuels.
- Policy 4.2.4 The Mayor will work with the government, the London boroughs and other partners to accelerate the achievement of legal limits in Greater London and improve air quality.
- Policy 4.2.5 The Mayor will work with other cities (here and internationally), global city and industry networks to share best practice, lead action and support evidence based steps to improve air quality.

Objective 4.3 establish and achieve new, tighter air quality targets for a cleaner London by transitioning to a zero emission London by 2050, meeting World Health Organization health-based guidelines for air quality.

- Policy 4.3.1 The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners.
- Policy 4.3.2 The Mayor will encourage the take up of ultra-low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines.
- Policy 4.3.3 Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality.
- Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces.

With regard to Policy 4.3.1, the Mayor of London has set a target for compliance with the now superseded WHO guideline value[11] for $PM_{2.5}$ of 10 µg/m^3 by 2030. However, recent modelling[12] suggests that due to the transboundary nature of $PM_{2.5}$, compliance in London is unlikely to be achieved without additional measures at national, European and international level.

GREATER LONDON AUTHORITY AIR QUALITY FOCUS AREAS

Air Quality Focus Areas have been identified by the Greater London Authority (GLA) where there is high human exposure in locations where the annual mean air quality objective for NO_2 is exceeded. The purpose of the Focus Areas is to allow local authorities to target actions to improve air quality where it is most needed and to inform the planning process with regard to the air quality impact of new developments.

[11] Air Quality Guidelines Global Update 2005, World Health Organisation
[12] $PM_{2.5}$ in London: Roadmap to meeting World Health Organization guidelines by 2030, GLA, October 2019

The proposed development is not located within an AQFA, but is approximately 500m southeast of AQFA 32 'Swiss Cottage from South Hamstead to Finchley Road Station'.

LOCAL POLICY

THE LONDON BOROUGH OF CAMDEN LOCAL AIR QUALITY MANAGEMENT

The London Borough of Camden carries out frequent assessments of air quality within the area and produces annual reports in accordance with the requirements of Defra.

Historically, routine monitoring has identified widespread exceedances of the air quality objectives for NO_2 and PM_{10}. As a consequence, in 2002, the Council declared a Borough-wide AQMA for these pollutants. More recent monitoring indicates that the NO_2 objectives are still widely exceeded at roadside locations within the Borough, but PM_{10} concentrations are now generally within the objective.

CAMDEN LOCAL PLAN

Policy CC4 'Air Quality' of Camden's Local Plan[13] states that:

'The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e., housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.'

CAMDEN'S CLEAN AIR ACTION PLAN 2019 - 2022

Camden's Clean Air Action Plan[14] outlines the Councils commitment to improving air quality in the Borough between 2019 and 2022. The key objectives of the plan are to reduce PM_{10}, $PM_{2.5}$ and NO_2 concentrations by:

- Reducing construction emissions
- Reducing building emissions (encouraging the use of clean fuels and technologies)
- Reducing transport emissions

[13] Camden Local Plan (Adopted July 2017)
[14] London Borough of Camden, Camden's Clean Air Action Plan 2019-2022.

- Supporting communities and schools
- Reducing emissions from delivery, servicing and freight
- Continuing public health and awareness raising
- Lobbying

The Action Plan is supported by The Camden Plan[15] and Camden's Environmental Sustainability Plan[16] drawing on European and National legislation in conjunction with national, regional and local policy to manage and improve air quality across the Borough.

[15] The Camden Plan 2012 - 2017
[16] Green Action for Change 2010 – 2020.

METHODOLOGY

This section outlines the assessment methodology, taking into account all relevant national and local policies and technical guidance relating to air quality.

CONSTRUCTION DUST

The potential impact of dust generated during site enabling, earthworks and construction works at the proposed development has been undertaken in accordance with the GLA's SPG for the control of dust and emissions during construction and demolition[17]. A range of best practice mitigation measures are provided within the guidance, which are dependent on the level of dust risk attributed to the site. The risk assessment and proposed mitigation are presented within the Construction Management Plan (CMP) for the proposed development.

CONSTRUCTION TRAFFIC

Construction traffic will contribute to existing traffic levels on the surrounding road network. However, based on the scale of the proposed development, the temporary increase in traffic is considered unlikely to be significant in terms of total flow or construction duration.

All non-road mobile machinery (NRMM) will comply with the emission standards specified in the Mayor of London's Control of Dust and Emissions during Construction and Demolition SPG.

The impact of vehicular emissions of NO_2 and PM_{10} from construction traffic and on-site machinery on local air quality is anticipated to be negligible.

OPERATIONAL TRAFFIC

The Environmental Protection UK (EPUK)/ IAQM planning guidance[18] , states that for developments within or near an AQMA, a detailed assessment of traffic-related impacts is required where:

- There is a change in the annual average daily traffic (AADT) flow of light goods vehicles (LGV) of more than 100 vehicles; and/or
- There is a change in the AADT flow of heavy goods vehicles (HGV) of more than 25 vehicles; and/or
- There is a change in the road re-alignment by more than 5m; and/or
- A new junction is introduced, which will significantly alter vehicle speeds.

In the context of these screening criteria, LGV refers to vehicles below 3.5 tonnes and HGV refers to vehicles above 3.5 tonnes.

[17] The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, The Mayor of London, July 2014

[18] Land-use Planning and Development Control: Planning for Air Quality, Guidance from Environmental Protection UK and the Institute of Air Quality Management for the consideration of air quality within the land use planning and development control process, January 2017.

The proposed development is a single residential dwelling and therefore the daily trip generation will be very low. The impact of operational traffic has therefore been scoped out of the assessment.

EXPOSURE ASSESSMENT

Detailed dispersion modelling of emissions from traffic on the local road network has been undertaken using the ADMS-Roads dispersion model, to predict pollutant concentrations at the proposed development and determine whether on-site mitigation will be required to protect future occupants from poor air quality.

A summary of the model input parameters is presented in Appendix A. The traffic flows used in the assessment have been projected to 2025 (the proposed opening year) using TEMPro v7.2[19].

EMISSION FACTORS

Concentrations of NOx, PM_{10} and $PM_{2.5}$ have been predicted using vehicle emission factors from the latest version of the Emissions Factor Toolkit (11.0) [20]. The predicted NOx concentrations have been converted to NO_2 using version 8.1 of the NOx to NO_2 calculator, available from the Defra air quality website[21].

METEOROLOGICAL DATA

Hourly sequential meteorological data from London City Airport (approximately 15 km southeast of the proposed development) for 2018 has been used in the dispersion modelling.

SENSITIVE RECEPTORS

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted using a Cartesian grid of 5 m resolution over the full extent of the development site at an elevation of 1.5m above road-level (representing ground-floor level exposure).

VERIFICATION

There is an inherent level of uncertainty associated with any assessment process; however, the methodology presented has been developed to minimise errors where possible. Potential errors in predicted concentrations due to uncertainties in the assessment source activity data (e.g., traffic flows and emission factors) and the estimated background concentration are minimised by the verification of modelled concentrations using local monitoring data.

The 2016 Local Air Quality Management Technical Guidance (LAQM.TG16) [22] recommends that modelled concentrations should be within 25% of monitored concentrations, ideally within 10%. Where there is a large discrepancy between modelled and measured concentrations, it is considered necessary to adjust the model results to reflect local air quality more accurately.

[19] https://www.gov.uk/government/publications/tempro-downloads
[20] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[21] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc
22 Local Air Quality Management Technical Guidance (LAQM.TG16), Defra, February 2018

The modelled concentrations have been verified using 2018 data from the Swiss Cottage automatic monitoring site. Full details of the model verification process are presented in Appendix B.

EXPOSURE CRITERIA

The London Councils Air Quality Planning Guidance[23] provides criteria for determining the significance of exposure to air pollution and level of mitigation required. The Air Pollution Exposure Criteria (APEC) are presented in Table 2. The applicable ranges assume a downward trend in pollutant concentrations has been established, which is anticipated due to the uptake of electric vehicles and the implementation of the Ultra-Low Emission Zone.

Table 2: Air Pollution Exposure Criteria

	Applicable Range NO_2 Annual Mean	Applicable Range PM_{10}	Recommendation
APEC - A	> 5% below national objective	**Annual Mean:** > 5% below national objective **24 hr Mean:** > 1-day less than national objective	No air quality grounds for refusal; however, mitigation of any emissions should be considered.
APEC - B	Between 5% below or above national objective	**Annual Mean:** Between 5% above or below national objective **24 hr Mean:** Between 1-day above or below national objective.	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., Maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered, and internal pollutant emissions minimised.
APEC - C	> 5% above national objective	**Annual Mean:** > 5% above national objective **24 hr Mean:** > 1-day more than national objective.	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. 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.

BUILDING EMISSIONS

The energy strategy for the proposed development is Air Source Heat Pumps (ASHP). There will be no combustion emissions associated with the site.

[23] London Councils Air Quality and Planning Guidance, January 2007

BASELINE AIR QUALITY

LOCAL AIR QUALITY MONITORING

AUTOMATIC MONITORING DATA

The nearest automatic air quality monitoring site (AQMS) to the proposed development is at Swiss Cottage, which is approximately 830m to the northwest. The site is affiliated to the London Air Quality Network (LAQN); therefore, the measured data are subject to high levels of quality assurance (QA) and quality control (QC).

The nearest automatic monitoring sites that measure urban background concentrations are at North Ken, Islington Arsenal and Camden Bloomsbury. Details of all four monitoring sites are presented in Table 3.

Table 3: Automatic Monitoring Sites

Site Name	Type	Easting	Northing	Pollutants Monitored	Approximate Location Relative to Proposed Development
Swiss Cottage (Camden)	Kerbside	526629	184391	NO_2, PM_{10}, $PM_{2.5}$	830m northwest
North Ken (Kensington and Chelsea)	Urban background	524045	181752	NO_2, PM_{10}, $PM_{2.5}$	3.6 km southwest
Bloomsbury (Camden)	Urban background	530123	182014	NO_2, PM_{10}, $PM_{2.5}$	3.4 km southeast
Arsenal (Islington)	Urban background	531325	186032	NO_2, PM_{10}	4.7 km northeast

Annual mean NO_2 and particulate (PM_{10} and $PM_{2.5}$) concentrations measured at these locations are summarised in Table 4, together with the number of measured exceedances of the short-term AQOs. The data have been obtained from LBC's 2018 Air Quality Annual Status Report[24] and the London Air Quality Network[25]. Data from 2020 and 2021 has not been included in the assessment due to the influence of the Covid-19 pandemic on traffic levels.

The data show that the annual mean AQO for NO_2 of 40 µg/m^3 is routinely exceeded at Swiss Cottage. In 2016, the number of measured hourly means above 200 µg/m^3 was more than double the 18 allowable per annum.

With the exception of Bloomsbury in 2015 and 2016, NO_2 concentrations measured at the urban background automatic monitoring sites nearest the proposed development were below the relevant air quality objectives. There is significant variation in annual mean NO_2 concentrations across the three sites, with the highest concentrations measured in Bloomsbury.

The data from all four automatic monitoring sites indicate a declining trend in annual mean NO_2 concentrations since 2016; a trend that has been widely observed across London, where there was an average reduction between 2016 and 2019 of 21%[26].

[24] London Borough of Camden Air Quality Annual Status Report for 2018, July 2019
[25] www.londonair.org.uk
[26] Air pollution monitoring data in London: 2016 to 2020, Greater London Authority, February 2020.

Concentrations of PM_{10} and $PM_{2.5}$ measured at Swiss Cottage and the three urban background monitoring sites are well within the short and long-term objectives. The data indicate that even at roadside locations, annual mean PM_{10} concentrations are unlikely to exceed 60% of the air quality objective. The measured $PM_{2.5}$ concentrations at all four sites exceed the proposed target concentration of 10 µg/m^3, however this level is routinely exceeded across London and there is currently no statutory obligation for compliance. The data indicate that particulate concentrations at both roadside and background locations in the area, are relatively stable.

Table 4: Automatically Measured Pollutant Concentrations

Site Name	2014	2015	2016	2017	2018	2019
Swiss Cottage						
Annual Mean NOx (µg/m^3)	177.1	158.6	178.9	140.0	126.8	96.7
Annual Mean NO_2 (µg/m^3)	**66**	**61**	**66**	**53**	**54**	**43**
Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m^3	13	11	**37**	1	2	1
Annual Mean PM_{10} (µg/m^3)	22	20	21	20	21	19
Number of Predicted Exceedances of the 24-Hour Mean PM_{10} AQO of 50 µg/m^3	11	8	7	8	4	8
Annual Mean $PM_{2.5}$ (µg/m^3)	-	17	17	14	15.6	11
North Ken						
Annual Mean NOx (µg/m^3)	53.2	45.6	59	50.8	40.7	39.3
Annual Mean NO_2 (µg/m^3)	34	32	35	33	27 (a)	27
Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m^3	0	0	0	1	0 (a)	0
Annual Mean PM_{10} (µg/m^3)	19	19	19	-	14	15
Number of Predicted Exceedances of the 24-Hour Mean PM_{10} AQO of 50 µg/m^3	3	1	7	-	1	5
Annual Mean $PM_{2.5}$ (µg/m^3)	-	11	12	12	9 (a)	10
Bloomsbury						
Annual Mean NOx (µg/m^3)	72.1	74.4	75.0	61.4	54.4	46.3
Annual Mean NO_2 (µg/m^3)	n/a	**48**	**42**	38	36	32
Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m^3	n/a	0	0	0	0	0
Annual Mean PM_{10} (µg/m^3)	20	n/a	20	19	17 (a)	18
Number of Predicted Exceedances of the 24-Hour Mean PM_{10} AQO of 50 µg/m^3	10	n/a	9	6	1	9
Annual Mean $PM_{2.5}$ (µg/m^3)	n/a	11	12	13	10	11
Arsenal						
Annual Mean NOx (µg/m^3)	52.2	40.0	55.0	48.3	39.3	36.8
Annual Mean NO_2 (µg/m^3)	n/a	29	33	31	27	25
Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m^3	n/a	0	0	1	0	0
Annual Mean PM_{10} (µg/m^3)	n/a	18	18	18	19	19

Number of Predicted Exceedances of the 24-Hour Mean PM_{10} AQO of 50 µg/m^3	n/a	1	3	3	1	9
(a) 88% data capture						

NON-AUTOMATIC MONITORING DATA

Monitoring of ambient NO_2 concentrations is also undertaken by LBC at a number of locations using passive diffusion tubes. A summary of the diffusion tube monitoring locations considered relevant to the assessment is presented in Table 5. The locations of the diffusion tubes are presented in Figure 3.

Table 5: Diffusion Tube Monitoring Locations

Site ID	Location	Type	Distance from kerb (m)	Easting	Northing
CA7	Frognal Way	Urban Background	30.0	526213	185519
CA15	Swiss Cottage (co-located with AQMS)	Kerbside	<1.0	526633	184392
CA17	47 Fitzjohn's Avenue	Roadside	5.0	525325	185255

A summary of the bias adjusted annual mean NO_2 concentrations measured between 2015 and 2019 is presented in Table 6. Again, Data from 2020 and 2021 has not been included in the assessment due to the influence of the Covid-19 pandemic on traffic levels. Exceedances of the air quality objective are highlighted in bold.

The annual mean NO_2 concentrations measured at the Frognal Way background diffusion tube site are well within the air quality objective of 40 µg/m^3. The annual mean concentrations measured at the Fitzjohn's Avenue roadside location are somewhat higher and consistently exceed the air quality objective, although the concentrations are lower than those measured on at Swiss Cottage. A decline in concentrations since 2016 is evident at all three monitoring locations.

Table 6: Annual Mean NO_2 Concentrations Measured by Diffusion Tube (µg/m^3)

Location	Type	2015	2016	2017	2018	2019
Frognal Way	Urban Background	27.8	27.9	32.3 (a)	22.1	22.8
Swiss Cottage	Kerbside	**69.3**	**73.9**	- (c)	**62.3**	**49.7** (a)
47 Fitzjohn's Avenue	Roadside	**55.8**	**56.4 (a)**	**- (c)**	**48.1**	**42.5**
(a) Data capture < 90% (b) Data capture < 50%						

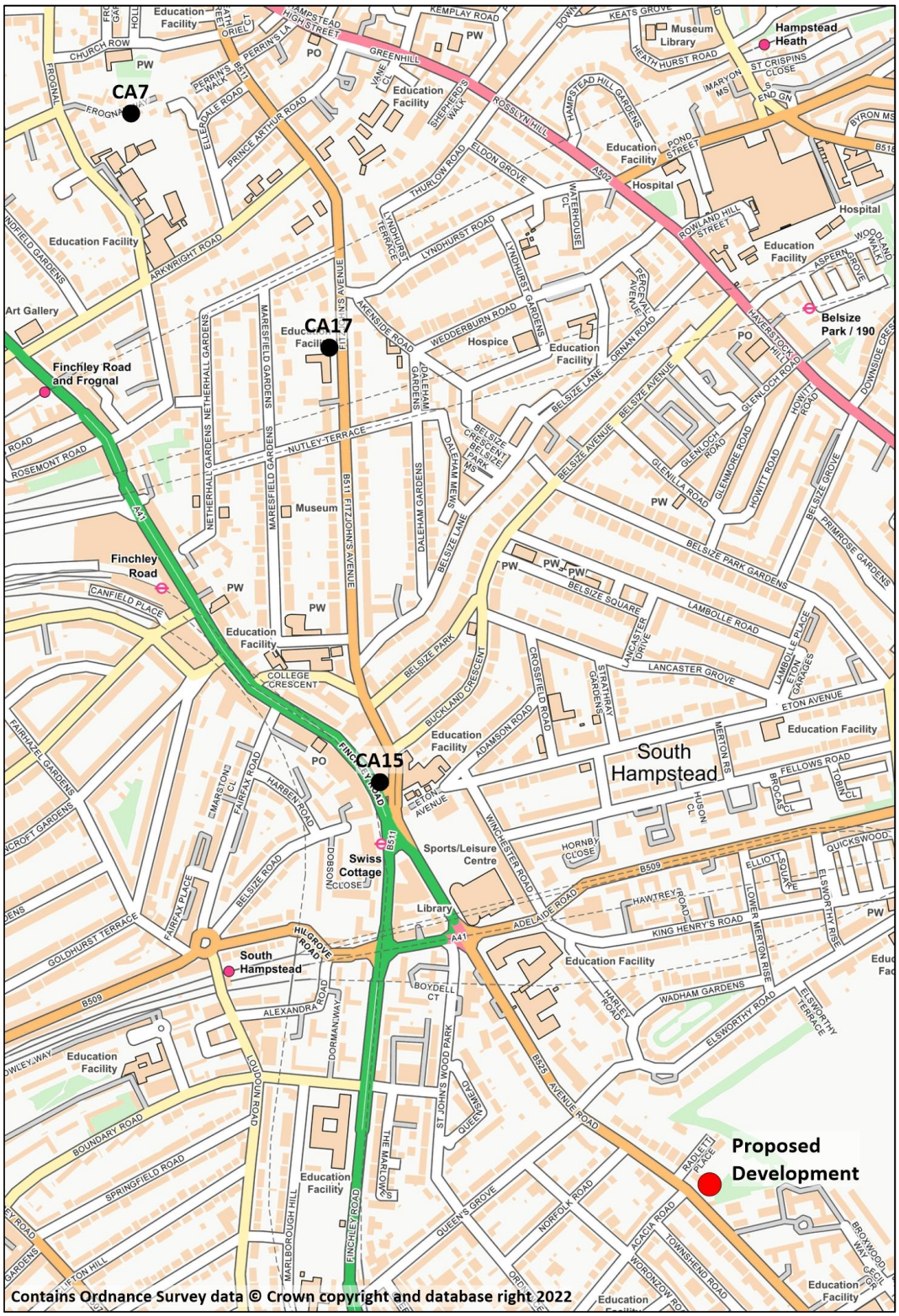

Figure 3: Location of Diffusion Tubes

MAPPED AND ASSESSMENT BACKGROUND CONCENTRATIONS

For comparison with the measured data at the nearest background monitoring sites (London Bloomsbury and Frognal Way), annual mean concentrations for the proposed development site have been obtained from the Defra UK Background Air Pollution maps[27]. These 1km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The latest background maps were issued in August 2020 and are based on 2018 monitoring data, with projections for future years.

The maximum 2018[28] annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the proposed development, the Swiss Cottage AQMS and the London Bloomsbury AQMS have been determined from contour plots of the mapped data and are presented in Table 7.

Table 7: Mapped and Measured 2018 Annual Mean Background Pollutant Concentrations (µg/m^3)

Pollutant	Mapped			Measured		Air Quality Standard
	Proposed Development	Swiss Cottage AQMS	London Bloomsbury AQMS	London Bloomsbury AQMS	Frognal Way	
NO_2	32.0	31.8	45.5	36	22.1	40
NOx	52.8	52.2	86.8	54.4	-	n/a
PM_{10}	19.4	19.6	20.8	17	-	40
$PM_{2.5}$	12.4	12.5	13.3	10	-	25

The nearest background monitoring location to both the Swiss Cottage verification site and the proposed development is the diffusion tube monitoring site at Frognal Way, however the measured NO_2 concentration at Frognal Way in 2018 was just 22.1 µg/m^3, considerably lower than the concentrations measured at all three background AQMS's.

The mapped concentrations at London Bloomsbury are considerably higher than the measured concentrations, indicating that the mapped data are over predicting concentrations at this location. For the purposes of the assessment the measured concentrations at London Bloomsbury have been used in the assessment, both for verification purposes and to assess potential exposure. It should be noted that whilst the data capture for PM_{10} at London Bloomsbury in 2018, was below 90%, using a lower background concentration for verification results in a higher adjustment factor for the modelled PM_{10} concentrations at the proposed development site and therefore a more conservative assessment of the potential exposure of future occupants to poor air quality.

[27] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[28] For consistency with verification year, met data and emission factors used in the assessment.

EXPOSURE ASSESSMENT

The potential impact of local air quality on future occupants of the development are identified in this section.

NITROGEN DIOXIDE

Predicted ground-floor level annual mean NO_2 concentrations due to emissions from traffic on the local road network are presented a contour plot in Figure 4. The concentrations are below 38 µg/m^3 at the facade of the proposed dwelling and therefore **the development falls within exposure category APEC-A, with respect to NO_2**.

The predicted concentrations at all locations on site are less than 70% of the 60 µg/m^3 threshold for a potential exceedance of the 1-hour mean air quality objective and therefore the risk of non-compliance at the development is negligible.

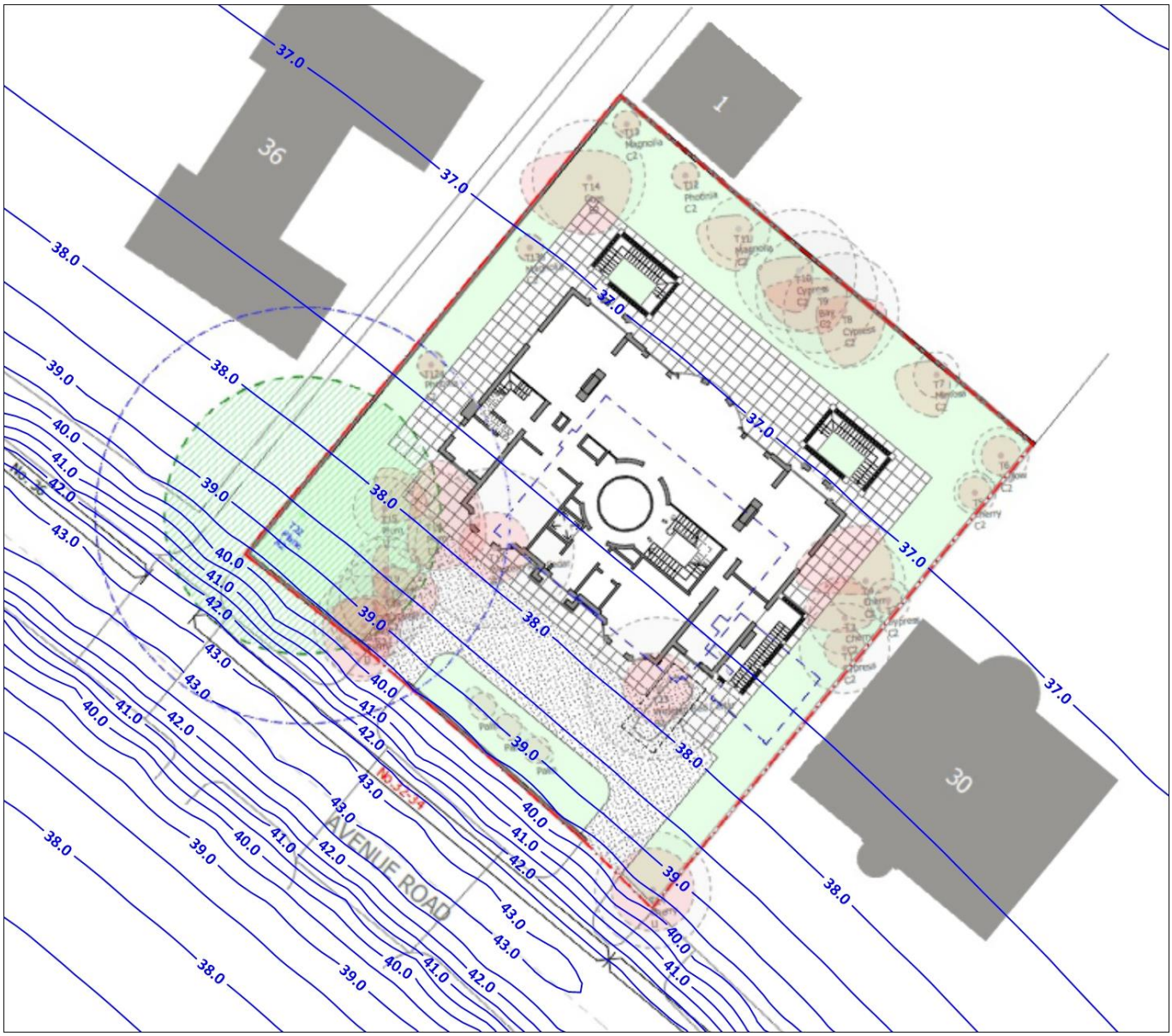

Figure 4: Predicted Ground-Floor Level Annual Mean NO_2 Concentrations (µg/m^3)

PARTICULATE MATTER

Predicted annual mean PM_{10} and $PM_{2.5}$ concentrations at ground-floor level across the proposed development site are presented as contour plots in Figure 5 and Figure 6, respectively. The predicted concentrations at the site are less than 50% of the long-term air quality standards and therefore **the development falls within exposure category APEC-A for particulate matter.**

LAQM.TG(16) provides a relationship between predicted annual mean PM_{10} concentrations and the likely number of exceedances of the short-term (24-hour mean) PM_{10} objective of 50 µg/m^3. The objective allows 35 exceedances per year, which is equivalent to an annual mean of 32 µg/m^3. On this basis, the dispersion modelling indicates that compliance with the short-term PM_{10} objective will be achieved at all locations on site.

The measured background $PM_{2.5}$ concentration used in the assessment of 10 µg/m^3, exceeds the GLA target and proposed exposure reduction target of 10 µg/m^3. Consequently, the predicted concentrations at the on-site are also above the target value. Following the implementation of increasingly stringent legislative measures aimed at reducing $PM_{2.5}$ emissions, concentrations at the proposed development in the future are anticipated to be lower than predicted.

Figure 5: Predicted Ground-Floor Level Annual Mean PM_{10} Concentration (µg/m^3)

Figure 6: Predicted Ground-Floor Level Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)

MITIGATION

The following mitigation measures will be required during the construction and operational phases to minimise the air quality impacts arising from the development.

CONSTRUCTION PHASE

Construction phase mitigation measures are presented within the CEMP for the proposed development. **The significance of dust impacts on nearby receptors, following the implementation of appropriate and best practice mitigation, is considered to be negligible**.

OPERATIONAL PHASE

Detailed dispersion modelling of traffic on the local road network indicates that concentrations of NO_2, PM_{10} and $PM_{2.5}$ will be well within the relevant long and short-term air quality standards at the façade of the proposed dwelling (**APEC-A**). On this basis, mitigation measures are not required to protect future occupants from poor air quality.

SUMMARY AND CONCLUSIONS

An assessment has been undertaken to assess the potential impacts on local air quality associated with the construction and operation of the proposed development.

Releases of dust and PM_{10} are likely to occur during site activities. However, through good site practice and the implementation of highest levels of dust control, as outlined in the CEMP for the proposed development, the impact of dust and PM_{10} releases will be effectively mitigated, and the resultant impacts are considered to be negligible.

Detailed dispersion modelling has been undertaken to predict concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the proposed development site to determine whether mitigation will be required to protect future occupants from poor air quality. The predicted concentrations are below the relevant long and short-term air quality objective at the facade of the new building (exposure category APEC-A).

The energy strategy for the proposed development is ASHP and therefore there will be no significant combustion emissions associated with the site.

Based on the results of the assessment and with the implementation of the recommended construction-phase mitigation measures, it is considered that air quality would not pose a constraint to the redevelopment of the site as proposed.

APPENDIX A – ADMS-ROADS INPUT PARAMETERS

Table B1: Summary of ADMS-Roads Input Parameters

Parameter	2018 Verification	2025 Exposure
ADMS-Roads Model Version	5.1	5.1
Vehicle Emission Factors	EFT v11 for 2018	EFT v11 for 2025
Meteorological Data	Hourly sequential data from London City Airport (2018)	Hourly sequential data from London City Airport (2018)
Surface Roughness	1.0m	1.0m
Monin-Obukhov Length	75m	75m

Table B3: Summary of Traffic Data for Model Verification

Road Link	2018 AADT (a)	HGV (%)	Average Speed (kph)
Finchley Road North of Swiss Cottage	49,103 (a)	5.8	16
Finchley Road South of Swiss Cottage	22,739 (b)	10.7	16
Avenue Road N of Adelaide Road	39,714 (c)	4.6	16
Avenue Road S of Adelaide Road	15,782 (c)	2.1	16
College Crescent	18,509 (c)	3.7	16

(a) DfT ATC 16434 for 2018
(b) DfT ATC 48537 for 2018
(c) AADT derived from 2016 London Atmospheric Emissions Inventory (LAEI) with TEMPro v7.2 growth factor for Camden applied to project flows to 2018.

Table B4: Summary of Traffic Data for the Prediction of Pollutant Concentrations at the Proposed Development

Road Link	2025 AADT (a)	HGV (%)	Average Speed (kph)
Avenue Road	17,111	2.1	24

(a) AADT derived from 2016 London Atmospheric Emissions Inventory (LAEI) with TEMPro v7.2 growth factor for Camden applied to project flows to 2025.

APPENDIX B – MODEL VERIFICATION

Most nitrogen dioxide (NO_2) 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 primary pollutant emissions. Verification of concentrations predicted by the ADMS-Roads model has followed the methodology presented in LAQM.TG16.

Predicted annual mean concentrations of NOx have been compared with the 2018 annual mean concentration measured by the LBC automatic air quality monitoring station located on the A41 at Swiss Cottage.

A Road-NOx (i.e., the component of total NOx coming from road traffic) concentration has been derived by subtracting the 2018 measured background NOx concentration from Bloomsbury from the NOx concentration measured at Swiss Cottage.

The ratio of the measured and modelled Road-NOx contributions provides an adjustment factor for the modelled Road-NOx concentrations. This factor is then applied to the modelled road NOx concentrations before they are converted to Road-NO_2 using the Defra NOx to NO_2 calculator and added to the background NO_2 concentration to produce a total adjusted modelled NO_2 concentration. The calculation of the adjustment factor for NO_2 is presented in Table C1.

Table C1: Verification Calculation for NO_2

Parameter	Value
2018 Measured NO_2 Concentration	53.7 µg/m^3
2018 Measured NOx Concentration	126.8 µg/m^3
2018 Background NOx Concentration	54.4 µg/m^3
Measured Road-NOx Concentration	72.4 µg/m^3
Modelled Road-NOx Concentration	36.0 µg/m^3
Adjustment Factor	**2.0**

Particulate Matter (as PM_{10})

Predicted annual mean concentrations of PM_{10} have been compared with the 2018 annual mean concentration measured by the Swiss Cottage automatic air quality monitoring station. A measured Road-PM_{10} (i.e., the component of total PM_{10} coming from road traffic) concentration has been derived by subtracting the measured background concentration at Bloomsbury from the concentration measured at Swiss Cottage.

The ratio of the measured and modelled Road-PM_{10} contributions provides an adjustment factor for the modelled Road-PM_{10} concentrations. The calculation of the adjustment factor for PM_{10} is presented in Table C2.

Table C2: Verification Calculation for PM_{10}

Parameter	Value
2018 Measured PM_{10} Concentration	21.0 µg/m^3
2018 Measured Background PM_{10} Concentration	17.0 µg/m^3
Measured Road-PM_{10} Concentration	4.0 µg/m^3
Modelled Road-PM_{10} Concentration	2.2 µg/m^3
Adjustment Factor	**1.8**

Particulate Matter (as $PM_{2.5}$)

Predicted annual mean concentrations of $PM_{2.5}$ have been compared with the 2018 annual mean concentration measured by the Swiss Cottage automatic air quality monitoring station. A measured Road-$PM_{2.5}$ (i.e., the component of total $PM_{2.5}$ coming from road traffic) concentration has been derived by subtracting the 2018 measured background concentration at Bloomsbury from the measured roadside $PM_{2.5}$ concentration.

The ratio of the measured and modelled Road-$PM_{2.5}$ contributions provides an adjustment factor for the modelled Road-$PM_{2.5}$ concentrations. The calculation of the adjustment factor for $PM_{2.5}$ is presented in Table C3.

Table C3: Verification Calculation for $PM_{2.5}$

Parameter	Value
2018 Measured $PM_{2.5}$ Concentration	16.0 µg/m^3
2018 Measured Background $PM_{2.5}$ Concentration	10.0 µg/m^3
Measured Road-$PM_{2.5}$ Concentration	6.0 µg/m^3
Modelled Road-$PM_{2.5}$ Concentration	1.4 µg/m^3
Adjustment Factor	**4.3**

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