PLANNING FOR SUSTAINABILITY

Land accessed from private lane between 25a & 25c Frognal

Air Quality Dispersion Modelling

Air Quality Statement
September 2019

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Revision Schedule

Air Quality: Dispersion Modelling
September 2019

Rev	Date	Details	Prepared by	Reviewed by	Approved by
01	Sep 2019	Final	J Kirk	P Giesberg	P Giesberg

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1 EXECUTIVE SUMMARY

Introduction

Planning for Sustainability have been commissioned to undertake a detailed air quality assessment to determine pollutant concentrations at the site of a proposed residential development to be located on land to the rear of 29-33 Arkwright Road, Camden.

The site is the subject of planning application 2019/1697/P, for which a baseline air quality assessment has previously been undertaken which considered the impact of the proposed development on local air quality. However, following submission of the previous Air Quality Statement, the London Borough of Camden (LBC) issued the following comment:

'Air Quality Assessment – Air Quality Officer notes that risk to new residents is more than stated, need more detailed assessment, more modelling required, levels worse than Planning for Sustainability indicate'

This report therefore sets out the results of a further air quality assessment which predicts pollutant concentrations at the site and assesses the suitability of the site for residential development in terms of exposure. The report should be read in conjunction with the previously issued Air Quality Statement, dated November 2018.

A baseline assessment of local air quality based on local monitoring data indicates that pollutant concentrations (NO_2 and PM_{10}) at the site are expected to be below the relevant objective limits. However, predicted concentrations set out within maps produced by the LAEI 2016 indicate a possible exceedance of the objective at the site as a result of an adjacent emissions source.

Detailed modelling has been undertaken to predict air quality at the site taking into account the main emissions sources in the vicinity of the site, namely traffic emissions. modelling results show that both NO_2 and PM_{10} concentrations would meet the relevant objectives for both pollutants at the site.

The assessment shows that air quality does not pose a constraint to development of the site for the proposed uses

2 Introduction

Introduction

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The site is the subject of planning application 2019/1697/P, for which a baseline air quality assessment has previously been undertaken which considered the impact of the proposed development on local air quality. However, following submission of the previous Air Quality Statement, the London Borough of Camden (LBC) issued the following comment:

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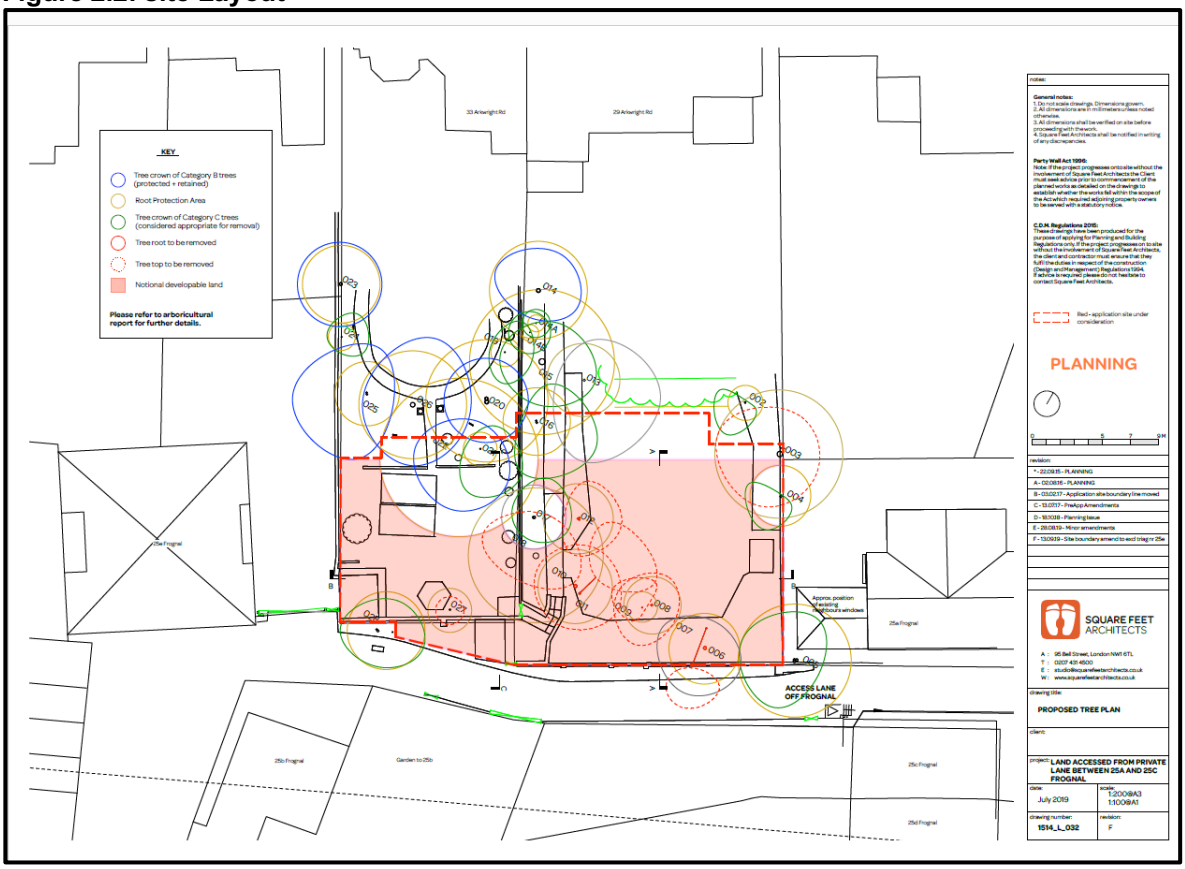
This report therefore sets out the results of a further air quality assessment which predicts pollutant concentrations at the site and assesses the suitability of the site for residential development in terms of exposure. The report should be read in conjunction with the previously issued Air Quality Statement, dated November 2018.

The development proposals are to provide two new residential dwellings which would be accessed via an existing access road leading off Frognal, currently providing access to two existing residential properties including 25E Frognal. A location plan and indicative masterplan of the site are provided in Figures 2.1 and 2.2 below.

Figure 2.1: Location of site

Figure 2.2: site Layout



Assessment Scope

The application is for the construction of 2 new residential dwellings to the rear of 29-33 Arkwright Road. The previous air quality statement concluded that air quality at the site would meet the relevant air quality objectives for nitrogen dioxide (NO_2) and particulate matter (PM_{10}). However, the previous assessment included a review of local monitoring data to determine likely pollutant concentrations at the site. This additional assessment includes a more detailed baseline assessment, including a review of the latest London Atmospheric Emissions Inventory (LAEI) 2016 maps of NO_2 and detailed modelling of local traffic emissions to determine pollutant levels at the site.

It is noted that the LAEI 2016 maps indicate an exceedance of the NO_2 objective at the site due to an emissions source which runs immediately south of the site. A detailed review of the site and surrounding area does not identify any significant emission source in this location, and it is concluded that the NAEI 2016 mapping has included a line source along this route representing the adjacent railway line. However, this railway line runs underground between Finchley Road and Frognal Station and Hampstead Heath Station, and therefore run underground when passing to the south of the site. Inclusion of emissions from the railway line within the modelling assessment has therefore been scoped out of the assessment as these would not impact air quality at the site.

The assessment has concentrated on NO_2 and PM_{10}, the pollutants most associated with traffic emissions and which can be harmful and cause discomfort to humans.

3 Policy Context

International Legislation and Policy

The EU Directive 2008/50/EC[1] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for a number of pollutants and the dates by which these objectives should be met. The Air Quality Standards Regulations 2010[2] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding, and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

National Legislation

The UK Air Quality Strategy

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[3], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems, which includes NO_2 and particulate matter (PM_{10}), the two main pollutants of concern within the LBC. The current statutory standards and objectives for NO_2 and PM_{10} in relation to human health are set out in Table 3.1.

Table 3.1: Relevant Objectives set out in the Air Quality Strategy

Pollutant	Concentrations	Measured As	Date to be Achieved By
Nitrogen Dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times per year	1 hour mean	31 December 2005
	40 μgm^{-3}	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 μgm^{-3}	Annual mean	31 December 2004

The statutory standards and objectives apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16))[4] issued by Defra for Local Authorities on where the objectives apply, as detailed in Table 1.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[2] Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001
[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007
[4] Defra (2016) Local Air Quality Management Policy Guidance (LAQM.TG(16))

Table 3.2: Locations Where Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at:**	**Objectives should generally not apply at:**
Annual Mean	All locations where members of the public might be regularly exposed.	Building facades of residential properties, schools, hospitals, libraries etc. Building facades of offices or other places of work where members of the public do not have regular access. Gardens of residential properties. Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
24 Hour Mean	All locations where the annual mean objective would apply. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1 Hour Mean	All locations where the annual mean and 24 hour mean objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

National Planning Policy Framework

The National Planning Policy Framework (NPPF)[5] sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to *'contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy*.'

Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 170) requires that *'planning policies and decisions should contribute to and enhance the natural local environment by …preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as air and water quality.'*

[5] Ministry of Housing, Communities and Local Government: National Planning Policy Framework (July 2018)

In dealing specifically with air quality the NPPF (paragraph 181) 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 183 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively*'.

Regional Legislation and Policy

The Mayor of London's Air Quality Strategy

The Mayor of London's AQS[6] sets out a series of policies and proposals for the implementation of the UK AQS and for the achievement of the air quality standards and objectives in Greater London. With regards the proposed development the following policies are of relevance:

Policy '6 - Reducing emissions from construction and demolition sites': The London Council's Best Practice guidance will be reviewed and updated, and more vigorously implemented;

Policy '7 - Using the planning process to improve air quality - new developments in London as a minimum shall be 'air quality neutral': The Mayor will encourage boroughs to require emissions assessments to be carried out alongside conventional air quality assessments. Where air quality impacts are predicted to arise from developments these will have to be offset by developer contributions and mitigation measures secured through planning conditions, section 106 agreements or the Community Infrastructure Levy;

The London Plan

The London Plan 2016[7] is the overall strategic plan for London setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. It specifically addresses how development can help support the implementation of the Mayor's Air Quality Strategy and achieve a reduction in pollutant emissions and public exposure to pollution.

Policy 7.14 – Improving Air Quality requires all development proposals to:

- Minimise increased exposure to existing poor air quality, make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs)) and promote greater use of sustainable transport modes through travel plans;
- Promote sustainable design and construction to reduce emissions from demolition and construction of buildings including following current best practice guidance;
- Be at least 'air quality neutral' and therefore not leading to further deterioration of existing poor air quality;
- Look, in the first instance, to implement measures on-site to reduce emissions from a development. If inappropriate or impractical, other measures should be considered and

[6] Mayor of London (2010) Clearing the Air, The Mayor's Air Quality Strategy, December 2010
[7] Greater London Authority (March 2016) The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011

where found to provide equivalent air quality benefits, planning obligations or planning conditions should be used to ensure their implementation;

- Permission will only be granted where a detailed assessment of biomass boilers shows no adverse impact from emissions.'

The Emerging London Plan

The Emerging London Plan[8] is currently out for consultation. In dealing with Air Quality the plan sets out the following:

'*London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced*;

1. Development proposals should not:
a) Lead to further deterioration of existing poor air quality
b) Create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits;
c) Reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality;
d) Create unacceptable risk of high levels of exposure to poor air quality.

2. Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality. Particular care should be taken with developments that are in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people.

3. The development of large-scale redevelopment areas, such as Opportunity Areas and those subject to an Environmental Impact Assessment should propose methods of achieving an Air Quality Positive approach through the new development. All other developments should be at least Air Quality Neutral.

4. Development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emissions Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

5. Air Quality Assessments (AQAs) should be submitted with all major developments, unless they can demonstrate that transport and building emissions will be less than the previous or existing use.

6. Development proposals should ensure that where emissions need to be reduced, this is done on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated'.

Local Air Quality Management

Local authorities are seen to play a particularly important role. The AQS describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to undertake regular reviews and assessments of air quality within its area to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an AQMA and prepare an action plan which identifies measures that will be introduced in pursuit of the objectives.

Camden Planning Policy

The Camden Local Plan 2017[9] sets out the policies to guide development across the borough. In terms the Plan sets out policy CC4 which states that the Council '*will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in*

[8] Mayor of London, Draft New London Plan, 2017
[9] LBC (2017) Camden Local Plan

the borough'. Under the policy the Council will take account of both exposure of new occupants and the effect of the development on air quality, requiring an air quality assessment to be undertaken and appropriate mitigation to be identified and adopted, where significant effects are identified.

4 Methodology

Introduction

Potential impacts on air quality due to local traffic emissions have been predicted using the ADMS-Roads dispersion model (version 4.1.1, released January 2018). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from the London City Airport Meteorological Station for 2017 has been used for the assessment.

Quantitative assessment of local air quality from road traffic emissions have been completed against the current statutory standards and objectives set out in Table 3.1 for NO_2 and PM_{10}.

Emissions Data

The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of NO_x and PM_{10}. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator (Version 7.1, published April 2019) available on the Defra air quality website (http://uk-air.defra.gov.uk).

The most recent emission factors released by Defra in May 2019, provided in the emissions factor toolkit EFT2019_9.0 have been used within the ADMS model to predict emissions from traffic using the adjacent road network during 2017 for model verification and in 2020, the anticipated year of first occupation.

Background Concentrations

The ADMS model estimates concentrations arising as a result of vehicle emissions. It is necessary to add an estimate of local background concentrations to obtain the total concentration for comparison against the air quality objectives.

Background concentrations of NO_2 are recorded at a local diffusion tube site on Frognal Way, approximately 0.4 km to the north-east of the site. Estimated background concentrations are also set out within maps published by Defra. Comparison of data for 2017 from both sources shows higher concentrations set out within the Defra maps. Background concentrations of NO_x, NO_2 and PM_{10} have therefore been taken from the Defra 2017 background maps (published in May 2019) as these are considered to represent worst-case background concentrations in the vicinity of the site. Concentrations have been extracted from the maps for the grid square which represents the site and surrounding road network for 2017.

The 2017 background data has also been used for the 2020 future year scenario. Use of this data represents a worst-case prediction of future concentrations at the site, given that local monitoring shows a gradual decline in concentrations in recent years. The Defra data is set out in Table 5.4.

Traffic Data

Base traffic flows for 2017 have been obtained for the road network within the vicinity of the site and those links used for model verification, from a number of sources. The majority of the data has been obtained from the London Atmospheric Emissions Inventory (LAEI) 2016. The data within the LAEI is for the 2016 base year. The data has been factored forward to 2017 using a central growth factor from the National Road Traffic Forecast (NRTF) of 1.012.

Traffic data for Finchley Road (A41), which runs to the west of the site, has been obtained from the Department of Transport (DfT) traffic data statistics website[10]. Traffic flows for Finchley Road

[10] https://roadtraffic.dft.gov.uk/downloads

set out within LAEI 2016 were considerably lower than in the DfT, therefore use of the DfT data was considered most appropriate to ensure a worst-case assessment.

Traffic data for Frognal, which runs to the east of the site, has been provided by the Transport Department at LBC. These are based on traffic counts undertaken in April and May 2019. The data for 2017 has been obtained using a NRTF conversion factor of 0.977.

Traffic data used for the modelling assessment is set out below in Table 4.1.

Table 4.1: Traffic Data

Road Link	Source of Data	Traffic Data for 2018		
		AADT	%HDV	Speed (kph)
Arkwright Road	LAEI 2016	9680	7	15 (0 at junctions)
Mill Lane	LAEI 2016	12995	7	25
Fitzjohn Avenue	LAEI 2016	18743	6	5[1]
Finchley Road (A41)	DfT	49103	6	48
Frognal	LBC	3051	7	15 (10 at junctions)
Fortune Green Lane	LAEI 2016	10197	6	30

[1] Monitoring site CA17 is located on Fitzjohn Avenue outside a school. Low traffic speeds have been used to take account of the stop/start and potentially queueing traffic during school drop off and pick up.

Model Outputs and Results Processing

For the 2020 assessment year the ADMS Model has predicted traffic related annual mean emissions of NO_x and PM_{10} as contour plots across the site and surrounding area. Relevant background concentrations, taken from the 2017 background maps, have subsequently been added to the model outputs to provide total concentrations.

Analysis of long-term monitoring data[11] suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment the annual mean concentration has been used to screen whether the one-hour mean objective is likely to be achieved as recommended within LAQM.TG(16). Similar to NO_2, an annual mean PM_{10} concentrations below 32 µg/m^3 has been used to screen whether the 24-hour PM_{10} mean objective is likely to be achieved, the approach also recommended within LAQM.TG(16).

Verification of Model Results

It is recommended that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

[11] D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003).

To verify the model results, the ADMS model has been used to predict NO_2 concentrations at monitoring sites CA17 47 Fitzjohns Road and CA25 Emmanuel Primary (Mill Lane). Verification has been carried out against 2017 monitoring data. A review of local monitoring shows concentrations during 2017 were considerably higher than in 2018, therefore use of 2017 monitoring is considered to represent a cautious approach to the assessment. Further details on the verification and calculation of adjustment factors is provided in Appendix B.

There is no suitable monitoring of PM_{10} data to allow verification of the PM model results. However, LAQM.TG (16) suggests applying the NO_x adjustment factor to modelled road-PM where no appropriate verification against PM data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

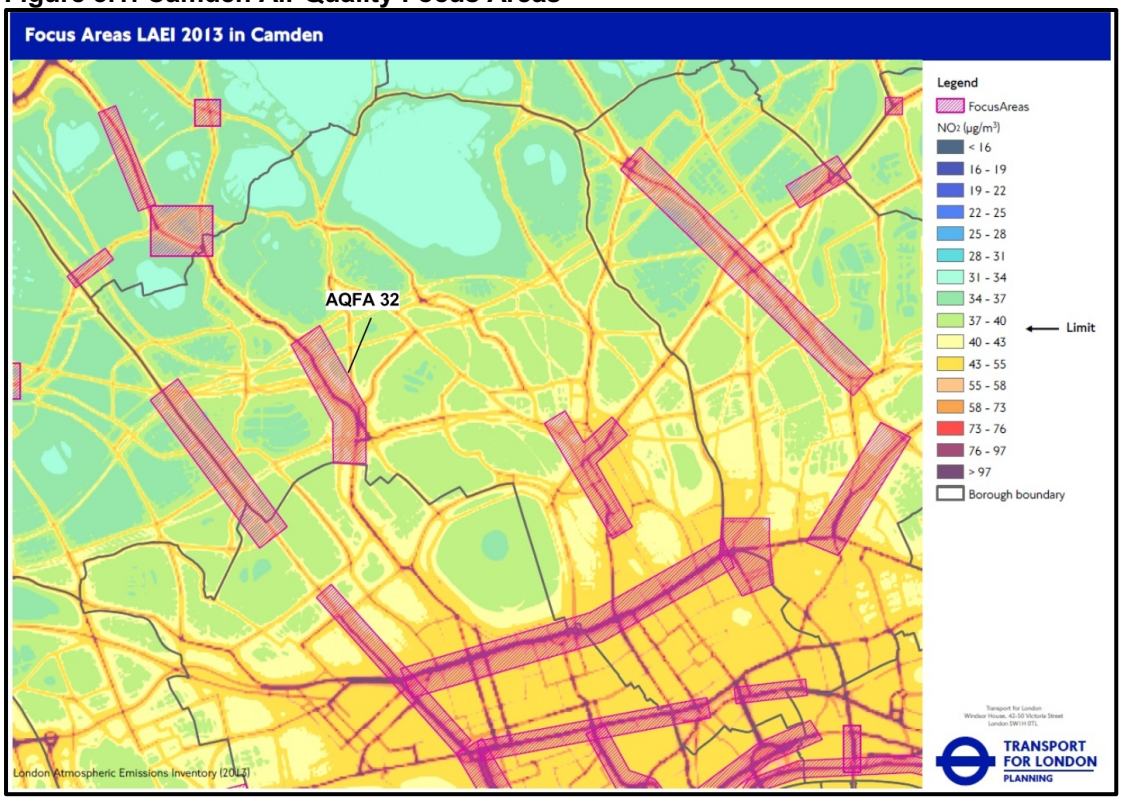
5 Baseline Assessment

Camden Review and Assessment of Air Quality

LBC has completed a number of detailed assessments of air quality which has identified exceedences of the annual mean NO_2 objective at a number of locations across the borough. This has resulted in LBC declaring a borough wide AQMA. The site therefore falls within an AQMA.

Furthermore, the site falls just within Air Quality Focus Area (AQFA) 32, as shown in Figure 5.1. AQFA's are areas, agreed between the Greater London Authority (GLA) and individual London boroughs, where pollution levels are in exceedence of the objectives and public exposure is highest. The boroughs must work towards improvements in these areas and all new development is expected to bring with it the highest standards on design and operation to ensure improvements can be secured from the outset.

Figure 5.1: Camden Air Quality Focus Areas[12]



Air Quality Monitoring

Nitrogen Dioxide

NO_2 concentrations are monitored extensively across the borough using both automatic monitoring equipment and diffusion tubes. In the vicinity of Arkwright Road there are three diffusion tube sites operated by LBC, one located on Frognal Way, one on Fitzjohn's Avenue and the other at Swiss Cottage, co-located with the Swiss Cottage Automatic monitoring site. There is also one located further west on Mill Lane at the Emmanuel Primary School. In addition, during 2017 residents were invited to apply for and set up diffusion tube sites to extend the existing monitoring carried out by the Council. Two sites where set up at Longland Gardens, however no data is available. A further two sites were set up at Holly Bush, which provided data during August and September 2017. The data is set out in Table 5.1.

[12] Transport For London, London Atmospheric Emissions Inventory 2013 https://data.london.gov.uk/dataset/laei-2013-london-focus-areas

Monitoring data set out in Table 5.1 shows annual mean NO_2 concentrations exceeding the 40 µg/m^3 objective limit at Swiss Cottage and 47 Fitzjohn's Avenue during 2018, with concentrations just below the objective at Emmanuel Primary. Between 2015 and 2017 the annual mean objective was exceeded at all three monitoring locations. The Swiss Cottage site is located directly adjacent to the A41, which experiences in the region of 50,000 vehicles per day, while the Fitzjohn's Avenue and Emmanuel Primary sites are located directly adjacent to the roadside and experience in excess of 10,000 vehicles per day.

NO_2 concentrations are known to decline rapidly away from source with concentrations falling to the equivalent of background levels within 100-200 m of a roadside. The Frognal Way monitoring site is located approximately 150 m to the west of Fitzjohn's Avenue and has recorded annual mean NO_2 concentrations consistently less than 75% of the annual mean objective since 2015. Both the Holly Bush sites are located approximately 50-60 m west of Fitzjohn's Avenue and data recorded at both sites indicates concentrations below the annual mean objective. The data shows a rapid decline in concentrations away from Fitzjohn's Avenue with concentrations declining by over 30 µg/m^3 within 150 m.

The monitoring data shows an overall decline in concentrations between 2015 and 2018 at all monitoring lcoations.

Diffusion tubes are unable to monitor short-term NO_2 concentrations. However, based on the recorded annual mean concentrations, the 1-hour objective is likely to be exceeded at the Swiss Cottage monitoring site as concentrations have exceeded 60 µg/m^3 during all four monitoring years presented. Exceedance of the 1-hour objective is likely to have occurred during 2017 at the Fitzjohn Avenue site, however concentrations declined in 2018 to less than 60 µg/m^3, therefore the short-term objective is unlikely to have been exceeded during this year.

Table 5.1: NO_2 Monitoring Data (µg/m^3)

site	Type	Year			
		2015	2016	2017	2018
Swiss Cottage Automatic site	R	60.8	65.9	52.2	53.7
CA15 - Swiss Cottage 1 (diffusion tube)	R	71.9	68.2	67.2	62.3
CA17 - 47 Fitzjohn's Avenue	R	-	56.4	63.5	48.1
CA7 - Frognal Way	UB	25.7	27.9	26.4	22.1
CA25 - Emmanuel Primary, Mill Lane	R	47.7	52.2	55.2	39.8
Holly Bush (Romneys House)	UB	-	-	Aug – 35.1 Sept – 21.4	-
Holly Bush	UB	-	-	Aug – 35.4	-

R - Roadside
UB – Urban Background

Particulates (PM_{10})

PM_{10} concentrations are monitored at 3 locations across the Borough using automatic monitoring equipment; Bloomsbury (background location), Euston Road (roadside location) and Swiss Cottage (roadside location). Monitoring data from all three sites is set out in Table 5.2 and 5.3.

During 2018 all three sites recorded annual mean PM_{10} concentrations of less than 75% of the objective limit of 40 µg/m^3. The data recorded also shows the number of days exceeding the 24-hour objective limit of 50 µg/m^3 is less than 35 at all three sites, therefore the short-term objective for PM_{10} is also being met at all three monitoring locations.

Table 5.2: Annual Mean PM_{10} Monitoring Data (µg/m^3)

site	Type	Year			
		2015	2016	2017	2018
Swiss Cottage Automatic site	R	20	21	20	20.7
Euston Road	R	18	24	20	21.2
Bloomsbury	UB	22	20	19	17.4

R – Roadside
UB – Urban Background

Table 5.3: Number of Days >50 µg/m^3 PM_{10}

site	Type	Year			
		2015	2016	2017	2018
Swiss Cottage Automatic site	R	8	7	8	4
Euston Road	R	5	10	3	2
Bloomsbury	UB	6	9	4	1

R – Roadside
UB – Urban Background

Defra Background Data

Additional information on estimated background pollutant concentrations has been obtained from the Defra background maps provided on the UK-AIR, the Air Quality Information Resource (http://uk-air.defra.gov.uk/). Estimated air pollution concentrations for oxides of nitrogen (NOx), NO_2, and PM_{10} have been extracted from the 2017 background pollution maps for the UK, which were published in May 2019. These maps are available in 1 km x 1 km grid squares and provide an estimate of concentrations between 2017 and 2030. The average concentrations for the grid square representing the site have been extracted for the 2017 base year and 2020 future year. The data is provided in Table 5.4.

The NO_x and PM_{10} background maps are provided not only as total concentrations but are also broken down into sector contributions (i.e. motorways and rail). However, as this assessment is considering the impact of the proposed development on existing air quality, background concentrations from all sources should be considered. The data presented in Table 5.4 provides total background concentrations of both pollutants.

Table 5.4: Annual Mean Background Concentrations from Defra Maps

Year	Annual mean concentrations (µgm^{-3})		
	Oxides of Nitrogen	Nitrogen dioxide	PM_{10}
2017	47.9	29.0	17.6
2020	37.8	24.3	16.8

The data indicates that existing background concentrations are currently meeting the NO_2 and PM_{10} objectives at the site. Background concentrations are also predicted to decline between 2017 and 2020, therefore use of the 2017 background data for the 2020 assessment year represents a cautious prediction of concentrations at the site.

London Atmospheric Emissions Inventory 2016

Contour maps of pollutant concentrations across London have been published as part of the LAEI 2016, based on the latest LAEI transport emissions data. A copy of the map covering the area in the vicinity of Arkwright Road is provided below in Figure 5.2.

The contour maps predict an exceedance of the annual mean NO_2 concentrations at the site, as indicated by the circle presented in Figure 5.2. Annual mean concentrations in the region of 40-43 $\mu g/m^3$ have been predicted in this location. However, the contour map indicates the exceedance is due to a significant linear emission source running along the southern boundary of the site between Frognal and the A41. As shown in Figure 2.1, the site is located adjacent to a small access road leading off Frognal and terminating after 60 m. The access road does not connect Frognal to the A41 and being an access road for only 2 properties, is not c0onsidered to be a significant emission source. However, as previously discussed in chapter 2, the railway line runs underground along this route between Fincheley Road and Frognal Station and Hampstead Heath Station. It is therefore likely that the LAEI 2016 mapping included this underground railway line as an emission source in this location, resulting in elevated NO_2 concentrations at the site.

Figure 5.2: LAEI 2016 Map[13]

Air Quality at the Development site

The site is located to the rear of 29-33 Arkwright Road, approximately 40 m south of the Arkwright Road, 115m to the east of the A41 and 25 m west of Frognal. Pollutant concentrations are known to decline rapidly away from source, falling to background levels within 100 – 200 m of roadside locations.

Monitoring data shows an exceedance of the annual mean NO_2 objective at roadside locations on Fitzjohn's Avenue, but concentrations of less than 75% of the objective at the Frognal Way monitoring site which is located 150 m to the west of Fitzjohn's Avenue. The data shows a rapid decline in concentrations away from source and it is expected that concentrations at the site will have decline sufficiently to be below the annual mean and 1-hour NO_2 objective levels, although concentrations are unlikely to have reached background levels given the proximity to the adjacent road emission sources.

[13] Provided by LBC during email correspondence dated 18/07/2019

Based on monitoring of PM_{10} concentrations at nearby roadside locations, concentrations of this pollutant are also expected to be below the annual mean and short-term objective limits at the site.

6 Exposure Assessment

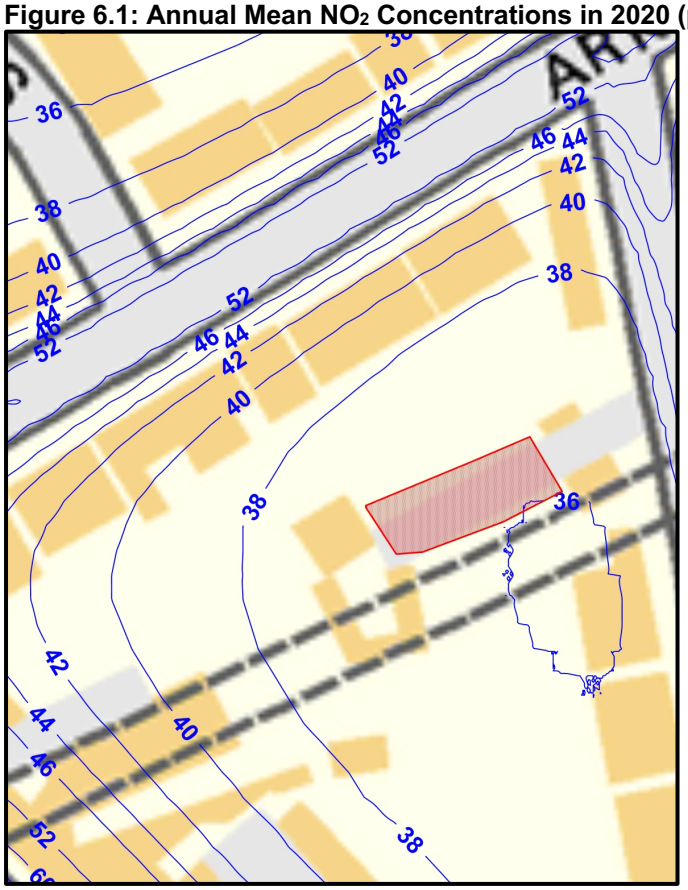
Nitrogen Dioxide Concentrations

The contour plot set out in Figure 6.1 shows annual mean NO_2 concentrations of 36-37 µg/m^3 at the site, below the objective limit of 40 µg/m^3. With predicted annual mean concentrations being less than 60 µg/m^3, it is expected that the hourly objective of 200 µg/m^3 will also be met at the site.

It should be noted that concentrations at the site have been predicted using worst-case assumptions i.e. undertaking verification against 2017 monitoring data and assuming no change in background concentrations between 2017 and 2020.

As NO_2 concentrations at the site are meeting the annual mean and short term objective limits the impact of the proposals in terms of new exposure in relation to NO_2 would be negligible. No mitigation in relation to exposure is therefore consider necessary at the site.

Figure 6.1: Annual Mean NO_2 Concentrations in 2020 (µg/m^3)

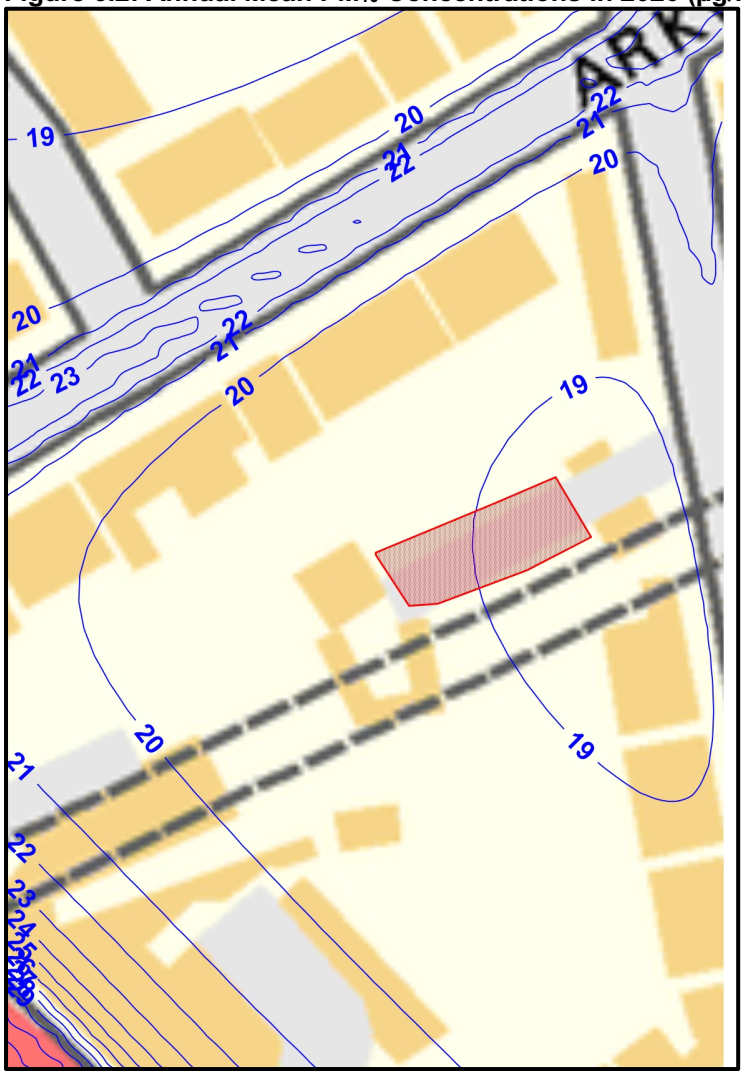


Particulate Matter Concentrations

Annual mean PM_{10} concentrations predicted at the site are presented in Figure 6.2. The data shows concentrations well below (<30 µg/m^3) the objective at the site.
As annual mean concentrations are below 32 µg/m^3, concentrations are also expected to be meeting the 24-hour objective at the site.

The impact of the proposals in terms new exposure to PM_{10} would be negligible. No mitigation in relation to exposure is therefore consider necessary at the site.

Figure 6.2: Annual Mean PM_{10} Concentrations in 2020 (µg/m^3)



7 Conclusion

Planning for Sustainability have been commissioned to undertake a detailed air quality assessment to determine pollutant concentrations at the site for a proposed residential development to be located on land to the rear of 29-33 Arkwright Road, Camden.

A baseline assessment of local air quality based on local monitoring data indicates that pollutant concentrations (NO_2 and PM_{10}) at the site are expected to be below the relevant objective limits. However, predicted concentrations set out within maps produced by the LAEI 2016 indicate a possible exceedance of the objective at the site as a result of an adjacent emissions source.

Detailed modelling has been undertaken to predict air quality at the site taking into account the main emissions sources in the vicinity of the site, namely traffic emissions. modelling results show that both NO_2 and PM_{10} concentrations would meet the relevant objectives for both pollutants at the site. The modelling results show that both NO_2 and PM_{10} concentrations would meet the relevant objectives for both pollutants at the site.

The assessment shows that air quality does not pose a constraint to development of the site for the proposed uses.

Appendix A

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
Defra	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
μgm^{-3} micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B

Model Verification

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

Verification of the model results has been carried out against data recorded at monitoring sites CA17 47 Fitzjohn's Avenue and CA25 Emmanuel Primary. Verification has been carried out against 2017 monitoring data as this is considered to be a worst-case year for air quality and concentrations during this year were considerably higher than during 2018.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NOx (Figure B1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the Defra NO_x from NO_2 calculator available on the UK-AIR website.

Figure B1: Comparison of Modelled Road NOx with Measured Road NOx

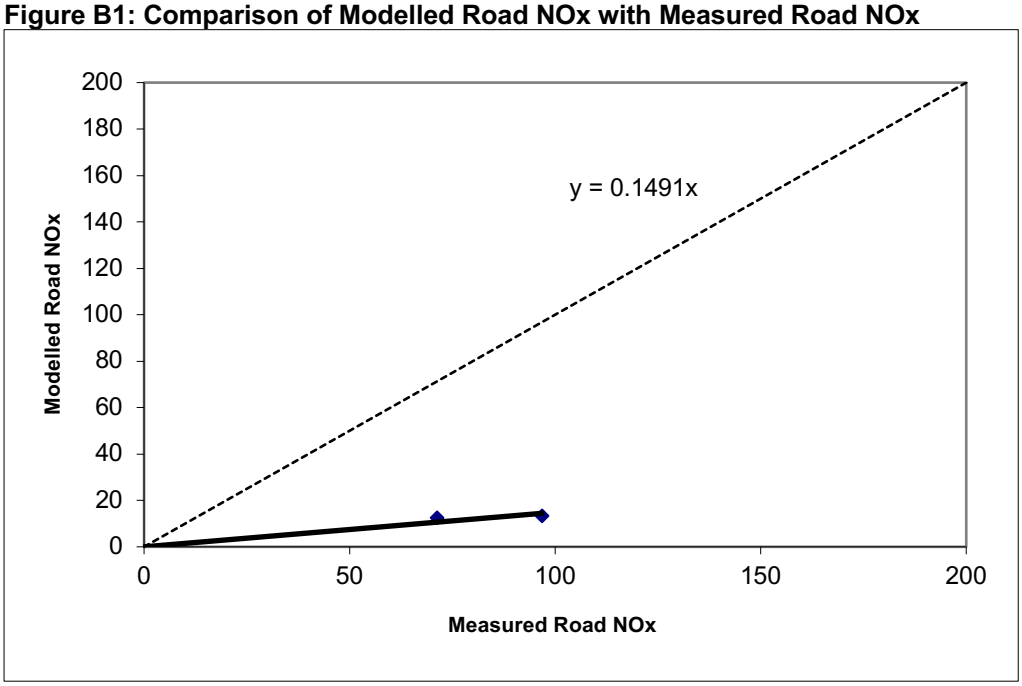
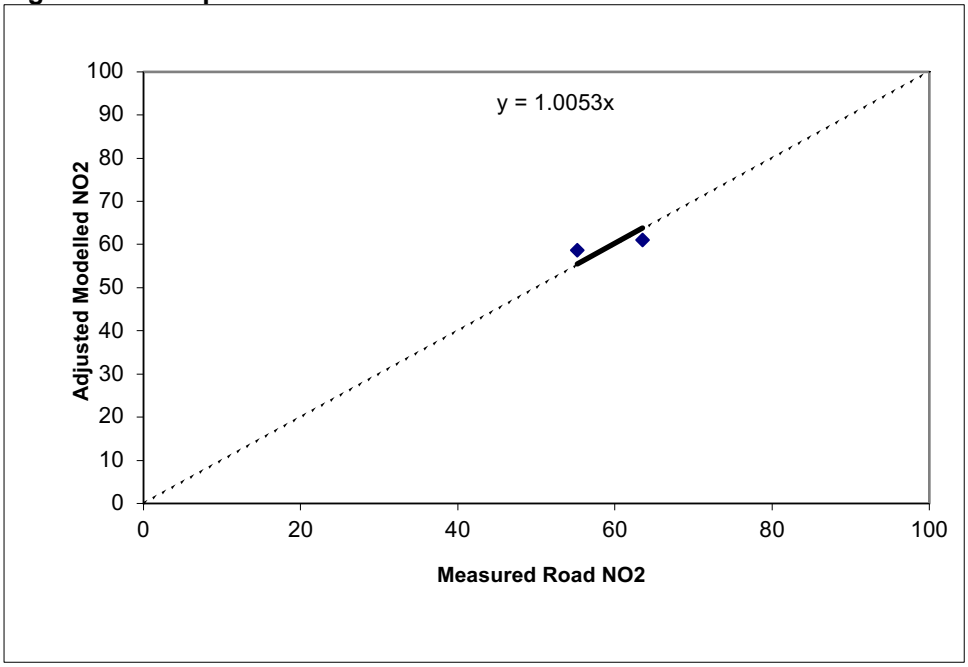


Figure B1 shows that the ADMS model is under-predicting the road-NO_x concentrations at the monitoring sites. An adjustment factor has therefore been determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.1491 =6.71). This factor has been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the Defra NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration.

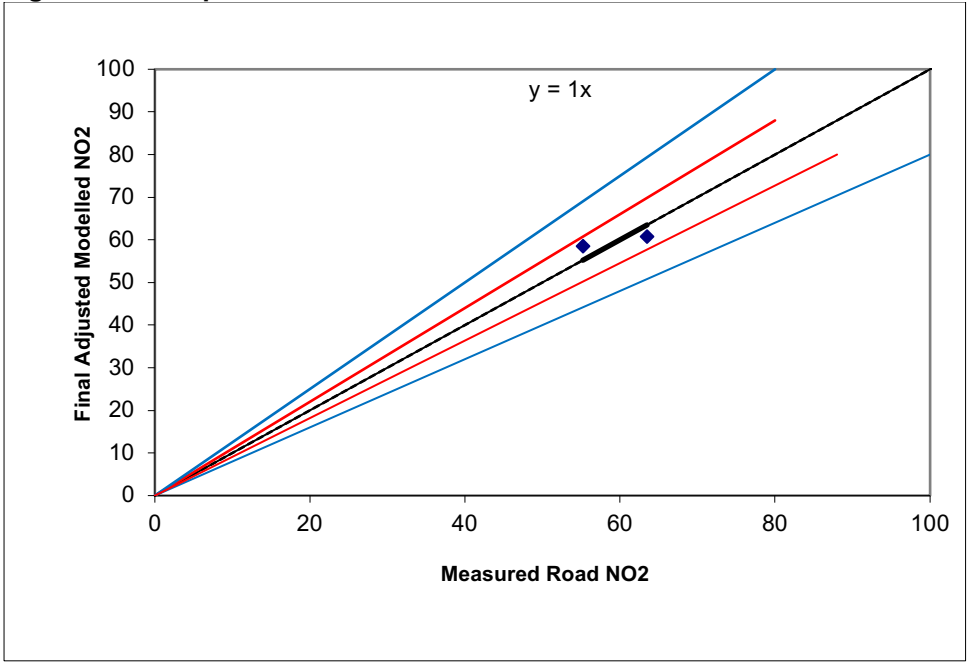
Figure B2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO_2, was calculated (1/0.0053= 0.995).

Figure B2: Comparison of Modelled NO2 with measured NOx



After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO_2. The final adjustment modelled values are shown in Figure B3.

Figure B3: Comparison of Final Modelled NO2 with measured NOx



The adjustment factor of 6.71 has been applied to the modelled NO_x-road concentrations predicted at the site. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 concentrations and adjusted by 0.995 to provide the final predicted annual mean NO_2 concentrations at each receptor.

These factors have also been used to adjust the predicted PM_{10} concentration