Air Quality Assessment for the proposed development at Haydon House, 296 Joel Street

Report to Creative Ideas & Architecture Office Ltd

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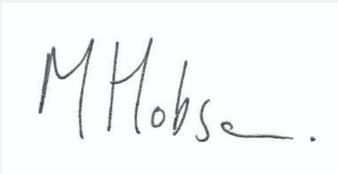
Signature	
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1 Introduction

Aether has been commissioned by Creative Ideas & Architecture Office Ltd. to undertake an air quality assessment for the proposed development at Haydon House, Joel Street. The development will consist of the demolition of the existing three storey office building to provide a new block of 14 flats. A maximum of eight car parking spaces will be provided with the development.

The development falls within the London Borough of Hillingdon which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM_{10}) or nitrogen dioxide (NO_2) at the proposed site and then advise whether any action is required to reduce the residents' exposure to air pollution. The assessment utilises ADMS-Roads, a comprehensive dispersion modelling tool for investigating air pollution problems due to small networks of roads and industrial sources.

A base year of 2019 has been selected as this is the most recent full calendar year prior to Covid 19 having an impact on traffic levels. The expected completion date of the proposed development is 2025. The assessment has therefore been completed for 2026, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located on Joel Street. (**Figure 1**).

Figure 1: Location of the development site

1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Haydon House development, as set out in the UK Air Quality Strategy[1], is presented in **Table 1** below.

Table 1: UK Air Quality Objectives for NO_2 and PM_{10}

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO_2)	40 µg/m^3	Annual mean
	200 µg/m^3	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM_{10})	40 µg/m^3	Annual mean
	50 µg/m^3	24 hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_X) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO_2 can also form in the atmosphere due to a chemical reaction between NO and ozone (O_3). Health based standards for NO_X generally relate to NO_2, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM_{10}.

A growing body of research has also pointed towards the smaller particles as a metric more closely associated with adverse health impacts. In particular, particulate matter with an aerodynamic diameter of less than 2.5 micrometres, known as $PM_{2.5}$. Local Authorities in England have a flexible role[2] in working towards reducing emissions and concentrations of $PM_{2.5}$ as there is no specific objective for them. However, there is a UK (excluding Scotland) annual mean objective of 20 µg/m^3.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants[3].

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

- Outside of buildings or other natural or man-made structures above or below ground

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

[2] https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf LAQM TG(22) – paragraph 1.13 – 1.17

[3] https://www.gov.uk/government/collections/comeap-reports

- Where members of the public are regularly present.

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members of the public do not have regular access. The 24-hour objective will apply at all locations where the annual mean objective would apply together with hotels. Therefore, in this assessment the annual mean and 24 hour mean objectives will apply at all floors of the residential development. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that amount of time. Therefore, in this assessment the hourly objective will also apply at all levels of the development.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan (AQAP).

The London Borough of Hillingdon declared an Air Quality Management Area (AQMA) in 2003 due to exceedances of the annual mean nitrogen dioxide (NO2) objective.[4] The AQMA covers the area from the southern boundary north to the border defined by, the A40 corridor from the western borough boundary, east to the intersection with the Yeading Brook north until its intersection with the Chiltern-Marylebone railway line. The proposed development is located between the Hillingdon AQMA and the Harrow AQMA. The latest Air Quality Action plan (AQAP)[5] was produced in 2019 which outlines measures that the council are taking to improve air quality during the period 2019 to 2024.

1.4 The ADMS-Roads Method

Local air quality has been assessed using ADMS-Roads, a comprehensive dispersion model that can be used to predict concentrations of pollutants in the vicinity of roads and small industrial sources. The model has been used for many years in support of planning applications for new residential/commercial developments.

ADMS-Roads is able to provide an estimate of air quality both before and after development, taking into account important input data such as background pollutant concentrations, meteorological data, traffic flows and on-site energy generation (if applicable). The model output can be verified against local monitoring data to increase the accuracy of the predicted pollutant concentrations and this approach has been followed in this assessment.

The use of dispersion modelling enables estimates of concentrations to be made at varying heights. As a result, suggestions for appropriate mitigation measures can be made where necessary, taking into consideration the identification of worst-case locations.

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[4] https://uk-air.defra.gov.uk/aqma/details?aqma_ref=28

[5] https://modgov.hillingdon.gov.uk/documents/s45069/Air%20Quality%20Action%20Plan%202019-2024.pdf

The most recent version of ADMS-Roads (v5.0.1) was issued in March 2022 and requires the following information to assess the impact at sensitive receptor locations:

- **Setup:** General site details and modelling options to be used
- **Source:** Source dimensions and locations, release conditions, emissions
- **Meteorology:** hourly meteorological data
- **Background:** Background concentration data
- **Grids:** Type and size of grid for output
- **Output:** Output required and sources/groups to include in the calculations.

2 Methodology

2.1 Local Pollutant Concentrations

It is good practice to include up-to-date local background pollutant concentrations in the assessment model, and also to verify modelled outputs against local monitoring data where available. This section provides an overview of the local data available for use in the assessment.

2.1.1 Local monitoring data

The London Borough of Hillingdon has twelve automatic monitoring sites which measure nitrogen dioxide (NO_2); particulate matter (PM_{10}) is also monitored at ten of these sites. Unfortunately, none of these automatic monitoring sites are located within close proximity to the development site and are therefore unlikely to be representative of the development site. NO_2 concentrations are also measured passively at diffusion tube sites across the Borough. Details of the monitoring sites that lie closest to the development site are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR).[6]

Table 2: Monitoring sites located closest to the development

Site Name	Site Type	Pollutant	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
HILL 32	UB	NO_2	510644, 188599	0.6	290
HILL 43	R	NO_2	510134, 187086	1.5	1780
HILL 33	R	NO_2	510284, 190524	0.5	1700
HILL 34	R	NO_2	509900, 190648	2	1900
HILL 15	R	NO2	511889, 186563	1	2670

Note: R = roadside, UB = urban background

[6] http://www.hillingdon-air.info/pdf/LB_Hillingdon_ASR_2020_final.pdf

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme[7]. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. The London Borough of Hillingdon has applied a national bias adjustment factor (0.84) to their 2019 diffusion tube results.

Monitoring results are presented in **Table 3**. Although the data shows that the annual mean NO_2 objective was only exceeded once in 2019 at site HILL 32, concentrations at sites HILL 43 and HILL 33 are very close the annual mean NO_2 objective in 2019. As expected, due to the Covid 19 pandemic, the annual mean NO_2 concentrations recorded in 2020 are significantly lower than in previous years. Diffusion tubes do not provide information on hourly exceedances, but research[8] identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m^3. Therefore, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites between 2018 and 2020.

Table 3: Monitoring results for sites close to the proposed development site, 2018-2020

Objective	Site Name	2018	2019	2020
NO_2	HILL 32	N/A	**44.4**	32.5
NO_2	HILL 43	N/A	39.4	29.1
NO_2	HILL 33	N/A	39.5	29.0
NO_2	HILL 34	N/A	35.9	26.3
NO_2	HILL 15	26.9	27.2	19.9

** exceedances of the NO_2 annual objective are highlighted in bold*

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website[9] and data has been extracted for the development and verification sites for this assessment. These 2018 baseline, 1 kilometre 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 projections in the 2018 LAQM background maps are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these maps do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

The estimated mapped background NO_X, NO_2 and PM_{10} concentrations around the development site are 24.9 µg/m^3, 17.7 µg/m^3 and 15.4 µg/m^3 respectively in 2019 (the baseline year used in the assessment). The background maps also provide projections to

[7] This is a national QA/QC scheme.
[8] As described in paragraph 7.97 of LAQM (TG22).
[9] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

future years. For 2026 (the first estimated year of occupation), the concentrations obtained for the same pollutants are 18.3 μg/m^3, 13.5 μg/m^3 and 14.1 μg/m^3 respectively.

The 2019 mapped background concentrations have been used in this assessment. To provide a worst case estimate with regards to expected improvements in air quality, the projected improvements in background air quality by 2026 have not been used in the dispersion modelling. This is in line with best practice to apply worst-case assumptions.

2.2 Model input data

Hourly meteorological data from London City has been used in the model. The wind-rose diagram (**Figure 2**) presents this below.

Figure 2: Wind-rose diagram for London City meteorological data, 2019

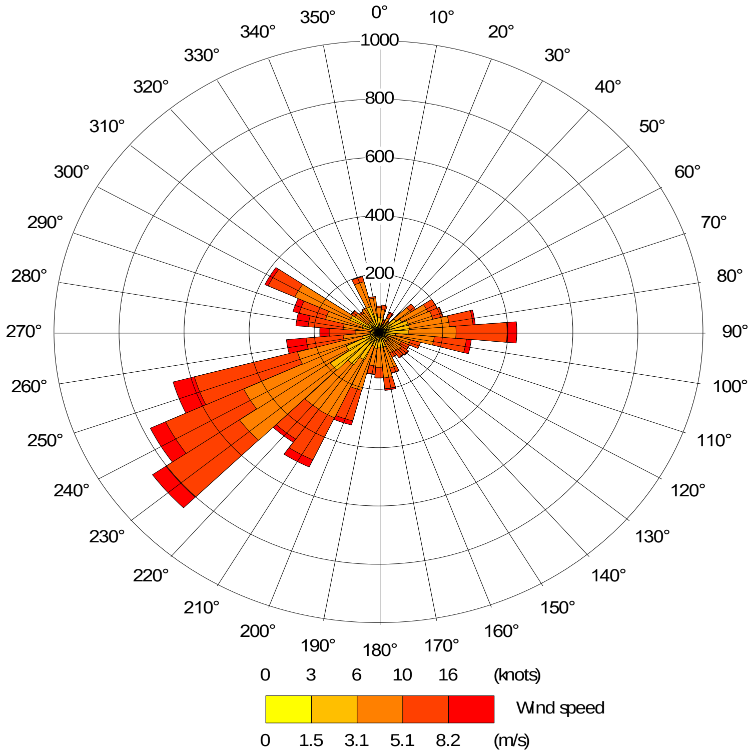
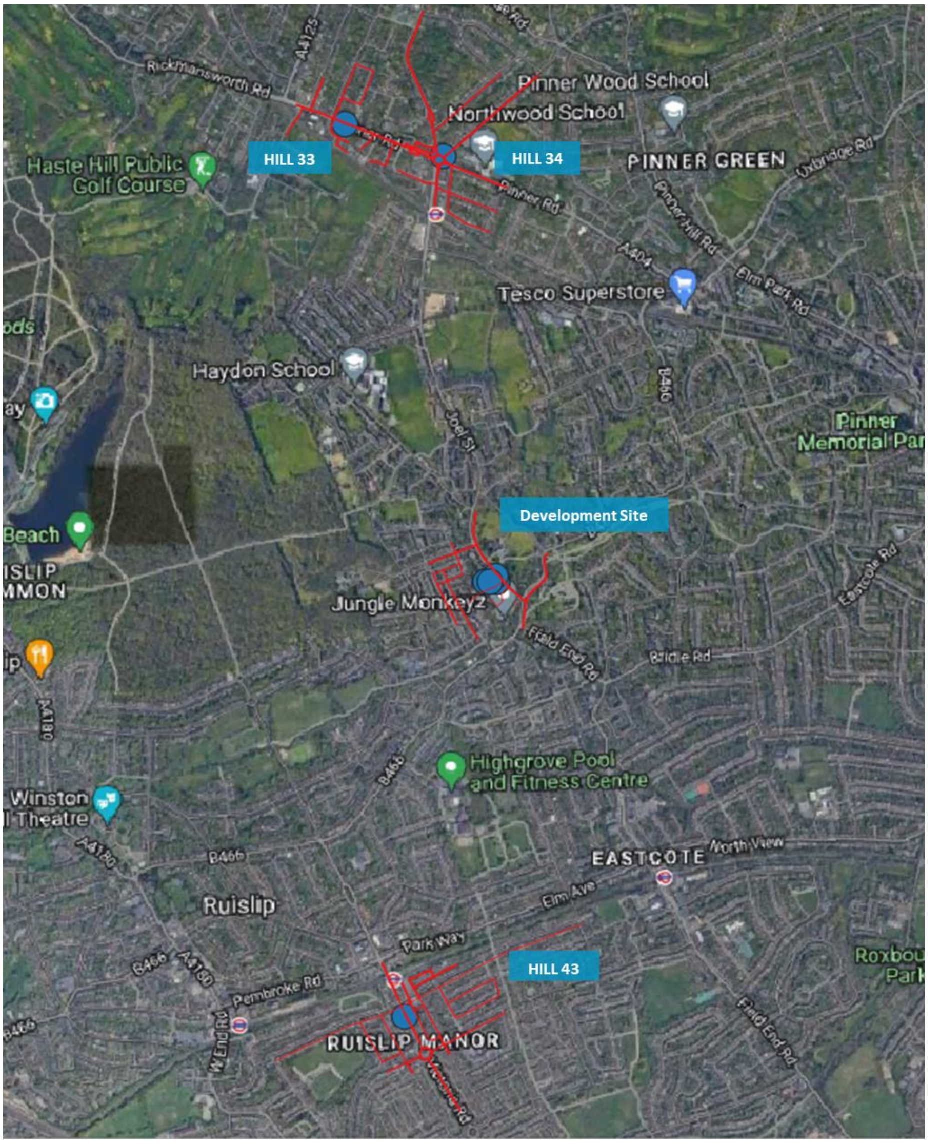


Figure 3: Road sources and receptors



Contains Google maps copyright and database rights [2022]

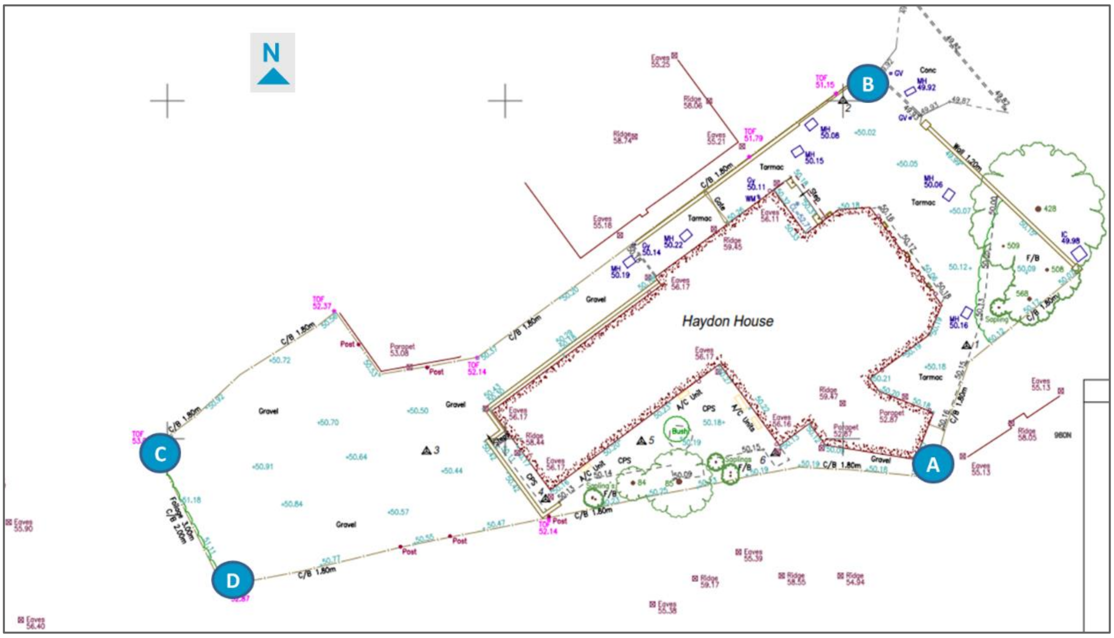
ArcMap software has been used to model the road source locations (red lines) that are within 200 metres of the receptor locations (blue circles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in terms of the length of roads and distances between sources and receptors. This is shown in **Figure 3** above. It is assumed that the contribution of other sources to NO_2 and PM_{10} is included in the background concentrations.

Four sensitive receptor locations have been selected for the assessment:

- A: Southeast corner of the development, located closest to Deerings Drive
- B: North corner of the development, located closest to Joel Street
- C: West corner of the development, representing the drop off in pollutant concentrations with distance from the road.
- D: Southwest corner of the development

These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architect's plans (**Figure 4**) show the development site in more detail with receptor locations highlighted (blue circles). An assessment is made for the receptors at varying heights (ground and second floor) to assess likely concentrations across floor levels. It has been assumed that background concentrations remain constant at all heights of the development based on the 2017 City Air Quality at Height report[10]. Exposure has been assumed to be represented at the mid-point of each floor.

Figure 4: The location of the receptors used in the modelling



2.3 Traffic data

Average annual daily traffic (AADT) count data for major roads in 2019 (the selected baseline year) has been obtained from the 2019 LAEI[11], which provides AADT, percentage HDV and speed data for major roads in London. In the absence of any other data being available for the minor roads, estimates are based upon average values for an 'urban minor road, London' from the DfT National Road Traffic Survey, 2019. All roads within 200 metres of the modelled receptors have been included in the assessment.

For the purpose of this assessment, the Trip End Model Presentation Program (TEMPro)[12] has been used to project traffic flows. It has been assumed that traffic on local roads will increase by 6 % between 2019 and 2026.

The Transport Assessment[13] concludes that the number of daily vehicular trips associated with the site will increase by a maximum of 17 as a result of the development. The resulting estimated increase in daily car trips has been taken into account in the assessment for roads with direct access to the site with development in

[10] http://www.wsp-pb.com/PageFilesn/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf
[11] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019
[12] https://www.gov.uk/government/publications/tempro-downloads
[13] Transport note produced by RGP

2026. Results (Section 3 of this report) therefore refer to concentrations modelled in 2026 both without and with the proposed development. However, it is worth noting that such a small increase in traffic is not expected to have a discernible impact on local air quality as it is below the IAQM threshold for requiring modelling[14]. Therefore, no receptors outside of the development site have been modelled.

An average speed of 26.7 kph has been assumed on all minor roads, which is the average traffic speed for Outer London during PM peak hours.[15] This provides a worst-case scenario, as it is the slowest time period reported, resulting in highest exhaust emissions.

2.4 Conversion of NO_X to NO_2

Evidence shows that the proportion of primary NO_2 in vehicle exhaust has increased[16]. This means that the relationship between NO_X and NO_2 at the roadside has changed from that currently used in the ADMS model. A NO_X to NO_2 calculator (Published in August 2020)[17] has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO_2 concentrations.

2.5 Model Verification

Model verification refers to checks that are carried out on model performance at a local level. This involves the comparison of predicted versus measured concentrations. Where there is a disparity, the first step is to check the input data and the model parameters in order to minimise the errors. If required, the second step will be to determine an appropriate adjustment factor that can be applied.

In the case of NO_2, the model should be verified for NO_X as the initial step and should be carried out separately for the background contribution and the source (i.e. road traffic). Once the NO_X has been verified and adjusted as necessary, a final check should be made against the measured NO_2 concentration.

For this project, modelled annual mean road-NO_X estimates have been verified against the concentrations measured at the HILL 43, HILL 33 and HILL 34 diffusion tube sites (see **Appendix A**). These diffusion tube sites were chosen as they are the monitoring sites located closest to the development site. However, it is worth noting that none of these sites lie in close proximity to the development site and therefore there will be uncertainty in the modelled results.

The adjustment factor determined for annual mean NO_X concentrations was also applied to the modelled annual mean PM_{10} concentrations. This was done as no PM_{10} monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment[18].

[14] Table 6.2 of IAQM / EPUK Land Use Planning and Development Control: Planning for Air Quality. January 2017
[15] Travel in London Report 10: http://www.tfl.gov.uk/corporate/publications-and-reports/travel-in-london-reports
[16] http://uk-air.defra.gov.uk/assets/documents/reports/aqeg/primary-no-trends.pdf
[17] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc
[18] Paragraph 7.572 of LAQM TG(22).

In addition, the adjusted results have been compared against the 2019 concentrations estimated in the London Atmospheric Emission Inventory (LAEI)[19]. The LAEI predicts annual mean NO_2 and PM_{10} concentration at a 20 m grid resolution. The highest concentrations estimated across the development site for NO_2 and PM_{10} in 2019 were 24.2 and 15.2 µg/m^3, respectively. These values are comparable to the predicted concentrations in 2019 (see **Table 4**), giving confidence to the results.

3 Results

3.1 Results of the Dispersion Modelling

Table 5 below provides the estimated pollutant concentrations in the base year (2019) and the development year (2026) without and with[20] the development. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2019 levels in the development year scenarios to provide a worst-case estimate with regards to expected improvements to air quality. This is in line with best practice to apply worst-case assumptions. Traffic growth has been predicted using the RTF calculator.

[19] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019
[20] 'With' development includes the impact of the additional traffic that will be generated with the development (see Section 2).

Table 4: Estimated pollutant concentrations in 2019 and 2026, with and without the development (µg/m³)

Floor level	Receptor	Annual mean NO_2 concentration (µg /m³)			Annual mean PM_{10} concentration (µg /m³)			With development NO_2 Change	With development PM_{10} change
		2019	2026 Without Development	2026 With Development	2019	2026 Without Development	2026 With Development		
Ground floor	A	22.5	22.7	22.7	15.9	16	16.0	<0.1	<0.1
	B	24.7	25.0	25.0	16.3	16.4	16.4	<0.1	0.1
	C	20.8	20.9	20.9	15.6	15.7	15.7	<0.1	<0.1
	D	21.1	21.2	21.2	15.7	15.7	15.7	<0.1	<0.1
2nd floor	A	21.6	21.7	21.7	15.8	15.8	15.8	<0.1	<0.1
	B	21.9	22.1	22.1	15.8	15.9	15.9	<0.1	<0.1
	C	20.6	20.7	20.7	15.6	15.6	15.6	<0.1	<0.1
	D	20.8	20.9	20.9	15.7	15.7	15.7	<0.1	<0.1

Note: The changes in NO_2 and PM_{10} presented may not exactly equal the difference in the constituent parts shown due to rounding.

Nitrogen dioxide

In the future year without development scenario, the model predicts annual mean NO_2 concentrations to be below (by at least 37 %) the annual mean objective at all locations. The worst-case location is identified as receptor B (north corner of the site). This is unsurprising given that receptor B lies next to Joel Street, where roadside concentrations will be maximised.

The estimated annual mean NO_2 concentrations at the development site are reasonable when compared to the data collected at the HILL 34 monitoring site. HILL 34 monitoring site lies on a busy A road with considerably more traffic than Joel Street and therefore concentrations are expected to be much higher at this location.

The Guidance states that authorities may assume exceedances of the hourly mean objective are only likely to occur where annual mean concentrations are 60 $\mu g/m^3$ or above. Therefore, it is considered highly unlikely that this objective will be exceeded at any of the receptors.

The model has also been run for a with development future year scenario taking into account predicted increases to traffic levels due to the development. The results indicate that annual mean NO_2 concentrations would increase by less than 0.1 $\mu g/m^3$ at all locations modelled.

Particulate matter

The model estimates no exceedance against the annual mean PM_{10} objective. Potential exceedances of the daily mean PM_{10} objective can be estimated based on the annual mean[21], such that:

$$No.24 - hour\ mean\ exceedances = -18.5 + 0.00145 \times Annual\ Mean^3 + \left(\frac{206}{Annual\ Mean}\right)$$

On this basis, it is estimated that in 2026 there will be no exceedances of the daily mean PM_{10} limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM_{10} objective would be met.

For estimating $PM_{2.5}$ concentrations, where no appropriate sites measuring both PM_{10} and $PM_{2.5}$ are available, then a nationally derived correction ratio of 0.7 can be used[22]. If this factor is used, then all locations in the modelling meet the EU Directive annual mean $PM_{2.5}$ limit value of 20 $\mu g/m^3$.

3.2 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation.

However, it is widely acknowledged that there is no safe level of exposure to air pollution[23], and as such, the developer is encouraged to consider mitigation measures

[21] Paragraph 7.100 of LAQM TG(22).
[22] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/estimating-pm2-5-from-pm10-measurements/
[23] https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

to reduce emissions arising from the site. The National Planning Policy Framework[24], updated July 2021, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that "*Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making*" (paragraph 105).

The NPPF also states that "*Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*" (paragraph 186).

In addition, the following relevant requirements for improving air quality are outlined (paragraph 112-113):

- Give priority first to pedestrian and cycle movements, both within the scheme and with neighbouring areas; and second – so far as possible – to facilitating access to high quality public transport, with layouts that maximise the catchment area for bus or other public transport services, and appropriate facilities that encourage public transport use
- Be designed to enable charging of plug-in and other ultra-low emission vehicles in safe, accessible and convenient locations
- All developments that will generate significant amounts of movement should be required to provide a travel plan, and the application should be supported by a transport statement or transport assessment so that the likely impacts of the proposal can be assessed.

Building on the NPPF, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice[25] which should be applied to all major development[26]. Examples of good practice include:

- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made.

[24] https://www.gov.uk/government/publications/national-planning-policy-framework--2 Published in July 2018
[25] http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[26] Major developments can be defined as developments where:
(1) The number of dwellings is 10 or above, (2) The residential development is carried out on a site of more than 0.5ha where the number of dwellings is unknown, (3) The provision of more than 1000 m^2 commercial floor space, (4) Development carried out on land of 1ha or more, (5) Developments which introduce new exposure into an area of existing poor air quality (e.g. an AQMA) should also be considered in this context.

- Where the development generates significant additional traffic, a detailed travel plan should be implemented.
- All gas-fired boilers to meet a minimum standard of < 40 mg NO_X/kWh
- All gas-fired CHP plant to meet a minimum emissions standard of:
  - Spark ignition engine: 250 mg NO_X/Nm^3
  - Compression ignition engine: 400 mg NO_X/Nm^3
  - Gas turbine: 50 mg NO_X/Nm^3
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:
  - Solid biomass boiler: 275 mg NO_X/Nm^3 and 25 mg PM/Nm^3

Other additional or alternative mitigation measures include supporting measures in the Local Authority's air quality action plan.

3.3 Mitigating the Impacts of the Construction Phase

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. The Institute of Air Quality Management (IAQM) has produced a document titled 'Guidance on the assessment of dust from demolition and construction'[27] published in May 2015. This guidance contains a methodology for determining the significance of construction developments on local air quality using a simple four step process:

- STEP 1: Screen the requirement for a more detailed assessment
- STEP 2: Assess the risk of dust impacts
- STEP 3: Determine any required site-specific mitigation
- STEP 4: Define post mitigation effects and their significance.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience adverse effects for airborne dust or dust soiling, or exposure to PM_{10}, over a time period relevant to the air quality objectives (see **Table 1**). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Following assessment of the impacts of dust as a result of the development, a qualitative risk impact level can be assigned, ranging from 'negligible' to 'high risk'. Based on the designated risk impact level, the mitigation measures which are appropriate for all sites and are applicable specifically to demolition, earthworks, construction and track out can be determined. Examples of the general measures include:

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- Ensure all vehicles switch off engines when stationary – no idling vehicles

[27] http://iaqm.co.uk/guidance/

- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable
- Ensure all loads entering and leaving the site are covered
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation

The use of the outlined IAQM methodology for assessing the impacts of dust from demolition/construction is considered to be current best practice. Therefore, it is recommended that the developer refers to the relevant IAQM documentation, to help reduce the impact of dust and vehicle exhaust emissions, and liaises with the Local Authority to come up with an acceptable dust management strategy.

In addition to the IAQM guidance referred to above, the Mayor of London has introduced standards to reduce emissions of pollutants from construction and demolition activity and associated equipment. In July 2014 the Mayor adopted the Control of Dust and Emissions from Construction and Demolition Supplementary Planning Guidance following extensive consultation. The SPG includes the world's first non-Road Mobile Machinery Low Emission Zone (NRMM LEZ) combining standards to address both nitrogen oxide (NO_X) and particulate matter (PM) emissions[28].

From 1st September 2015, construction equipment used on the site of any major development within Greater London has been required to meet the EU Stage IIIA as a minimum; and construction equipment used on any site within the Central Activity Zone or Canary Wharf has been required to meet the EU Stage IIIB standard as a minimum. Some exemptions are provided where pieces of equipment are not available at the emission standard stipulated or in the volumes required to meet demand in a construction environment as dynamic as London. From September 2020, the requirements became more stringent. Construction equipment used on major development sites within the Central Activity Zone, Canary Warf and Opportunity Areas must meet EU Stage IV standards and EU Stage IIIB across the rest of London. As Stages IIB and IV have not been defined for machines with constant speed engines, e.g. generators, these machines needed to meet stage V from September 2020 by default.

3.4 Air Quality Neutral Assessment

Policy SI1 Part B(2)(a) and Part E of the London Plan 2021 requires development proposals within Greater London to be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas). A method for assessing this is outlined in the Draft London Plan Guidance for Air Quality Neutral[29] November 2021.

The guidance provides two sets of benchmarks which cover the two main sources of air pollution from new developments:

- Building Emissions Benchmark (BEB) – emissions from equipment used to supply heat and energy to the buildings
- Transport Emissions Benchmark (TEB) – emissions from private vehicles travelling to and from the development.

[28] https://nrmm.london/

[29] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/london-plan-guidance/air-quality-neutral-aqn-guidance

A development must meet both benchmarks separately to be Air Quality Neutral. If one or both benchmarks are not met, appropriate mitigation or offsetting will be required.

3.4.1 Building emission benchmarks

Air source heat pumps will be installed at the development. Therefore, there are no on-site combustion sources and hence there are zero heat related NOx emissions, and no further assessment is required. **The site therefore meets the building emission benchmark.**

3.4.2 Transport emissions benchmark

The TEB is provided in terms of the number of trips per metre squared of floorspace (GIA) over a year (trips/m^2/year) for non-residential use, or the anticipated number of trips per dwelling (trips/dwelling/year) for residential use. The TEB only estimates car or light van trips generated by the development's occupiers. The TEB does not include trips generated by deliveries and servicing, taxis or heavy vehicle movements from non-occupiers.

Table 5: Transport Emission Benchmarks trip rates by Land Use Category and London Zone

Land use class	Annual trips per	London Zone		
		CAZ*	Inner	Outer
Residential (including student accommodation and large-scale purpose-built shared living development)	Dwelling	68	114	447
Office/Light Industrial	m^2 (GIA)	2	1	16
Retail (Superstore)		39	73	216
Retail (Convenience)		18	139	274
Restaurant/Café		64	137	170
Drinking establishments		0.8	8	N/A
Hot food takeaway		N/A	32.4	590
Industrial		N/A	3.9	16.3
Storage and distribution		N/A	1.4	5.8
Hotels		1	1.4	6.9
Care homes and hospitals		N/A	1.1	19.5
Schools, nurseries, doctors' surgeries, other non-residential institutions		0.1	30.3	44.4
Assembly and leisure		3.6	10.5	47.2

**Central Activity Zone: Central area of Greater London containing a unique cluster of vital economic activities*

The annual values per dwelling for outer London have been applied to the development.

As outlined in the Transport Technical Note[30] produced for the site, the development is likely to produce a total of 34 vehicle trips per day. The predicted trip rate for the development has been compared against that allowable in the TEB for Outer London and 'Residential' and the results are shown in **Table 6** below.

[30] Note produced by RGP.

Table 6: Transport Emission Benchmark calculation

Land use class	TEB (trips/dwelling/yr)	Development Trip rate (trips/dwelling/yr)	Difference
Residential	442	886	**-439**

The results show that the **development does not meet the Transport Emissions Benchmark and therefore further action is required**

4 Summary and Conclusions

An air quality assessment has been undertaken for a proposed residential development at Haydon House. The London Borough of Hillingdon has declared an Air Quality Management Area (AQMA) due to exceedances of the annual mean nitrogen dioxide (NO_2) objective. The proposed development lies outside this AQMA. The development is expected to generate an additional 17 vehicle journeys a day and this has been taken into account in the modelling.

A conservative approach with regards to expected improvements to air quality has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2019) and the first year of occupation (2026). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise. This is in line with best practice to apply worst-case assumptions.

The ADMS-Roads dispersion model has been used to determine the impact of emissions from road traffic on sensitive receptors. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean nitrogen dioxide (NO_2) and particulate matter (PM_{10}) concentrations are below the objective in both the 'without' and 'with' development scenario. Based on the evidence it is also estimated that there will be no exceedances of either short term objective for NO_2 or PM_{10}. Therefore, no mitigation is required as the air quality objectives are predicted to be met.

However, it is recommended that measures such as providing secure and covered cycle storage, car share schemes, and installing electric charging points, should be considered to reduce the emissions arising from the development. In addition, the developer is encouraged to refer to the IAQM's 'Guidance on the assessment of dust from demolition and construction' in order to minimise the impact of the construction/demolition phase on local air quality.

The proposed development has been assessed and found to be compliant with London's 'air quality neutral' guidance for buildings. However, the development does not meet the transport emissions benchmark and therefore further action is required. In the first instance, it is recommended that re-assessment of the trip generation is undertaken to provide a trip rate estimate that considers people using active travel and public transport to visit the site and the impact of the Travel Plan. If the development is still not able to meet the transport benchmark, the next step would be to seek agreement with Hillingdon Council on the way forward.

Appendix A – Model Verification

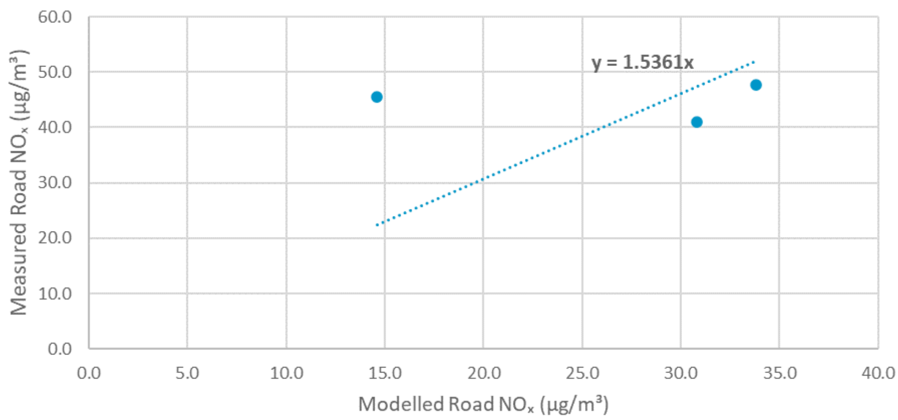
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_X concentration during 2019 at the diffusion tube sites described in **Table 2**.

The model output of road-NO_X has been compared with the 'measured' road-NO_X. Measured NO_X for the monitoring sites was calculated using the NO_X to NO_2 calculator[17].

A primary adjustment factor was determined to convert between the 'measured' road contribution and the model derived road contribution (**Figure A.1**). This factor was then applied to the modelled road-NO_X concentration for each receptor to provide adjusted modelled road-NO_X concentrations. Total NO_2 concentrations were then determined by combining the adjusted modelled road-NO_X concentrations with the 2019 background NO_2 concentration.

The results imply that the model was under-predicting the road-NO_X contribution. This is a common experience with ADMS and most other models.

Figure A.1: Comparison of Measured road-NO_X to unadjusted modelled road-NO_X concentrations



RMSE

The root mean square error (RMSE) is used to define the average error or uncertainty of the model. The following RMSE value has been calculated:

NO_2: 8.66

If the RMSE values are higher than ±25 % of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. In this case the model is being assessed against the annual mean objective, which is 40 µg/m^3 for NO_2. An RMSE value of less than 10 µg/m^3 is obtained and therefore the model behaviour is acceptable.

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