

Air Quality Assessment for the proposed development at Bellmore Allotments, Hillingdon, UB4 0EJ



Report to Baily Garner Ltd
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Aether 

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1. Introduction

Aether has been commissioned by Baily Garner to undertake an air quality assessment for the proposed residential development at Bellmore Allotments, Burns Close, Hillingdon, UB4 0EJ. The development will comprise of 111 dwellings split across five blocks, and 127 car parking spaces will be provided. The original report was produced in February 2017. An update was completed in November 2018 to include the revised site plans, the input data was not modified.

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 (PM₁₀) or nitrogen dioxide (NO₂) 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.

The expected completion date of the proposed development is 2020. The assessment has therefore been completed for 2021, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located on Burns Close, Hillingdon, UB4 0EJ ([Figure 1](#)).

Figure 1: Location of the development site



Source: OpenStreetMap® 2017

1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Bellmore Allotments development, as set out in the UK Air Quality Strategy¹, is presented in Table 1 below.

Table 1: UK Air Quality Objectives for NO₂ and PM₁₀

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 (99.8 th 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 (90.4 th percentile)

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ 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. NO₂ can also form in the atmosphere due to a chemical reaction between NO and ozone (O₃). Health based standards for NO_x generally relate to NO₂, 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 PM₁₀.

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 Pollutants².

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; and
- 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

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

² <https://www.gov.uk/government/collections/comeap-reports>

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 developments. 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 AQMA³ in 2003 which 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. This is due to exceedances of the annual mean nitrogen dioxide (NO₂) objective. The proposed development site falls within the AQMA. The latest AQAP was published in 2017, which includes information on ongoing or completed air quality measures such as school travel plans, improvements to transport infrastructure and electric vehicle trials.

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.

The most recent version of ADMS-Roads (v4.1) was issued in February 2017 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;

³ https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=342

- Meteorology: hourly meteorological data;
- Background: Background concentration data;
- Grids: Type and size of grid for output; and
- 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.

Local monitoring data

London Borough of Hillingdon has ten automatic monitoring sites which monitor nitrogen dioxide (NO₂); particulate matter (PM₁₀) is also monitored at nine of these sites. Unfortunately, none of these monitoring sites are located within close proximity to the development site. NO₂ concentrations are also measured passively at diffusion tube sites across the Borough. Seven of these diffusion tube sites lie within 2.5 km to the development site. Details of the monitoring sites near to the development site are given in Table 2.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)⁴.

Table 2: Monitoring sites within 2.5 km of the Bellmore Allotments development

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
HD208	B	NO ₂	510761, 180766	180	1,370
HD49	R	NO ₂	508651, 182274	7	1,470
HD209	B	NO ₂	511828, 182023	79	1,740
HD302	R	NO ₂	509755, 179934	12	2,050
HD202	B	NO ₂	510361, 179820	14	2,150
HD402	R	NO ₂	509328, 179603	2	2,470
HD203	R	NO ₂	509683, 179486	2	2,500

Note: R = roadside, B = background.

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme. 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

⁴ At the time of completing this report, the 2017 ASR was not publicly available. Other Hillingdon air quality reports can be found at: <https://www.hillingdon-air.info/laqm.php>

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 (1.03) to their 2016 diffusion tube results.

Monitoring results are presented in Table 3. The data shows the annual mean NO₂ objective was exceeded for the last three years at monitoring site HD203. No exceedances occurred at any of the other diffusion tube sites in recent years. Diffusion tubes do not provide information on hourly exceedances, but research⁵ 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/m³. Therefore, exceedances of the 1 hour mean objective are not expected at any of the diffusion tube sites.

Table 3: Monitoring results for sites within 2.5 km the proposed development site, 2014-2016

Objective	Site Name	2014	2015	2016
Annual mean NO ₂ (µg/m ³)	HD208	30.5	27.3	28.9
	HD49	26.5	22.1	20.9
	HD209	33.7	30.5	30.9
	HD302	38.9	30.7	30.8
	HD202	35.5	26.7	26.1
	HD402	NA	32.1	32.3
	HD203	46.8	41.9	40.9

Note: Values exceeding the 40 µg/m³ annual mean objective are shown in bold, NA – data unavailable.

Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁶ and data has been extracted for the London Borough of Hillingdon for this assessment. These 2015 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 estimated mapped background NO_x, NO₂ and PM₁₀ concentrations around the development site are 36.6 µg/m³, 24.3 µg/m³ and 16 µg/m³ respectively in 2016 (the baseline year used in the assessment). The background maps also provide projections to future years. For 2021 (the first estimated year of occupation), the concentrations obtained for the same pollutants are 29.2 µg/m³, 20.1 µg/m³ and 15.4 µg/m³ respectively.

⁵ As described in Box 5.2 of LAQM Technical Guidance (TG16).

⁶ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

The closest monitoring site to the development, HD208, is a background monitoring site. The NO₂ concentrations measured at this site are higher than those predicted by the concentration maps. Therefore, this site provides a more conservative estimate of NO₂ concentrations and has been used in this assessment. To provide a conservative estimate, the projected improvements in background air quality by 2021 have not been used in the dispersion modelling.

2.2 Traffic data

In the absence of any other data being available for the surrounding minor roads, average annual daily traffic (AADT) estimates for 2016 (the selected baseline year) are based upon average values for an 'urban minor road, London' from the DfT National Road Traffic Survey, 2016⁷. Therefore, there will be uncertainty in the model input. All roads within 200 metres of the modelled receptors have been included in the assessment. The values are shown in Appendix B.

For the purpose of this assessment, the RTF⁸ model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 6.9 % between 2016 and 2021.

The proposed development includes 127 additional car parking spaces. The traffic assessment has determined that the development will result in 333 additional car journeys per day⁹. 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 2021. Results (**Section 3** of this report) therefore refer to concentrations modelled in 2021 both without and with the proposed development.

An average speed of 27 kph has been assumed on all surrounding roads, which is the average traffic speed for Outer London during PM peak hours¹⁰. This provides a worst-case scenario, as it is the slowest time period reported, resulting in highest exhaust emissions.

Queuing Traffic

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60¹¹ has been used for estimating emissions from queuing traffic. This defines a representative AADT for queuing traffic to be 30,000 at 5 kph, assuming an average vehicle length of 4m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)¹² to calculate emission rates. The emission rates were then used within the dispersion model as separate road sources of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods.

⁷ <http://www.dft.gov.uk/statistics/series/traffic/>

⁸ <http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls>

⁹ Email correspondence with Bronellia Cornwall on 26/01/18

¹⁰ Travel in London Report 9: <http://www.tfl.gov.uk/corporate/publications-and-reports/travel-in-london-reports>

¹¹ Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004

¹² Latest version 8.0, <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

2.3 Model input data

Hourly meteorological data from Heathrow for 2016 has been used in the model. The wind-rose diagram (Figure 2) presents this below.

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2016

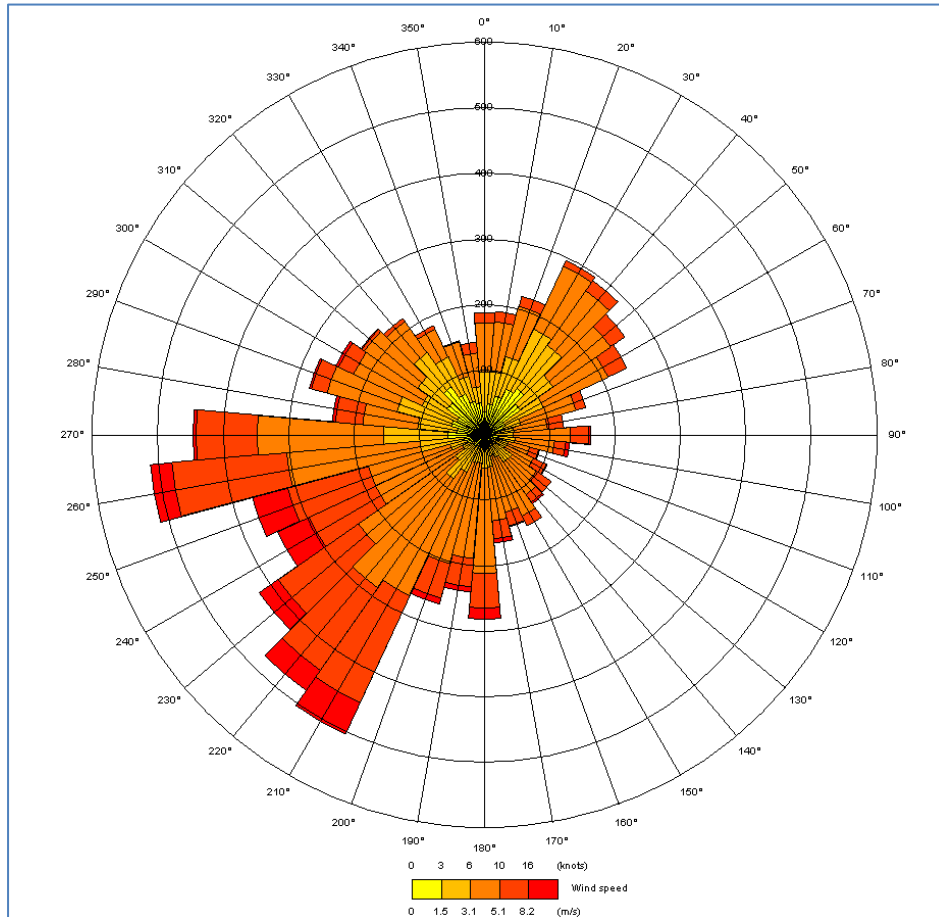
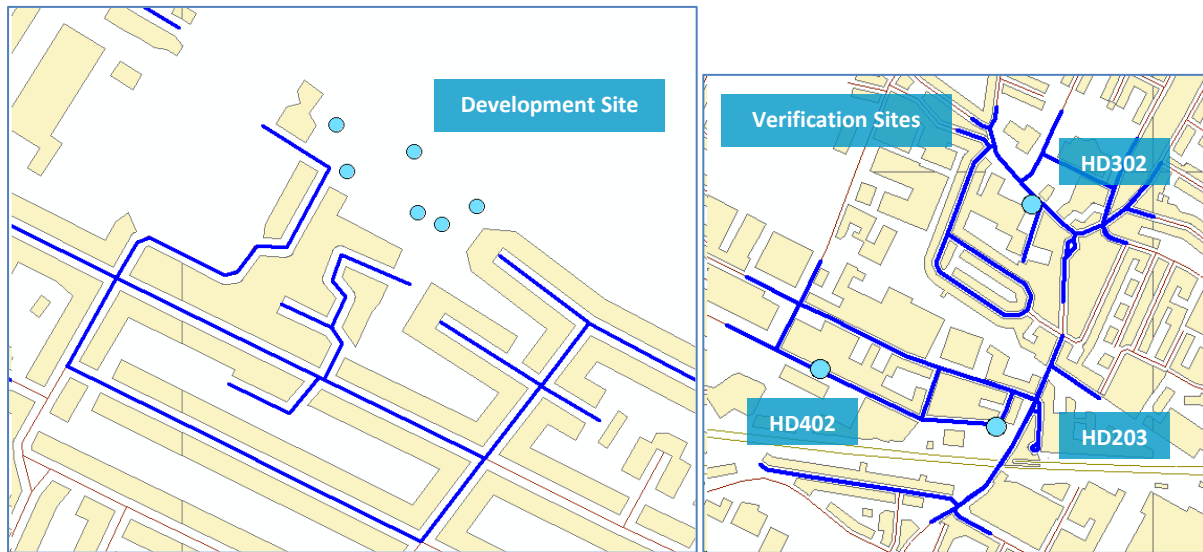


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2017]

ArcMap software has been used to model the road source locations (blue 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 NO₂ and PM₁₀ is included in the background concentrations.

Six sensitive receptor locations have been selected for the assessment:

- A. West corner of block E, located closest to Burns Close.
- B. East corner of block E, located close to the Melrose Close entrance.
- C. South facing façade of block D, located close to the Melrose Close entrance.
- D. East facing façade of blocks C and D, located closest to Marvell Avenue.
- E. South facing façade of block E, representing the drop off in pollutant concentrations.
- F. South facing façade of block A, located close to the Burns close entrance.

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 to assess likely concentrations across floor levels. 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



2.4 Conversion of NO_x to NO₂

Recent evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹³. This means that the relationship between NO_x and NO₂ at the roadside has changed from that currently used in the ADMS model. A NO_x to NO₂ calculator (Published in October 2017)¹⁴ has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO₂ 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 NO₂, 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

¹³ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁴ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

verified and adjusted as necessary, a final check should be made against the measured NO₂ concentration.

For this project, the nearest roadside monitoring site, HD49, has recorded anomalously low NO₂ concentrations, such that they are below both mapped and monitored background concentrations. As such, results from this monitoring site cannot be used to verify concentrations at the development site. Therefore, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at the three next closest diffusion tube sites, HD302, HD402 and HD203 (see Appendix A). 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 PM₁₀ concentrations. This was done as no PM₁₀ monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment¹⁵.

¹⁵ This is in accordance with Paragraph 7.528 of LAQM TG (16), which states that in the absence of any PM₁₀ data for verification, it may be appropriate to apply the road NO_x adjustment to the modelled road PM₁₀.

3. Results

3.1 Results of the Dispersion Modelling

Table 4 provides the estimated pollutant concentrations in the development year (2021) without and with development. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2016 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

Table 4: Estimated pollutant concentrations in 2021 ($\mu\text{g}/\text{m}^3$)

Receptor	Floor level	Annual mean NO ₂ concentration ($\mu\text{g}/\text{m}^3$)		Annual mean PM ₁₀ concentration ($\mu\text{g}/\text{m}^3$)		NO ₂ Change	PM ₁₀ Change
		Without development	With development	Without development	With development		
A	0	30.6	30.9	16.3	16.3	0.2	<0.1
	1	30.0	30.2	16.2	16.2	0.2	<0.1
	2	29.6	29.7	16.1	16.1	<0.1	<0.1
B	0	29.8	29.9	16.2	16.2	0.1	<0.1
	1	29.7	29.8	16.1	16.2	0.1	<0.1
	2	29.6	29.7	16.1	16.1	<0.1	<0.1
C	0	29.7	29.8	16.1	16.2	0.1	<0.1
	1	29.7	29.8	16.1	16.2	0.1	<0.1
	2	29.5	29.6	16.1	16.1	<0.1	<0.1
D	0	29.6	29.6	16.1	16.1	<0.1	<0.1
	1	29.5	29.6	16.1	16.1	<0.1	<0.1
	2	29.4	29.5	16.1	16.1	<0.1	<0.1
E	0	29.5	29.6	16.1	16.1	<0.1	<0.1
	1	29.5	29.6	16.1	16.1	<0.1	<0.1
	2	29.4	29.5	16.1	16.1	<0.1	<0.1
F	0	29.8	30.0	16.2	16.2	0.1	<0.1
	1	29.7	29.8	16.1	16.2	<0.1	<0.1
	2	29.5	29.5	16.1	16.1	<0.1	<0.1

In the without development scenario, the model predicts annual mean NO₂ concentrations to be below (by at least 23 %) the annual mean objective at all locations. The worst-case location is identified as receptor A at ground floor level. This receptor is located closest to Burns Close and is closer than any other receptor to a road source. Hence, roadside concentrations will be maximised. It has been assumed that the background concentration at all heights of the development is the same as that at ground level.

The estimated annual mean NO₂ concentrations at the development site are reasonable when compared to the data collected at the HD302 and HD402 monitoring sites. Like the development site, these monitoring sites are surrounded by minor roads. The 2016 measured concentrations at these

sites is very similar to the modelled concentrations at the development site in 2021 (see [Tables 3 and 4](#)). Higher concentrations were recorded at the HD203 monitoring site than those modelled for the development site. This is likely due to the proximity of this site to the bus route on Station Road. HD203 is located close to a bus stop on this road, idling and the acceleration of buses along this road would increase NO₂ concentrations.

The Guidance states that authorities may assume exceedances of the hourly mean objective are only likely to occur where annual mean concentrations are 60 µg/m³ 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 scenario taking into account predict increases to traffic levels on local roads. The results indicate that annual mean NO₂ concentrations would increase by a maximum of 0.2 µg/m³.

The model estimates no exceedance against the annual mean PM₁₀ objective. Potential exceedances of the daily mean PM₁₀ objective can be estimated based on the annual mean¹⁶, such that:

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

On this basis, it is estimated that in 2021 there will be no exceedances of the daily mean PM₁₀ limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM₁₀ objective would be met as 35 exceedances of limit value are allowed per year.

3.2 Significance

Professional judgement is an important part of the assessment of significance. However, there are various documents available that attempt to qualitatively or quantitatively provide ways of assessing the significance of a development on air quality. The most commonly applied is Environmental Protection UK's Air Quality Guidance Document¹⁷ which outlines how impacts may be assessed quantitatively. The assessment is made up of two steps – firstly to assess the magnitude of change in concentration (e.g. between with and without development) relative to the objective level, and secondly the percentage above / below the objective based upon the total modelled concentration at a given location or receptor. By combining these two values, you can obtain the impact descriptor. This method is presented in [Table 5](#) below.

¹⁶ Paragraph 7.92 of LAQM TG(16)

¹⁷ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

Table 5: Significance of change description

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

In addition to the criteria provided above, the Guidance document states that the table is intended to be used by rounding the change in percentage pollutant concentrations to whole numbers. Changes of 0 % i.e. less than 0.5 % are described as negligible.

In applying these criteria, it can be concluded that there is likely to be negligible impact on local annual mean NO₂ concentrations as the maximum change in concentration due to the development is 0.5 %.

3.3 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation as the pollutant concentrations are estimated to meet all of the air quality objective levels.

However, it is widely acknowledged that there is no safe level of exposure to air pollution¹⁸, and as such, the developer is further encouraged to consider further mitigation measures in order to reduce the emissions arising from the site. In order to minimise potential cumulative effects from major developments¹⁹, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice²⁰ which should be applied to all major development. Examples of good practice include:

- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made.
- 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

In addition, to minimise the use of private vehicles by residents, the developer is encouraged to install secure and covered cycle storage.

¹⁸ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

¹⁹ Major developments can be defined as developments where the number of dwellings is 10 or above

²⁰ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

3.4 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 IAQM has produced a document titled 'Guidance on the assessment of dust from demolition and construction'²¹ 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 PM₁₀, 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 trackout 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
- 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 August 2014 the Mayor adopted the Control of Dust and Emissions from Construction

²¹ <http://iaqm.co.uk/guidance/>

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) emissions²².

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 become more stringent.

Air Quality Neutral Assessment

London Plan Policy 7.14 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 AQMAs). A method for assessing this is outlined in the Sustainable Design and Construction Supplementary Planning Guidance (SPG) April 2014²³. The SPG outlines building emission benchmarks for NO_x and PM₁₀ for all land use classes and these are presented in Table 6 below. This development comes under land use class C3 (residential dwellings).

Table 6: Building Emission Benchmarks by Land Use Category

Land use class	NO _x (g/m ²)	PM ₁₀ (g/m ²)
A1 (Retail)	22.60	1.29
A3-A5 (Restaurants, drinking establishments, hot food takeaway)	75.20	4.32
A2, B1 (Financial/professional services/business)	30.80	1.77
B2-B7 (General industrial)	36.60	2.95
B8 (Storage and distribution)	23.60	1.90
C1 (Hotels)	70.90	4.07
C2 (Residential institutions)	68.50	5.97
C3 (Residential dwellings)	26.20	2.28
D1 (a) (Medical and health services)	43.00	2.74
D1 (b) (Crèche, day centres etc.)	75.00	4.30
D1 (c-h) (Schools, libraries, places of worship etc.)	31.00	1.78
D2 (a-d) (Cinemas, concert halls etc.)	90.30	5.18
D2 (e) (Swimming pools, gymnasium etc.)	284.00	16.30

²² <https://nrmm.london/>

²³ <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/sustainable-design-and>

Transport emission benchmarks have so far only been derived for three land use classes, but with varying benchmarks across the London zones. These are presented in Table 7 below.

Table 7: Transport Emission Benchmarks by Land Use Category and London Zone

Pollutant and benchmark unit	Land use class	CAZ*	London zone	
			Inner	Outer
NO _x (g/m ² /annum)	Retail (A1)	169	219	249
	Office (B1)	1.27	11.4	68.5
NO _x (g/dwelling/annum)	Residential (C3)	234	558	1553
PM ₁₀ (g/m ² /annum)	Retail (A1)	29.3	39.3	42.9
	Office (B1)	0.22	2.05	11.8
PM ₁₀ (g/dwelling/annum)	Residential (C3)	40.7	100	267

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

New major developments²⁴ in London must meet these benchmarks, or implement mitigation measures to reduce emissions either on-site or off-site. Where this is not practical or desirable, some form of pollutant offsetting could be applied. One route would be to enforce the necessary “air quality neutral” measures via a Section 106 agreement.

The guidance on application of Air Quality Neutral²⁵ has been followed in this assessment. Building Emissions have been developed for the proposed building based upon:

- Gross Floor Area (m²) of development
- On-site emissions of NO_x and PM₁₀ associated with building use (kg/annum) calculated from energy use (kWh/annum) and a default emission factor (kg/kWh)

Table 8 presents the input data used for the building emissions benchmark calculation. Figures on gross internal area (GIA) were provided by the architect. Annual energy use has been estimated based upon CIBSE TM46:2008 energy benchmarks²⁶.

Table 8: Building Emissions Input Data

Land use class	Boiler fuel	GIA (m ²)	Energy Use (kWh/annum)	NO _x EF (kg/kWh)
C3 (Residential dwellings)	Gas	10,084	6,352,920	0.00004

²⁴ As outlined in the London Plan (10 or more residential dwellings (or where the number is not given, an area of more than 0.5 ha; or for all other uses, where the floor space is 1,000 m² or more, or the site area is 1 ha or more).

²⁵ <http://www.london.gov.uk/sites/default/files/GLA%20AQ%20Neutral%20Policy%20Final%20Report%20April%202014%20J1605.pdf>

²⁶ CIBSE TM46:2008 Table 1 Benchmark categories and values – values for “long term residential” applied.

It has been possible to estimate annual building NO_x emissions from the input data gathered and compare this total against the relevant Building Emissions Benchmarks (Table 9). The results indicate that the **proposed development site meets the air quality neutral requirements for buildings**. This conclusion is based on the assumption that CSH/ BREEAM Ultra-Low NO_x gas boilers (< 40mg/Kwh) are installed, and that no other energy generation is associated with the development. Gas consumption will result in negligible particulate matter emissions and therefore compliance with the building emissions benchmarks for PM₁₀ are not considered further.

In addition, the developer is directed to recent guidance manuals on reducing air pollution from boilers and buildings²⁷. These manuals outline best practice guidance with advice including:

- Maximising energy efficiency
- Guidance on heating / cooling including choice of e.g. boiler systems (and fuel)
- Maintenance and control settings

Table 94: Comparison of development building emissions to NO_x Building Emissions Benchmark

Pollutant	Land use class	BEB (g/yr)	Development (g/yr)	+/- (kg/yr)
NO _x	C3 (Residential dwellings)	264,200	254,117	-10.1

The data below (Table 10) has been used in order to derive estimated transport emissions for the development for comparison against the Transport NO_x and PM₁₀ emissions benchmarks for Outer London. As outlined previously, as a worst-case it is estimated that the development will create 333 daily car trips. For the purposes of the air quality neutral calculations, these trips are attributed across the 111 dwellings proposed within the development.

Table 10: Transport Emissions Input Data

Land use class	Trip rate (trips/ dwelling/ yr)	Av. Trip (km)*	NO _x EF (g/km)**	PM ₁₀ EF (g/km)**
C3 (Residential dwellings)	(333x365/111) = 1095	11.4	0.353	0.0606

*From London Travel Demand Survey

**London Atmospheric Emissions Inventory

Transport emissions resulting from the development have been compared to the Transport Emissions Benchmarks for Outer London and the results are shown in Table 11 below. **The proposed development does not meet the air quality neutral requirements for transport**. Therefore, the developer is advised to implement the mitigation measures outlined above, i.e. the provision of secure and covered cycle storage, EV “rapid charge” points and a detailed travel plan.

²⁷ <http://www.camden.gov.uk/ccm/content/environment/green/airquality/guidance-for-reducing-pollution-from-boilers-and-buildings.en>

Table 11: Comparison of development transport emissions to NO_x and PM₁₀ Transport Emissions Benchmark (TEB)

Pollutant	Land use class	TEB (g/yr)	Development (g/yr)	+/- (kg/yr)
NO _x	C3 (Residential dwellings)	1,553	4,406	+2.9
PM ₁₀	C3 (Residential dwellings)	267	756.5	+0.5

4. Summary and Conclusions

An air quality assessment has been undertaken for a proposed residential development at Bellmore Allotments, Burns Close, Hillingdon, UB4 0EJ. The London Borough of Hillingdon declared an AQMA in 2003 due to exceedances of the annual mean nitrogen dioxide (NO₂) objective. The proposed development lies within this AQMA.

A conservative approach has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2016) and the first year of occupation (2021). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise.

An air quality assessment has been carried out using the ADMS-Roads dispersion model 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 NO₂ concentrations are below the objective in the 'without' and 'with' development scenarios. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the 'without' and 'with' development scenarios. Based on the evidence it is also estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. Therefore, no mitigation is required as the air quality objectives are predicted to be met. Instead other measures such as providing secure and covered cycle storage, car share schemes, and installing an electric vehicle (EV) charging point, 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 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, it does not meet the air quality neutral requirements for transport. Therefore, the implementation of the mitigation measures above, i.e. cycle storage, car share schemes and EV charge points, is recommended. The assessment has been completed on the assumption that CSH/ BREEAM Ultra-Low NO_x gas boilers are installed. If the development plans regarding energy generation do not meet this requirement, re-assessment may be required.

Appendix A – Model Verification

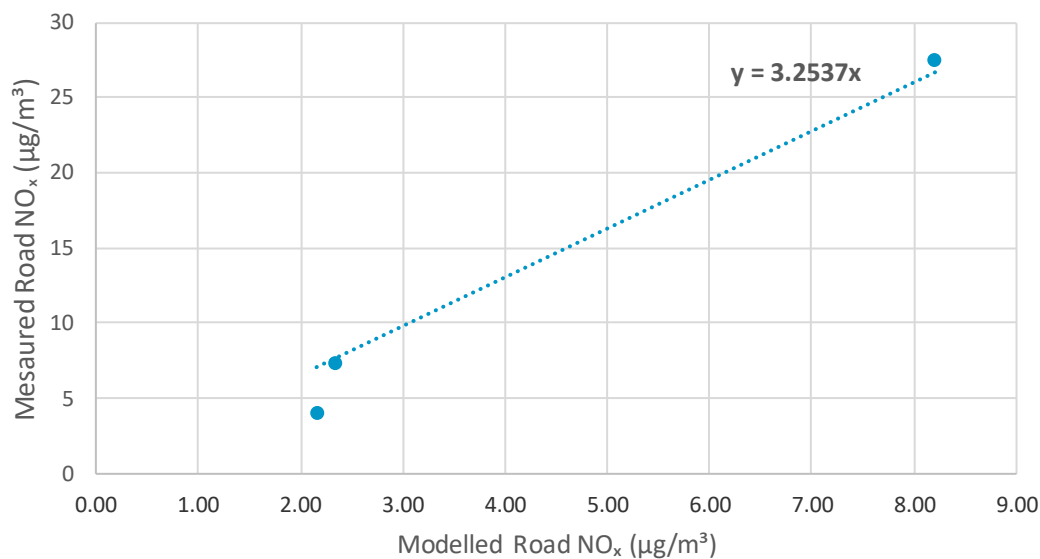
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2016 at three of the diffusion tube sites described in [Table 2](#).

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 NO₂ calculator¹⁴.

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 NO₂ concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the 2016 background NO₂ 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:

NO₂: 4.95

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 objectives, which is 40 µg/m³ for NO₂. An RMSE value of less than 10 µg/m³ is obtained and therefore the model behaviour is acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2016 (and prediction for 2021 without development)

Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Minor roads	2,200	2	27

Note: With development results in an average daily traffic increase of 333 vehicles on all roads that have direct access to the site.



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