

The background of the entire page is a photograph of a city street during the day. In the foreground, there is a line of vehicles, including a white van, a dark SUV, and another white van. The road has white lane markings and a yellow dashed line. In the background, there are trees with autumn-colored leaves and a tall building. A large white circle is overlaid on the left side of the image, containing the title and subtitle text.

**Air Quality Assessment for
the proposed development
at Mulberry House, 1a Eldon
Road, Reading, RG1 4DS**

Report to Atlas Planning Group

October 2019

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1 Introduction

Aether has been commissioned by Atlas Planning Group to undertake an air quality assessment for the proposed development at Mulberry House, 1a Eldon Road in Reading. The development will consist of 11 flats across five storeys. Ten car parking spaces will be provided with the development.

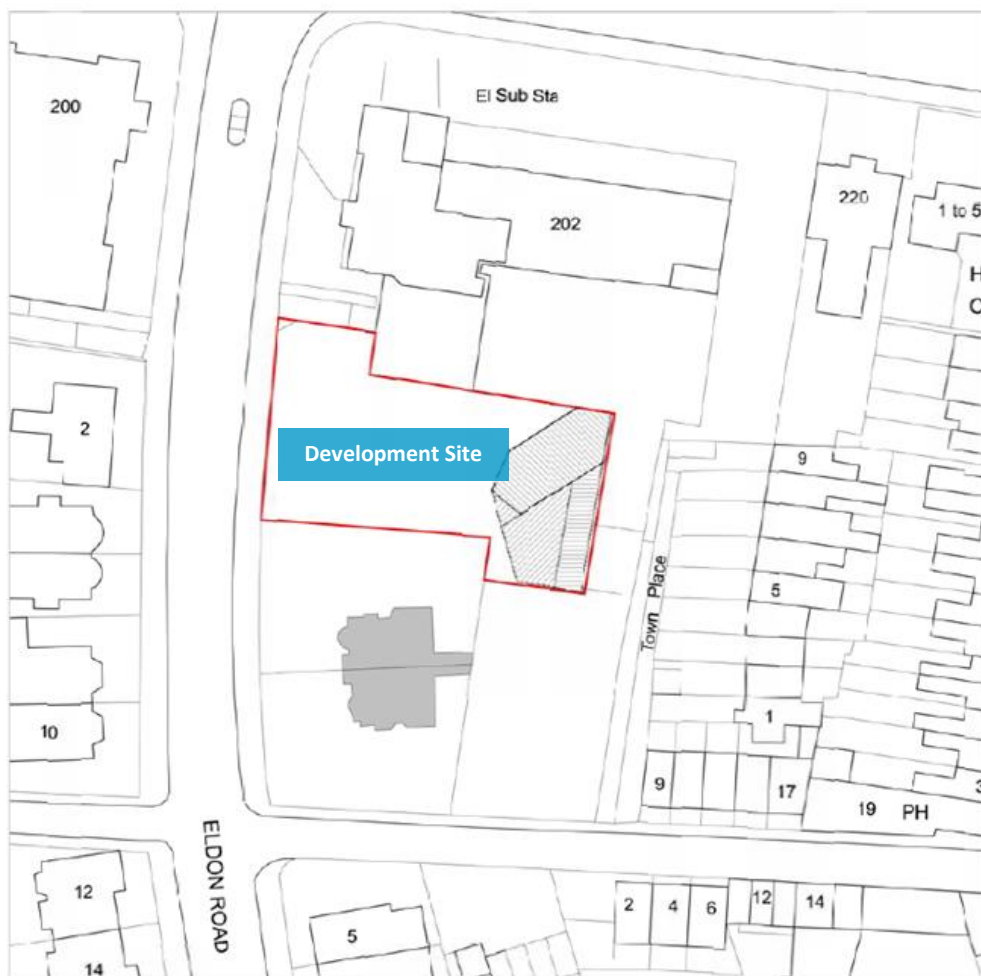
The development falls within Reading Borough Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM₁₀) or nitrogen dioxide (NO₂) 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 2021. The assessment has therefore been completed for 2022, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located on Eldon Road, Reading (**Figure 1**).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Eldon Road 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 (99.8th 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 (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
- 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

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>

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).

Reading Borough Council has declared one AQMA³ which covers Reading Town Centre, areas along the major radial road routes into Reading (including J11 of the M4) and along the railway lines where they pass through built-up areas. This AQMA was declared in 2009 due to exceedances of the annual mean NO₂ objective. An AQAP was published in 2009, with the most recent update published in 2016⁴. The Eldon Road development lies within the AQMA.

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 (v4.1.1) was issued in January 2018 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.

³ https://uk-air.defra.gov.uk/aqma/details?aqma_ref=467

⁴ http://www.reading.gov.uk/media/6389/Air-Quality-Action-Plan/pdf/AQAP_Update_2016.pdf

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

Reading Borough Council has four automatic monitoring sites which monitor NO₂ and PM₁₀. Unfortunately, none of these automatic monitoring sites lie within 500 m of the development. One of the automatic monitors makes up part of Defra's Automatic Urban and Rural Network (AURN) and is located within 1 km of the development site. NO₂ concentrations are also measured passively at diffusion tube sites across the Borough. Three of these diffusion tube sites lie within 500 m of the development site, with several additional sites lying within 1 km. Details of the nearby monitoring sites are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)⁵.

Table 2: Monitoring sites within close proximity of the Eldon Road development

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
DT05	R	NO ₂	473072, 173204	3	580
DT09	R	NO ₂	472716, 173218	10	230
DT01	R	NO ₂	472015, 173223	5.5	470
DT26	R	NO ₂	472071, 173157	3	420
Reading AURN*	UB	NO ₂ , PM ₁₀	473441, 173198	NA	950

*Note: R = roadside, UB = urban background, * automatic monitor, NA = not applicable*

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme⁶. 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. Reading Borough Council has applied a national bias adjustment factor (0.91) to their 2018 diffusion tube results.

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO₂ objective was exceeded three times between 2016 and 2018 at the DT05 monitoring site, although this site has results that sit right on the objective limit in 2017 and 2018. None of the other nearby diffusion tubes had exceedances between 2016 and 2018.

⁵ <http://www.reading.gov.uk/airquality>

⁶ This is a national QA/QC scheme.

Diffusion tubes do not provide information on hourly exceedances, but research⁷ 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, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites.

The AURN site gives a background NO₂ value of 26 µg/m³ in 2018, which is a reduction upon previous years. Annual mean PM₁₀ concentrations have remained constant across the monitoring period.

Table 3: Monitoring results for sites close to the proposed development site, 2016-2018

Objective	Site Name	2016	2017	2018
Annual mean NO ₂ (µg/m ³)	DT05	49	40	40
	DT09	32	32	30
	DT01	33	31	32
	DT26	NA	NA	36
	Reading AURN*	34	29	26
Hourly mean NO ₂ (no. exceedances)	Reading AURN*	4	0	0
Annual mean PM ₁₀ (µg/m ³)	Reading AURN*	13	12	13
Daily mean PM ₁₀ (no. exceedances)	Reading AURN*	3	3	1

*Values exceeding the limit values are shown in bold, * automatic monitor, NA = data unavailable*

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁸ and data has been extracted for the development location for this assessment. These 2017 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 40.4 µg/m³, 25.1 µg/m³ and 16.2 µg/m³ respectively in 2018. For 2022 (the estimated first full year of occupation), the concentrations obtained for the same pollutants are 33.6 µg/m³, 21.8 µg/m³ and 15.4 µg/m³ respectively.

The Reading AURN background monitoring site has been used to provide background concentrations for 2018 in this assessment. This is due to the location of the monitor, which is set back from the same major road network (albeit at 1 km distance) as the Eldon Road development. The monitored background concentration for NO₂ is also in line with that obtained from the background maps. The monitored background for PM₁₀ is lower than that obtained from the maps. The monitored background values has been used – in either case it would not impact on the result conclusions and mitigation needs (Section 3).

⁷ As described in Box 5.2 of LAQM Technical Guidance (TG16).

⁸ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

To provide a conservative estimate, any projected improvements in background air quality by 2022 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 Heathrow for 2018 has been used in the model. The wind-rose diagram (**Figure 2**) presents this below.

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2018

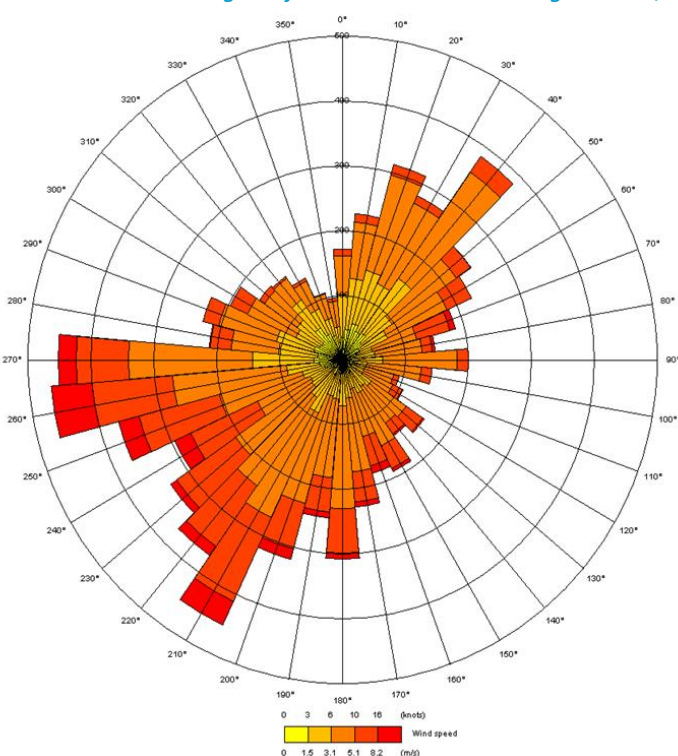


Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2019]

ArcMap software has been used to model the road source locations (blue lines) that are within 200 metres of the receptor locations (yellow triangles). 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.

Three sensitive receptor locations have been selected for the assessment:

- A: Western side of the development, located closest to Eldon Road
- B: Northern corner of the development, located closest to Kings Road (A329)
- C: Southern 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 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 report⁹. Exposure has been assumed to be represented at the mid-point of each floor.

As the development is set back from the major road network, a fourth receptor (receptor D) has also been selected to ensure the model is behaving correctly at the nearby A329 roadside. This receptor, shown above in **Figure 3**, has been placed close to the development, but at the same distance from the main road (A329) as the chosen verification sites (**Section 2.5**).

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



2.3 Traffic data

Average annual daily traffic (AADT) count data for 2018 (the selected baseline year) has been obtained for Kings Road (A329), Wokingham Road (A329), Queens Road (A329), and for London Road (A4) both east and west of the development site, from Department for Transport (DfT) Traffic Counts¹⁰, which provides data for major roads. In the absence of any other data being available for the minor roads, estimates are based upon average

⁹ <http://www.wsp-pb.com/PageFiles/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf>

¹⁰ <http://www.dft.gov.uk/traffic-counts>

values for an 'urban minor road, south east' from the DfT National Road Traffic Survey, 2018¹¹. 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 RTF¹² model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 5.1 % between 2018 and 2022.

The proposed development includes 10 additional car parking spaces. 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 2022; however this has no accountable impact on modelled concentrations. Results (**Section 3** of this report) therefore refer to concentrations modelled in 2022 regardless of whether the development takes place or not. As a result, the assessment and its conclusions are focused on the exposure of residents to currently elevated levels of pollutant concentrations, rather than assessing the impacts of the development per se.

In the absence of any other data being available, average speeds on local roads have been assumed based on the speed limit.

2.3.1 Queuing Traffic

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60¹³ 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 4 m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)¹⁴ 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. Queuing traffic has been modelled on the Kings Road and Queens Road sections of the A329 in this assessment.

2.4 Conversion of NO_x to NO₂

Evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹⁵. 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 April 2019)¹⁶ 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

¹¹ <http://www.dft.gov.uk/statistics/series/traffic/>

¹² <http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls>

¹³ Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004

¹⁴ Latest version 8.0, <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

¹⁵ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁶ <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

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

For this project, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at the DT01, DT05 and DT09 diffusion tube sites (see **Appendix A**). These sites were selected because they represent the monitoring sites closest to the proposed development, that are also located on roads with AADT data available (see **Section 2.3**). For this reason, the nearby DT26 diffusion tube site was not selected for model verification.

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 adjustment¹⁷.

¹⁷ Paragraph 7.529 of LAQM TG(16)

3 Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the base year (2018) and the development year (2022) with¹⁸ the development. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2018 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

¹⁸ Additional trips generated by the development are accounted, but are not expected to impact local air quality (see Section 2).

Table 4: Estimated pollutant concentrations in 2018 and 2022 ($\mu\text{g}/\text{m}^3$)

Floor level	Receptor	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
		2018	2022	2018	2022		
G	A	28.3	28.4	13.3	13.4	0.1	<0.1
	B	28.5	28.6	13.4	13.4	0.1	<0.1
	C	28.0	28.1	13.3	13.3	0.1	<0.1
	D*	35.0	35.4	14.1	14.2	0.4	<0.1
1	A	28.2	28.3	13.3	13.3	0.1	<0.1
	B	28.3	28.4	13.3	13.3	0.1	<0.1
	C	27.9	28.0	13.3	13.3	<0.1	<0.1
2	A	27.9	27.9	13.3	13.3	<0.1	<0.1
	B	28.0	28.1	13.3	13.3	0.1	<0.1
	C	27.7	27.8	13.3	13.3	<0.1	<0.1
3	A	27.5	27.6	13.2	13.2	<0.1	<0.1
	B	27.6	27.6	13.2	13.2	<0.1	<0.1
	C	27.4	27.5	13.2	13.2	<0.1	<0.1
4	A	27.2	27.2	13.2	13.2	<0.1	<0.1
	B	27.2	27.3	13.2	13.2	<0.1	<0.1
	C	27.1	27.2	13.2	13.2	<0.1	<0.1

Note: The changes in NO₂ and PM₁₀ presented may not exactly equal the difference in the constituent parts shown due to rounding. *Test (see Section 2.3)

In the base year scenario, the model predicts annual mean NO₂ concentrations to be below (by 29 %) the annual mean objective at all development locations (receptors A-C). The worst-case location is identified as receptor B, although concentration levels are largely similar across the site. This is to be expected, as the development site receptors are set back from the roadside.

The estimated annual mean NO₂ concentrations at the development site are reasonable when compared to the data collected at the nearby diffusion tube sites. Receptor D was placed at a location close to the development site, but at a similar proximity to the A329 as the Council's monitoring sites. An annual mean NO₂ result in line with those of other roadside monitoring sites in Reading was achieved (35 µg/m³ in 2018).

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 future year scenario taking into account predicted increases to traffic levels on local roads. The results indicate that annual mean NO₂ concentrations would change by 0.1 µg/m³ at worst-case locations.

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 mean¹⁹, such that:

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

On this basis, it is estimated that in 2022 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 Mitigation Measures

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

However, it is widely acknowledged that there is no safe level of exposure to air pollution²⁰, and as such, the developer is encouraged to consider mitigation measures to reduce emissions arising from the site. The National Planning Policy Framework²¹, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments “should ensure that appropriate opportunities to promote sustainable transport can be – or have been taken up”. It states that developments should be located and designed where practical to:

¹⁹ Paragraph 7.92 of LAQM TG(16)

²⁰ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

²¹ <https://www.gov.uk/government/publications/national-planning-policy-framework--2> Published in July 2018

- Give priority to pedestrian and cycle movements, and have access to high quality public transport facilities
- Incorporate facilities for charging plug-in and other ultra-low emission vehicles
- A key tool to facilitate the above will be a Travel Plan. All developments which generate a significant amount of movement should be required to provide a Travel 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'²² 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

²² <http://iaqm.co.uk/guidance/>

reduce the impact of dust and vehicle exhaust emissions, and liaises with the Local Authority to come up with an acceptable dust management strategy.

4 Summary and Conclusions

An air quality assessment has been undertaken for a proposed residential development at Mulberry House, 1a Eldon Road, Reading, RG1 4DS. Reading Borough Council has declared one Air Quality Management Area (AQMA) due to the exceedance of the annual mean nitrogen dioxide (NO₂) objective. The proposed development falls within the AQMA, but is set back from the roadside, where exposure to increased pollutant concentrations is of reduced concern.

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 (2018) and the first year of occupation (2022). 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 NO₂ concentrations are below the objective in the base year and development year (2022) scenarios. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective under both scenarios. Based on the evidence it is estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. Ten parking spaces are to be provided with the development, but the potential increased traffic generation will have no discernible impact on future-year pollutant concentrations.

Therefore, no specific mitigation e.g. mechanical ventilation is required as the air quality objectives are predicted to be met. Instead, other measures such as providing secure and covered cycle storage, adopting a travel plan, and installing an electric 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/demolition phase on local air quality.

Appendix A – Model Verification

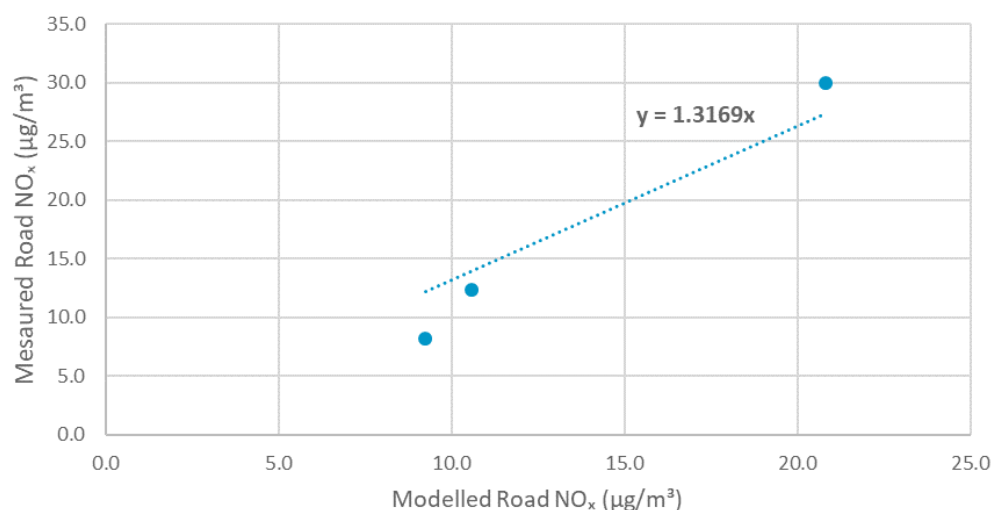
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2018 at the DT01, DT05 and DT09 diffusion tube sites described in **Table 2**.

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 calculator¹⁶.

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 2018 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: 2.4

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/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 2018 (and prediction for 2022 without development)

Development/ verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	A329 - Kings Road	21,189 (22,271)	4.7	48
	A329 - Wokingham Road	10,508 (11,045)	3.8	48
	A329 - Queens Road	19,529 (20,526)	1.8	48
	A4 - London Road - west of D	12,566 (13,208)	4.1	48
	A4 - London Road - east of D	23,802 (25,017)	4.0	48
	Minor Roads	2,200 (2,312)	2.0	48
Verification sites	A327 - Mount Pleasant	6,419 (6,747)	9.4	48
Traffic queues	A329 - Kings Road Q	30,000 (31,532)	4.7	5
	A329 - Queens Road Q	30,000 (31,532)	1.8	5

Note: The development is not expected to result in any additional daily traffic, D = development, Q = traffic queue



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