Air Quality Assessment:
152-156 Kentish Town Road, Camden

June 2016

Experts in air quality
management & assessment

Document Control

Client	Marek Wojciechowski Architects	Principal Contact	Aaron Thompson

Job Number	J2499

Report Prepared By:	Ricky Gellatly & Laurence Caird

Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J2499/1/F3	3 June 2016	Final	Dr Clare Beattie (Principal Consultant)

Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
12 Airedale Road, London SW12 8SF Tel: 0208 673 4313
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
Companies House Registration No: 2814570

Executive Summary

The air quality impacts associated with the construction and operation of the proposed mixed-use development at 152-156 Kentish Town Road in Camden have been assessed.

Existing air quality conditions along Kentish Town Road show poor air quality close to the road at ground level, with concentrations of nitrogen dioxide exceeding the annual mean objective at a nearby diffusion tube monitoring site. This is to be expected in Camden, with the entire borough have been declared an Air Quality Management Area. Away from roads, background concentrations are below the objectives.

The construction works will give rise to a mostly *Low* to *Medium Risk* of dust impacts. It will be necessary to apply a package of mitigation measures to minimise dust emissions. With these mitigation measures in place, the overall impacts during construction will be 'not significant'.

Air quality conditions for new residents of the residential units within the proposed development have been determined. Pollutant concentrations are predicted to be below the air quality objectives at the worst-case locations assessed; air quality conditions for new residents will thus be acceptable.

The proposed development has also been shown to meet the London Plan's requirement that new developments are at least 'air quality neutral'.

Overall, the construction and operational air quality impacts of the proposed development are judged to be 'not significant'.

Contents

1	Introduction	3
2	Policy Context and Assessment Criteria	4
3	Assessment Approach	11
4	Site Description and Baseline Conditions	16
5	Construction Phase Impact Assessment	19
6	Operational Phase Impact Assessment	24
7	Mitigation	28
8	Residual Impacts	30
9	Conclusions	31
10	References	32
11	Glossary	34
12	Appendices	36
A1	London-Specific Policies and Measures	37
A2	Construction Dust Assessment Procedure	40
A3	EPUK & IAQM Planning for Air Quality Guidance	47
A4	Professional Experience	53
A5	Modelling Methodology	55
A6	‘Air Quality Neutral’	62
A7	Construction Mitigation	64

1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed mixed-use development of 152-156 Kentish Town Road in Camden. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Marek Wojciechowski Architects.

1.2 The proposed development will see the existing building demolished and a new five-story building built to replace it. This building will provide retail space in the basement and on the ground floor, office space on the first floor, a dental surgery, and nine apartments over the second to fourth floors. It lies within a borough-wide Air Quality Management Area (AQMA) declared by Camden Council for exceedences of the nitrogen dioxide and PM_{10} objectives. The development will not provide any new car parking and as such is not expected to lead to a significant increase in traffic on the local roads. The new occupants of the apartments on the second to fourth floors will, however, be exposed to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.3 The air quality neutrality of the proposed development has also been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

1.4 GLA has also released Supplementary Planning Guidance on the Control of Dust and Emissions from Construction and Demolition (GLA, 2014b). The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will need to be applied.

1.5 This report describes existing local air quality conditions (2014), and the predicted air quality in the future assuming that the proposed development proceeds. The assessment of traffic-related impacts focuses on 2017, which is the anticipated year of opening. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.6 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with Camden Council.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) provides the policy framework (Defra, 2007) for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Planning Policy

National Policies

2.2 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should *"contribute to…reducing pollution"*. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the effects of pollution on health and the sensitivity of the area and the development should be taken into account.

2.3 More specifically the NPPF makes clear that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan".

2.4 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2014), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that *"Defra carries out an annual national assessment of air quality using* *modelling and monitoring to determine compliance with EU Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*".

2.5 The PPG states that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)".

2.6 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality"*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".*

The London Plan

2.7 The London Plan (GLA, 2015) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to air quality.

2.8 Policy 7.14, 'Improving Air Quality', addresses the spatial implications of the Mayor's Air Quality Strategy and how development and land use can help achieve its objectives. It recognises that Boroughs should have policies in place to reduce pollutant concentrations, having regard to the Mayor's Air Quality Strategy.

2.9 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

The Mayor's Air Quality Strategy

2.10 The revised Mayor's Air Quality Strategy (MAQS) was published in December 2010 (GLA, 2010). The overarching aim of the Strategy is to reduce pollution concentrations in London to achieve compliance with the EU limit values as soon as possible. The Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures. These additional measures and the role of the Low Emission Zone are described in Appendix A1.

2.11 The MAQS also addresses the issue of 'air quality neutral' and states that the "*GLA will work with boroughs to assist in the development of methodologies that will allow an accurate assessment of the impacts of the emissions of new developments*" (Para 5.3.19).

GLA SPG: Sustainable Design and Construction

2.12 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a) provides details on delivering some of the priorities in the London Plan. Section 4.3 covers Air Pollution. It defines when developers will be required to submit an air quality assessment, explains how location and transport measures can minimise emissions to air, and provides emission standards for gas-fired boilers, Combined Heat and Power (CHP) and biomass plant. It also sets out, for the first time, guidance on how Policy 7.14B(c) of the London Plan relating to 'air quality neutral' (see Paragraph 2.9, above) should be implemented.

GLA SPG: The Control of Dust and Emissions During Construction and Demolition

2.13 The GLA's SPG on The Control of Dust and Emissions During Construction and Demolition (GLA, 2014b) outlines a risk assessment based approach to considering the potential for dust generation from a construction site, and sets out what mitigation measures should be implemented to minimise the risk of construction dust impacts, dependent on the outcomes of the risk assessment. This guidance is largely based on the Institute of Air Quality Management's (IAQM) 2014 guidance on the Assessment of dust from demolition and construction (Institute of Air Quality Management, 2014), and it states that "*the latest version of the IAQM Guidance should be used*".

Local Policies

2.14 Camden Council's Draft Local Plan (Camden Council, 2016) includes a whole section on air quality. Within this, Policy CC4 states that:

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

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

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

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

2.15 Until the new Local Plan is adopted the Council's Local Development Framework from 2010 remains the relevant set of planning policy documents. The Local Development Framework Core Strategy (Camden Council, 2010) includes Policy CS16 on improving Camden's health and well-being, where it is stated that:

"The Council will seek to improve health and well-being in Camden. We will… recognise the impact of poor air quality on health and implement Camden's Air Quality Action Plan which aims to reduce air pollution levels".

2.16 The Core Strategy is supported by the Camden Development Policies document (Camden Council, 2010). Policy DP32 sets out how Camden will expect developments to reduce their impact on air quality:

"The Council will require air quality assessments where development could potentially cause significant harm to air quality. Mitigation measures will be expected in developments that are located in areas of poor air quality".

2.17 Camden Council has also prepared a Supplementary Planning Document - Camden Planning Guidance (CPG) 6 Amenity (Camden Council, 2011), which provides further guidance on air quality. It includes information on when an air quality assessment will be required, what an air quality assessment should cover and what measures can reduce air quality emissions and protect public exposure. The Council's overarching aim is for new development to be 'air quality neutral' and not lead to further deterioration of existing poor air quality. Mitigation and offsetting measures to deal with any negative air quality impacts associated with the development proposals may be required. The development should be designed to minimise exposure of occupants to existing poor air quality. It states that the Council requires assessments for:

"development that could have a significant negative impact in air quality. This impact can arise during both the construction and operational stages of a development as a result of increased NOx and PM_{10} emissions".

2.18 This assessment is written taking account of the contents of the CPG on Amenity.

Air Quality Action Plan

2.19 Camden Council has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough, and has developed an Air Quality Action Plan (Camden Council, 2014). This identifies actions and mitigating measures necessary to improve air quality in the borough. It sets out objectives to reduce transport emissions and any emissions associated with new development. Key objectives associated with new development include identifying the impact of new development on air quality and controlling emissions from construction sites.

Assessment Criteria

2.20 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.21 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2009). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour PM_{10} objective could be exceeded where the annual mean concentration is above 32 $\mu g/m^3$ (Defra, 2009). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedence of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 $\mu g/m^3$ it is unlikely that the 24-hour mean objective will be exceeded.

2.22 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2009). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

2.23 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.

2.24 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedences of the 24-hour mean PM_{10} objective are possible (Defra, 2009).

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

2.25 Guidance from IAQM (Institute of Air Quality Management, 2014) is that, with appropriate mitigation in place, the impacts of construction dust will be 'not significant'. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that impacts will normally be 'not significant'.

Operational Significance

2.26 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by Environmental Protection UK (EPUK) and IAQM[1] (EPUK & IAQM, 2015) has therefore been used. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in

[1] The IAQM is the professional body for air quality practitioners in the UK.

Appendix A3. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A4.

3 Assessment Approach

Consultation

3.1 The assessment follows a methodology agreed with Camden Council via an email exchange between Adam Webber (Senior Sustainability Officer (Air Quality) at Camden Council) and Ricky Gellatly (Air Quality Consultants) during February 2016.

Existing Conditions

3.2 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2016a) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2016). Local sources have also been identified through discussion with Camden Council, as well as through examination of the Council's Air Quality Review and Assessment reports.

3.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid. Whether there are current exceedences of the annual mean EU limit value for nitrogen dioxide in the study area has been determined using the maps of roadside concentrations published by Defra (2016c). These are the maps, currently based on 2014 data, used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedences of the limit value to the EU.

Construction Impacts

3.4 The construction dust assessment considers the potential for impacts within 350 m of the site boundary; or within 50 m of roads used by construction vehicles. The assessment methodology follows the GLA's SPG on the Control of Dust and Emissions During Construction and Demolition (GLA, 2014b), which is based on that provided by IAQM (Institute of Air Quality Management, 2014). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A2 explains the approach in more detail.

Road Traffic Impacts

Sensitive Locations

3.5 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of worst-case receptors located on the façade of the property closest to Kentish Town Road. Receptors have been modelled at the façade of the proposed residential apartments on the second, third and fourth floors, both at the roadside edge of the balcony and at the actual access points to the apartments themselves (the doors leading onto the balconies). These locations are shown in Figure 1 overlaid over a plan of the second floor. In addition, concentrations have been modelled at Camden's diffusion tube monitoring sites CA16 and CA23, the locations of which are shown later in this report in Figure 2, in order to verify the modelled results (see Appendix A5 for verification method).

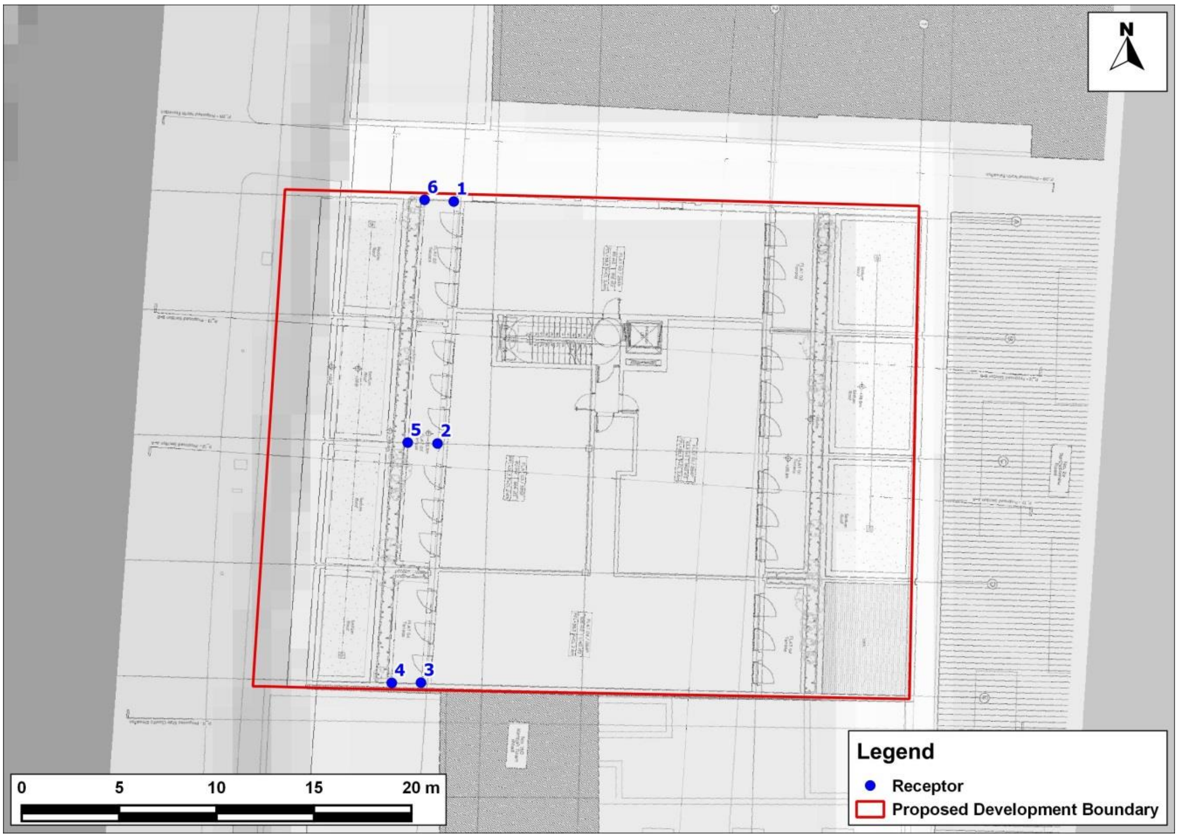

Figure 1: Receptor Locations

Contains Ordnance Survey data © Crown copyright and database right 2016. Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v1.0. Ordnance Survey licence number 100046099. Contains data from Marek Wojciechowski Architects drawing no. 15052 P_04.

Assessment Scenarios

3.6 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2014) for model verification purposes and the proposed year of opening (2017) for the impact assessment. In addition to the set of 'official' predictions, a sensitivity test has been carried out for nitrogen dioxide that involves assuming much higher nitrogen oxides emissions from certain vehicles than have been predicted by Defra. This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016a).

Modelling Methodology

3.7 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs, assumptions and the verification are provided in Appendix A5, together with the method used to derive current and future year background nitrogen dioxide concentrations. Where assumptions have been made a realistic worst-case approach has been adopted.

3.8 Parts of Kentish Town Road form canyon-like settings, with tall buildings either side of a fairly narrow road. Diffusion tube monitors CA23 and CA26 both lie within canyon-like stretches of road. The development building itself, however, is directly opposite a junction, which creates a large gap in the street canyon, and residential exposure is only proposed on the second floor and above (with the second-floor floor level being 7.2 m above ground level), higher than several of the other nearby buildings. The proposed apartments are also set well back from the kerb (11 m), as can be seen in Figure 1.

3.9 The approach taken for this assessment has been to not treat any of the roads in the model as street canyons, which is considered a realistic worst-case approach. The result of using this approach will be that the model will under-predict concentrations at the diffusion tube monitoring sites, which are both in quite canyon-like settings, as it will assume more dispersion to be taking place here than will actually occur. This will result in a higher verification factor and thus higher concentrations being predicted at the receptors within the proposed development, effectively applying some of the canyon-like dispersion environment of the diffusion tube monitoring sites to the development site without it having to be modelled as a very unrealistic very wide canyon. This is considered a much more realistic approach than assuming the development site to be within a canyon, which would result in minimal predicted pollutant dispersion between the road and the second-floor, recessed apartment façades.

Uncertainty in Road Traffic Modelling Predictions

3.10 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

3.11 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A5). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2014) concentrations.

3.12 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

3.13 Historically, large reductions in nitrogen oxides emissions have been projected, which has led to significant reductions in nitrogen dioxide concentrations from one year to the next being predicted. Over time, it was found that trends in measured concentrations did not reflect the rapid reductions that Defra and DfT had predicted (Carslaw et al., 2011). This was evident across the UK, although the effect appeared to be greatest in inner London; there was also considerable inter-site variation. Emission projections over the 6 to 8 years prior to 2009 suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25%, whereas monitoring data showed that concentrations remained relatively stable, or even showed a slight increase. Analysis of more recent data for 23 roadside sites in London covering the period 2003 to 2012 showed a weak downward trend of around 5% over the ten years (Carslaw and Rhys-Tyler, 2013), but this still falls short of the improvements that had been predicted at the start of this period. This pattern of no clear, or limited, downward trend is mirrored in the monitoring data assembled for this study, as set out later in Paragraph 4.6.

3.14 The reason for the disparity between the expected concentrations and those measured relates to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have had to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles has often been no better than that of earlier models. This has been compounded by an increasing proportion of nitrogen dioxide in the nitrogen oxides emissions, i.e. primary nitrogen dioxide, which has a significant effect on roadside concentrations (Carslaw et al., 2011) (Carslaw and Rhys-Tyler, 2013).

3.15 A detailed analysis of emissions from modern diesel vehicles has been carried out (AQC, 2016a). This shows that, where previous standards had limited on-road success, the 'Euro VI' and 'Euro 6' standards that new vehicles have had to comply with from 2013/16[2] are delivering real on-road

[2] Euro VI refers to heavy duty vehicles, while Euro 6 refers to light duty vehicles. The timings for meeting the standards vary with vehicle type and whether the vehicle is a new model or existing model.

improvements. A detailed comparison of the predictions in Defra's latest Emission Factor Toolkit (EFT v6.0.2) against the results from on-road emissions tests has shown that Defra's latest predictions still have the potential to under-predict emissions from some vehicles, albeit by less than has historically been the case (AQC, 2016a). In order to account for this potential under-prediction, a sensitivity test has been carried out in which the emissions from Euro IV, Euro V, Euro VI, and Euro 6 vehicles have been uplifted as described in Paragraph A5.6 in Appendix A5. The results from this sensitivity test are likely to over-predict emissions from vehicles in the future (AQC, 2016a) and thus provide a reasonable worst-case upper-bound to the assessment.

'Air Quality Neutral'

3.16 The guidance relating to air quality neutral follows a tiered approach, such that all developments are expected to comply with minimum standards for gas and biomass boilers and for CHP plant (GLA, 2014a). Compliance with 'air quality neutral' is then founded on emissions benchmarks that have been derived for both building (energy) use and road transport in different areas of London. Developments that exceed the benchmarks are required to implement on-site or off-site mitigation to offset the excess emissions (GLA, 2014a).

3.17 Appendix A6 of this report sets out the emissions benchmarks. The approach has been to calculate the emissions from the development and to compare them with these benchmarks.

4 Site Description and Baseline Conditions

4.1 The proposed development site is located on the eastern side of the busy Kentish Town Road, directly opposite the junction with Prince of Wales Road. This junction is signal-controlled, so traffic is likely to be stop-start and travelling at low speeds, which will result in higher vehicle emissions at the junction, in comparison with other sections of the road.

Industrial sources

4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2016a) and Environment Agency's 'what's in your backyard' (Environment Agency, 2016) websites has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality. Camden Council has also confirmed that there are none in the local area.

Air Quality Review and Assessment

4.3 Camden Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. The entire borough was declared an AQMA in 2002 for exceedences of the annual mean nitrogen dioxide objective and the 24-hour mean PM_{10} objective.

Local Air Quality Monitoring

4.4 Camden Council currently operates five automatic monitoring stations within its area but none of these are close to the proposed development site, all being over 2 km away. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Gradko (using the 50% TEA in acetone method). These include one deployed along Kentish Town Road some 375 m north of the proposed development and another along Camden Road some 600 m to the south of the proposed development. Results for the years 2009 to 2014 are summarised in Table 2 for these two sites and the monitoring locations are shown in Figure 2. Monitoring data have been provided by Camden Council. There are no nearby sites that measure PM_{10} or $PM_{2.5}$ concentrations.

Table 2: Summary of Nitrogen Dioxide Monitoring 2009-2014 (μg/m^3) [a]

Site No.	Site Type	Location	2009	2010	2011	2012	2013	2014
CA16	Roadside	Kentish Town Road	**68**	**74**	**57**	**59**	**65**	**61**
CA23	Roadside	Camden Road	**73**	**84**	**72**	**67**	**78**	**76**
Objective			**40**					

[a] Exceedences of the objectives are shown in bold

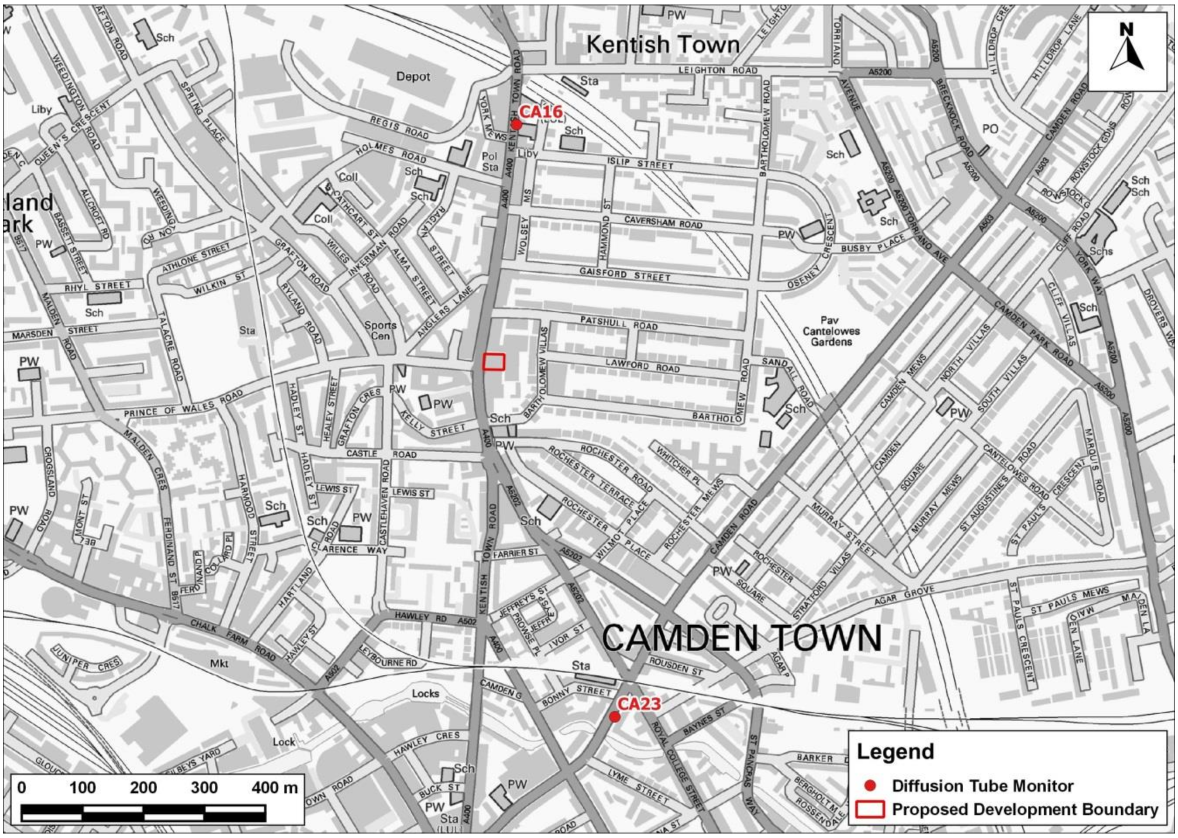

Figure 2: Monitoring Locations

Contains Ordnance Survey data © Crown copyright and database right 2016. Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v1.0. Ordnance Survey licence number 100046099.

4.5 The measured concentrations at both sites have been consistently well above the objective for the past six years. Measured concentrations have also exceeded 60 µg/m^3 in recent years, which indicates the potential for the 1-hour nitrogen dioxide objective to be exceeded. It is worth noting that both monitors lie within canyon-like settings, closer to the road than the development, and at street level.

4.6 There are no clear trends in monitoring results for the past six years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards (the implications of this are discussed in Section 3 of this report).

Exceedences of EU Limit Value

4.7 There are several AURN monitoring sites within the Greater London Urban Area that have measured exceedences of the annual mean nitrogen dioxide limit value. Furthermore, the national map of roadside annual mean nitrogen dioxide concentrations (Defra, 2016c), used to report exceedences of the limit value to the EU, identifies exceedences of this limit value in 2014 along many roads in London, including Kentish Town Road adjacent to the proposed development. The

Greater London Urban Area has thus been reported to the EU as exceeding the limit value for annual mean nitrogen dioxide concentrations. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations show no exceedences of the limit values anywhere in London. These maps are for 2014 concentrations (Defra, 2016c).

Background Concentrations

4.8 In addition to these locally measured concentrations, estimated background concentrations at the proposed development site have been determined for the opening year 2017 (Table 3). The background concentrations have been derived as described in Appendix A5. The background concentrations are all below the objectives.

Table 3: Estimated Annual Mean Background Pollutant Concentrations in 2017 (μg/m³)

Year	NO_2	PM_{10}	$PM_{2.5}$
2017 [a]	30.5	22.2	15.0
2017 Worst-case Sensitivity Test [b]	*31.3*	*N/A*	*N/A*
Objectives	**40**	**40**	**25** [b]

n/a = not applicable.

[a] In line with Defra's forecasts

[b] Assuming higher emissions from modern diesel vehicles as described in Appendix A5.

[c] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

5 Construction Phase Impact Assessment

5.1 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway.

Potential Dust Emission Magnitude

Demolition

5.2 There will be a requirement to demolish the existing 11 m high building with an approximate total volume of 5,780 m^3, which is primarily constructed of brick and concrete. Stripping out of the building is likely to take around two weeks and the demolition works around four weeks. The method of demolition has not yet been decided. Based on the example definitions set out in Table A2.1, the dust emission class for demolition is considered to be *medium.*

Earthworks

5.3 The site covers some 791 m^2 and most of this will be subject to earthworks, involving removal of the foundations of the demolished buildings and the excavation of the earth in the area that is to form the basement of the proposed development building. The earthworks will last around 14 weeks and dust will arise mainly from the handling of dusty materials, such as dry soil. It is anticipated that a maximum of seven earth-moving vehicles will be active on the site at any one time. Based on the example definitions set out in Table A2.1, the dust emission class for earthworks is considered to be *medium*.

Construction

5.4 The structural construction works will take place over an 18-week period and the total building volume will be considerably less than 25,000 m^3. Piling will be used but sand-blasting will not. Based on the example definitions set out in Table A2.1, the dust emission class for construction is considered to be *small*.

Trackout

5.5 It is anticipated that there will be no more than eight outward heavy vehicle movements per day, all of which will travel southbound along Kentish Town Road. Wheel washing facilities will be provided. Based on the example definitions set out in Table A2.1, the dust emission class for trackout is considered to be *small*.

5.6 Table 4 summarises the dust emission magnitude for the proposed development.

Table 4: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	Medium
Earthworks	Medium
Construction	Small
Trackout	Small

Sensitivity of the Area

5.7 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

5.8 The IAQM guidance, upon which the GLA's guidance is based, explains that residential properties are 'high' sensitivity receptors to dust soiling, while commercial premises are 'low' sensitivity receptors (Table A2.2). There are very few residential properties within 20 m of the site, just a few first, second and third floor apartments directly south of the development building (see Figure 3), along with fewer than ten commercial premises. There are considerably more receptors within 50 m of the site boundary, including both commercial and residential properties. Using the matrix set out in Table A2.3, the area surrounding the onsite works is of 'medium' sensitivity to dust soiling.

5.9 Table 4 shows that dust emission magnitude for trackout is 'small' and Table A2.3 thus explains that there is a risk of material being tracked 50m from the site exit. Vehicles leaving the site will all travel south along Kentish Town Road. There are more than ten residential properties within 20 m of the roads along which material could be tracked (see Figure 4), and Table A2.3 thus indicates that the area is of 'high' sensitivity to dust soiling due to trackout.

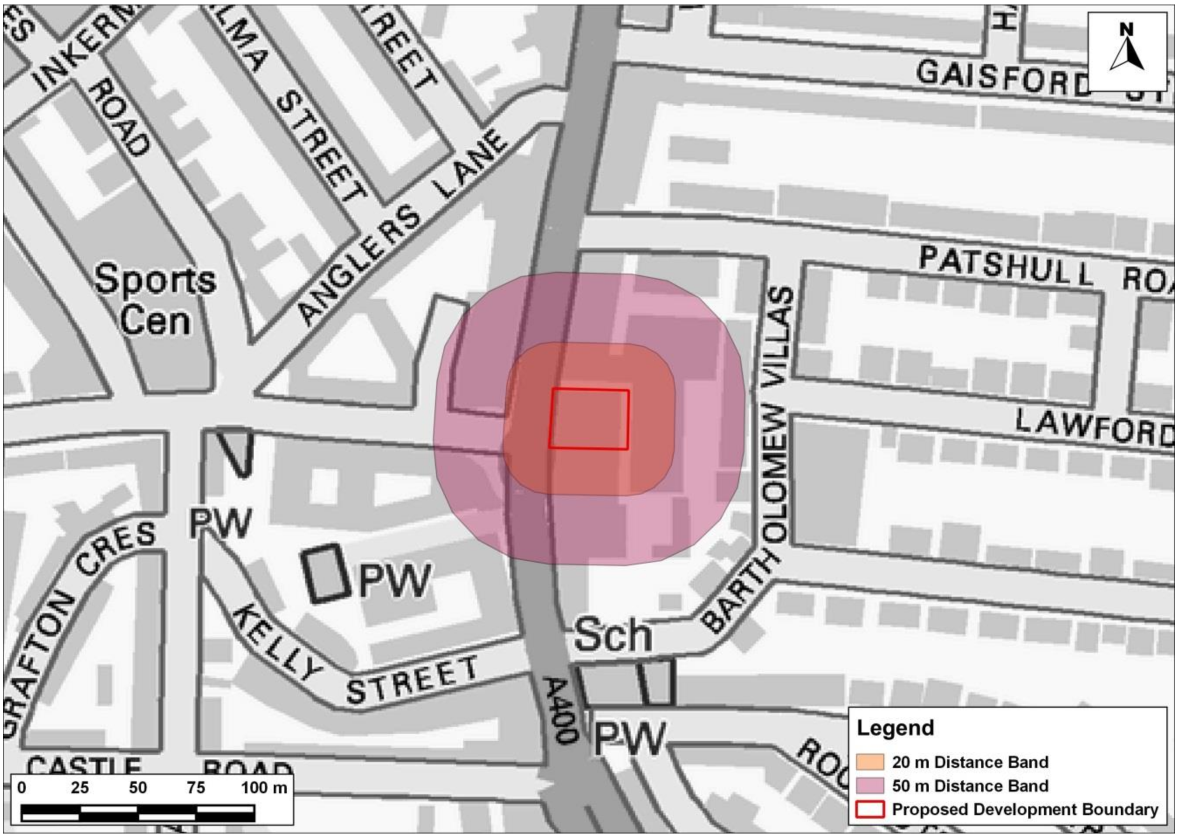

Figure 3: 20 m and 50 m Distance Bands around Site Boundary

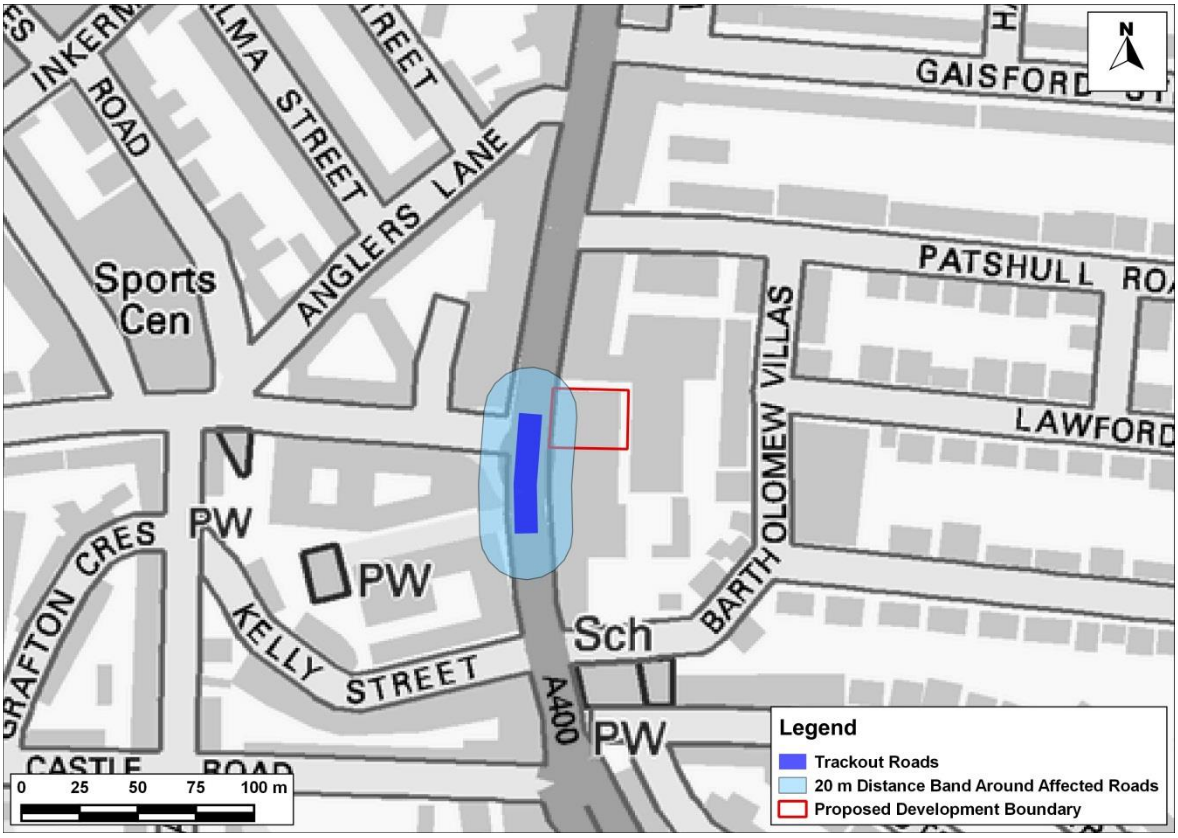

Figure 4: **20 m Distance Bands around Roads Used by Construction Traffic Within 50m of the Site Exit**

Sensitivity of the Area to any Human Health Effects

5.10 Residential properties are also classified as being of 'high' sensitivity to human health effects. The matrix in Table A2.4 requires information on the baseline annual mean PM_{10} concentration in the area. The maximum predicted PM_{10} concentration at the sensitive receptors within the proposed development is 22.9 µg/m^3 (see Table 7), and this value has been used. Using the matrix in Table A2.4, both the area surrounding the onsite works and the area surrounding roads along which material may be tracked from the site are of 'low' sensitivity to human health effects.

Sensitivity of the Area to any Ecological Effects

5.11 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of the site boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

Summary of the Area Sensitivity

5.12 Table 5 summarises the sensitivity of the area around the proposed construction works.

Table 5: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	Medium Sensitivity	High Sensitivity
Human Health	Low Sensitivity	Low Sensitivity

Risk and Significance

5.13 The dust emission magnitudes in Table 4 have been combined with the sensitivities of the area in Table 5 using the matrix in Table A2.6 in Appendix A2, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 6. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 7.

Table 6: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition	Medium Risk	Low Risk
Earthworks	Medium Risk	Low Risk
Construction	Low Risk	Negligible
Trackout	Low Risk	Negligible

5.14 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (Institute of Air Quality Management, 2014).

6 Operational Phase Impact Assessment

Road Traffic Impacts

6.1 Predicted air quality conditions for residents of the proposed development are set out in Table 7 for Receptors 1 to 6 (see Figure 1 for receptor locations). All of the values are below the relevant objective/criterion. Air quality for future residents of the development will thus be acceptable.

Table 7: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2017 for New Receptors in the Development Site

Receptor	Annual Mean NO_2 (µg/m^3)		Annual Mean PM_{10} (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)
	'Official' Prediction [a]	*Worst-case Sensitivity Test* [b]		
Second Floor (8.7 m Height)				
1a	37.5	*38.7*	22.9	15.4
2a	37.5	*38.7*	22.9	15.4
3a	37.4	*38.5*	22.9	15.4
4a	37.5	*38.6*	22.9	15.4
5a	37.6	*38.8*	22.9	15.4
6a	37.6	*38.8*	22.9	15.4
Third Floor (11.6 m Height)				
1b	35.0	*36.1*	22.6	15.2
2b	35.0	*36.0*	22.6	15.2
3b	35.0	*36.0*	22.6	15.2
4b	34.9	*36.0*	22.6	15.2
5b	35.0	*36.0*	22.6	15.2
6b	35.0	*36.0*	22.6	15.2
Fourth Floor (14.8 m Height)				
1c	33.4	*34.3*	22.5	15.1
2c	33.4	*34.3*	22.5	15.1
3c	33.4	*34.3*	22.5	15.1
4c	33.4	*34.3*	22.5	15.1
5c	33.4	*34.3*	22.5	15.1
6c	33.4	*34.3*	22.5	15.1
Objective / Criterion	**40**		**32** [c]	**25** [d]

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described in Paragraph A5.6.

[c] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedence of the 24-hour mean PM_{10} concentration is possible, as outlined in LAQM.TG(09) (Defra, 2009). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedence of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (EPUK & IAQM, 2015).

[d] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

'Air Quality Neutral'

6.2 In terms of the minimum standards, the proposed development will comply with the SPG; ultra-low NOx boilers (<40 mg NOx/kWh) will be installed.

Building Emissions

6.3 Each residential apartment will contain a 12 kW domestic gas-fired boiler with a NOx emission rate of 39 mg/kWh. The retail and office units will not have any combustion plant associated with them. Applying the extremely worst-case assumption that the boilers will all operate continuously throughout the year, the total NOx emission from all of the proposed boilers will be 36.9 kg/annum. Gas-fired boilers have extremely low PM_{10} emissions so it is not considered necessary to consider PM_{10} emissions and the development will be air quality neutral in terms of this pollutant. Appendix 6 shows the Building Emissions Benchmarks (BEBs) for each land use category, used in Table 8 to calculate the NOx BEBs for this development.

Table 8: Calculation of Building Emissions Benchmark for the Development

	Description	Value	Reference
A	Gross Internal Floor Area of Residential Units (m^2)	796	Marek Wojciechowski Architects
B	NOx BEB for Residential Units ($g/m^2/annum$)	26.2	Table A6.1
C	Gross Internal Floor Area of B1 Offices (m^2)	575	Marek Wojciechowski Architects
D	NOx BEB for B1 Offices ($g/m^2/annum$)	30.8	Table A6.1
E	Gross Internal Floor Area of A1 Retail (m^2)	1,170	Marek Wojciechowski Architects
F	NOx BEB for A1 Retail ($g/m^2/annum$)	22.6	Table A6.1
G	Gross Internal Floor Area of D1 Dental Surgery (m^2)	103	Marek Wojciechowski Architects
H	NOx BEB for D1 Dental Surgery ($g/m^2/annum$)	43.0	Table A6.1
Total BEB NOx Emissions (kg/annum)		**69.4**	(A x B + C x D + E x F + G x H) / 1000

6.4 The worst-case Total Building NOx Emission of 36.9 kg/annum is just over half of the Total BEB NOx Emission of 69.4 kg/annum. The proposed development is thus better than air quality neutral in terms of building emissions.

Road Transport Emissions

6.5 The proposed development includes no car parking provision and as such is expected to generate very few vehicle movements. It can therefore be concluded that the development will be better than air quality neutral in terms of transport emissions.

Significance of Operational Air Quality Impacts

6.6 The operational air quality impacts without mitigation are judged to be ‘not significant’. This professional judgement is made in accordance with the methodology set out in Appendix A3, and also takes into account the results of the worst-case sensitivity test for nitrogen dioxide. Future year concentrations are expected to lie between the two sets of results, but in order to provide a reasonable worst-case assessment, the judgement of significance focuses primarily on the results from the sensitivity test.

6.7 More specifically, the judgement that the air quality impacts will be ‘not significant’ without mitigation takes account of the assessment that pollutant concentrations for new residents of the residential apartments within the proposed development will be below the air quality objectives. New residents will, therefore, experience acceptable air quality.

7 Mitigation

Construction Impacts

7.1 Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby sensitive receptors.

7.2 The site has been identified as a *Low* to *Medium* Risk site during demolition and earthworks and as *Negligible* to *Low* Risk during construction works and for trackout, as set out in Table 6. The GLA's SPG on *The Control of Dust and Emissions During Construction and Demolition* (GLA, 2014b) describes measures that should be employed, as appropriate, to minimise the potential impacts, along with guidance on what monitoring should be undertaken during the construction phase. This reflects best practice experience and has been used, together with the professional experience of the consultant and the findings of the dust impact assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A7.

7.3 The mitigation measures should be written into a dust management plan (DMP). The GLA's guidance suggests that, for a Medium Risk site, automatic monitoring of particulate matter (as PM_{10}) will be required. It also states that, on certain sites, it may be appropriate to determine the existing (baseline) pollution levels before work begins. However, the guidance is clear that the Local Authority should advise as to the appropriate air quality monitoring procedure and timescale on a case-by-case basis. Given that this site is mostly Negligible to Low risk it may not be appropriate to recommend monitoring.

7.4 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

Road Traffic Impacts

7.5 The assessment has demonstrated that the scheme will not expose new sensitive receptors to unacceptable air quality. It is, therefore, not considered necessary to propose further mitigation measures for this scheme.

Good Design and Best Practice Measures

7.6 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:

- scheme design such that the most sensitive uses (residential) are highest up in the development building, with residential occupation only on the second floor and higher;
- setting back of the apartments from the road by 11 m;
- no provision car parking spaces, encouraging the use of sustainable transport;
- installation of solar panels on the roof to meet renewable targets rather than combustion plant, and
- installation of ultra-low NOx boilers only, with emission rates below 40 mg/kWh.

Air Quality Neutral

7.7 The air quality neutral policy is intended to minimise the cumulative impacts of many schemes throughout London. The proposed development has been shown to be better than air quality neutral, and should thus assist in this aim. No further mitigation is required for air quality neutral.

8 Residual Impacts

Construction

8.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be ‘not significant’. The mitigation measures set out in Section 7 and Appendix A7 are based on the IAQM guidance. With these measures in place and effectively implemented the residual effects are judged to be ’not significant’.

8.2 The IAQM guidance does, however, recognise that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be ’not significant’.

Road Traffic Impacts

8.3 The residual impacts will be the same as those identified in Section 6.

9 Conclusions

9.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be 'not significant'.

9.2 The impact of traffic emissions from local roads on the air quality for future residents has been assessed at six worst-case locations within the proposed development, on every residential floor. In the case of nitrogen dioxide, a sensitivity test has also been carried out which considers the potential under-performance of emissions control technology on modern diesel vehicles. The assessment has demonstrated that air quality conditions for new residents will be acceptable, with concentrations of all pollutants below the air quality objectives.

9.3 The proposed development also complies with the requirement that all new developments in London should be at least air quality neutral.

10 References

AQC (2014) *Air Quality Neutral Planning Support Update: GLA 80371*.

AQC (2016a) *Emissions of Nitrogen Oxides from Modern Diesel Vehicles* , [Online], Available: http://www.aqconsultants.co.uk/Resources/Download-Reports.aspx.

AQC (2016b) *Deriving Background Concentrations of NOx and NO2*, [Online], Available: http://www.aqconsultants.co.uk/Resources/Download-Reports.aspx.

Camden Council (2010) *Camden Core Strategy 2010-2025*.

Camden Council (2010) *Camden Development Policies 2010 - 2025, Local Development Framework*.

Camden Council (2011) *Camden Planning guidance - Amenity*.

Camden Council (2014) *Air quality action plan 2013 - 2015*, [Online], Available: http://www.camden.gov.uk/ccm/content/environment/air-quality-and-pollution/air-quality/filestorage/air-quality-action-plan-2009-2012.en.

Camden Council (2016) *Camden Local Plan Submission Draft*.

Carslaw, D., Beevers, S., Westmoreland, E. and Williams, M. (2011) *Trends in NOx and NO2 emissions and ambient measurements in the UK*, [Online], Available: uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf.

Carslaw, D. and Rhys-Tyler, G. (2013) *Remote sensing of NO2 exhaust emissions from road vehicles*, July, [Online], Available: http://uk-air.defra.gov.uk/assets/documents/reports/cat05/1307161149_130715_DefraRemoteSensingReport_Final.pdf.

DCLG (2014) *Planning Practice Guidance*, [Online], Available: http://planningguidance.planningportal.gov.uk/blog/guidance/.

Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Defra.

Defra (2009) *Review & Assessment: Technical Guidance LAQM.TG(09)*, Defra.

Defra (2016a) *UK Pollutant Release and Transfer Register*, [Online], Available: prtr.defra.gov.uk.

Defra (2016b) *Defra Air Quality Website*, [Online], Available: http://laqm.defra.gov.uk/.

Defra (2016c) *UK Ambient Air Quality Interactive Map*, [Online], Available: http://uk-air.defra.gov.uk/data/gis-mapping.

DfT (2011) *DfT Automatic traffic Counters Table TRA0305-0307*, [Online], Available: http://www.dft.gov.uk/pgr/statistics/datatablespublications/roads/traffic.

Directive 2008/50/EC of the European Parliament and of the Council (2008).

Directive 97/68/EC of the European Parliament and of the Council (1997).

Environment Agency (2016) *'what's in your backyard'*, [Online], Available: http://www.environment-agency.gov.uk/homeandleisure/37793.aspx.

EPUK & IAQM (2015) *Land-Use Planning & Development Control: Planning For Air Quality*, IAQM.

GLA (2010) *Mayor's Air Quality Strategy: Cleaning the Air*.

GLA (2013) *London Atmospheric Emissions Inventory (LAEI) 2010*.

GLA (2014a) *Sustainable Design and Construction Supplementary Planning Guidance*, [Online], Available: https://www.london.gov.uk/sites/default/files/Revised%20SD%26C%20SPG_0.pdf.

GLA (2014b) *The Control of Dust and Emissions from Construction and Demolition SPG*, [Online], Available: https://www.london.gov.uk/sites/default/files/Dust%20and%20Emissions%20SPG%208%20July%202014_0.pdf.

GLA (2015) *The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011*, [Online], Available: http://www.london.gov.uk/sites/default/files/London%20Plan%20March%202015%20%28FALP%29.pdf.

Institute of Air Quality Management (2014) *Guidance on the Assessment of Dust from Demolition and Construction*.

National Planning Policy Framework (2012), DCLG.

The Air Quality (England) (Amendment) Regulations, 2002, Statutory Instrument 3043 (2002), HMSO.

The Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000), HMSO.

11 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
BEB	Building Emissions Benchmark
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
$\mu g/m^3$	Microgrammes per cubic metre
MAQS	Mayor's Air Quality Strategy
NRMM	Non-road Mobile Machinery
NO	Nitric oxide
NO_2	Nitrogen dioxide

NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
SPG	Supplementary Planning Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEB	Transport Emissions Benchmark
ULEZ	Ultra Low Emission Zone

12 Appendices

A1 London-Specific Policies and Measures 37

A2 Construction Dust Assessment Procedure 40

A3 EPUK & IAQM Planning for Air Quality Guidance 47

A4 Professional Experience 53

A5 Modelling Methodology 55

A6 'Air Quality Neutral' 62

A7 Construction Mitigation 64

A1 London-Specific Policies and Measures

London Plan

A1.1 The London Plan sets out the following points in relation to planning decisions:

"Development proposals should:

a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs or where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3);

b) promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils "The control, of dust and emissions form construction and demolition";

c) be at least "air quality neutral" and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs));

d) ensure that where provision needs to made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-sire provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches;

e) where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."

The Mayor's Air Quality Strategy

A1.2 The Mayor's Air Quality Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures, including:

Policy 1 – Encouraging smarter choices and sustainable travel;

Measures to reduce emissions from idling vehicles focusing on buses, taxis, coaches, taxis, PHVs and delivery vehicles;

Using spatial planning powers to support a shift to public transport;

Supporting car free developments.

Policy 2 – Promoting technological change and cleaner vehicles:

Supporting the uptake of cleaner vehicles.

Policy 4 – Reducing emissions from public transport:

Introducing age limits for taxis and PHVs.

Policy 5 – Schemes that control emissions to air:

Implementing Phases 3 and 4 of the LEZ from January 2012

Introducing a NOx emissions standard (Euro IV) into the LEZ for Heavy Goods Vehicles (HGVs), buses and coaches, from 2015.

Policy 7 – Using the planning process to improve air quality:

Minimising increased exposure to poor air quality, particularly within AQMAs or where a development is likely to be used by a large number of people who are particularly vulnerable to air quality;

Ensuring air quality benefits are realised through planning conditions and section 106 agreements and Community Infrastructure Levy.

Policy 8 – Creating opportunities between low to zero carbon energy supply for London and air quality impacts:

Applying emissions limits for biomass boilers across London;

Requiring an emissions assessment to be included at the planning application stage.

Low Emission Zone (LEZ)

A1.3 A key measure to improve air quality in Greater London is the Low Emission Zone (LEZ). This entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects older, diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. The LEZ was introduced on 4th February 2008, and was phased in through to January 2012. From January 2012 a standard of Euro IV was implemented for lorries and other specialist diesel vehicles over 3.5 tonnes, and buses and coaches over 5 tonnes. Cars and lighter Light Goods Vehicles (LGVs) are excluded. The third phase of the LEZ, which applies to larger vans, minibuses and other specialist diesel vehicles, was also implemented in January 2012. As set out in the 2010 MAQS, a NOx emissions standard (Euro IV) is included in the LEZ for HGVs, buses and coaches, from 2015.

Ultra Low Emission Zone (ULEZ)

A1.4 The Mayor has confirmed the introduction of the Ultra Low Emission Zone (ULEZ) in the Capital on 7 September 2020. The ULEZ will operate 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches.

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM, upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix A7.

STEP 4: Determine Significant Effects

A2.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (Institute of Air Quality Management, 2014).

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be ‘not significant’.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Effects on People and Property from Dust Soiling [3]

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Low	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A2.4: Sensitivity of the Area to Human Health Effects [3]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

[3] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.5: Sensitivity of the Area to Ecological Effects [3]

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A3 EPUK & IAQM Planning for Air Quality Guidance

A3.1 The guidance issued by EPUK and IAQM[4] (EPUK & IAQM, 2015) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A3.4 The good practice principles are that:

[4] The IAQM is the professional body for air quality practitioners in the UK.

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".

A3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the follow apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use;
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A3.8 Coupled with any of the following:

- the development has more than 10 parking spaces;
- the development will have a centralised energy facility or other centralised combustion process.

A3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, the criteria for which are set out below. The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria is likely to be more appropriate.

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor;
- the development will have one or more substantial combustion processes where the combustion unit is:
  - any centralised plant using bio fuel;
  - any combustion plant with single or combined thermal input >300 kW; or
  - a standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year).
- the development will have a combustion unit of any size where emissions are at a height that may give rise to impacts through insufficient dispersion, e.g. through nearby buildings.

A3.10 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area.

A3.11 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Assessment of Significance

A3.12 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach developed by EPUK and IAQM[5] (EPUK & IAQM, 2015) has therefore been used. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

A3.13 There is no official guidance in the UK in relation to development control on how to assess the significance of air quality impacts. The approach developed by EPUK and IAQM[6] (EPUK & IAQM, 2015) has therefore been used. The guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either significant or not significant. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts. In such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

5 The IAQM is the professional body for air quality practitioners in the UK.

6 The IAQM is the professional body for air quality practitioners in the UK.

A3.14 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant.

A3.15 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A4 Professional Experience

Dr Clare Beattie, BSc (Hons) MSc PhD CSci MIEnvSc MIAQM

Dr Beattie is a Principal Consultant with AQC, with more than fifteen years' relevant experience. She has been involved in air quality management and assessment, and policy formulation in both an academic and consultancy environment. She has prepared air quality review and assessment reports, strategies and action plans for local authorities and has developed guidance documents on air quality management on behalf of central government, local government and NGOs. Dr Beattie has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has also provided support to the integration of air quality considerations into Local Transport Plans and planning policy processes. She has carried out numerous assessments for new residential and commercial developments, including the negotiation of mitigation measures where relevant. She has carried out BREEAM assessments covering air quality for new developments. Clare has worked closely with Defra and has recently managed the Defra Air Quality Grant Appraisal contract over a 4-year period. She is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is a Principal Consultant with AQC, with ten years' experience in the field of air quality including the detailed assessment of emissions from road traffic, airports, heating and energy plant, and a wide range of industrial sources including the thermal treatment of waste. He has experience in ambient air quality monitoring for numerous pollutants using a wide range of techniques and is also competent in the monitoring and assessment of nuisance odours and dust. Mr Caird has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Ricky Gellatly, BSc (Hons) AMIEnvSc MIAQM

Mr Gellatly is a Senior Consultant with AQC with over four years' relevant experience. Prior to joining AQC he worked as an air quality consultant at Odournet UK Ltd. He has also worked as an oceanographer, and holds a first class degree in meteorology and oceanography from the University of East Anglia. He has undertaken air quality assessments for a wide range of projects, assessing many different pollution sources using both qualitative and quantitative methodologies, with most assessments having included dispersion modelling (using a variety of models). He has assessed road schemes, energy from waste facilities, anaerobic digesters, poultry farms, urban extensions, rail freight interchanges, energy centres, waste handling sites, sewage works and shopping and sports centres, amongst others. He also has experience in ambient air quality monitoring, the analysis and interpretation of air quality monitoring data, monitoring and assessment of nuisance odours and the monitoring and assessment of construction dust.

Full CVs are available at www.aqconsultants.co.uk.

A5 Modelling Methodology

Model Inputs

A5.1 Predictions have been carried out using the ADMS-Roads dispersion model (v3.4). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the Emission Factor Toolkit (Version 6.0.2) published by Defra (2016b).

A5.2 The model has been run using the full year of meteorological data that correspond to the most recent set of nitrogen dioxide monitoring data (2014). The meteorological data have been taken from the monitoring station located at Heathrow Airport, which is considered suitable for this area.

A5.3 AADT flows, speeds, and vehicle fleet composition data have been taken from the London Atmospheric Emissions Inventory (LAEI) (GLA, 2013). The traffic data used in the impact assessment are summarised in Table A5.1.

Table A5.1: Summary of Traffic Data used in the Assessment (2017 AADT Flows)

Road Link	AADT	%Car	%Taxi	%LGV	%Rigid HDV	%Artic HDV	%Bus	%MC
Kentish Town Road (North of Site)	18,262	61.8	4.2	15.4	4.5	0.2	6.4	7.5
Kentish Town Road (South of Site)	18,262	61.8	4.2	15.4	4.5	0.2	6.4	7.5
Prince of Wales Road (East of Castlehaven Road)	8,516	78.4	3.1	8.6	5.4	1.2	1.8	1.5
Prince of Wales Road (West of Castlehaven Road)	11,093	79.0	3.1	8.6	5.2	1.2	1.4	1.5
Grafton Road	5,932	82.3	3.3	9.0	3.3	0.6	0.0	1.5
Castle Road	3,188	79.9	3.1	8.8	5.4	1.2	0.0	1.5
Castlehaven Road	8,466	81.9	3.3	9.0	3.6	0.8	0.0	1.5
Kentish Town Road (South of Castle Road)	16,689	64.1	3.2	13.2	3.2	0.1	6.8	9.4
Royal College Street	8,163	69.6	3.5	15.2	2.9	0.1	3.8	4.9

A5.4 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2011).

A5.5 Figure A5.1 shows the road network included within the model (traffic data for roads used in the model verification are provided in Table A5.3 below).

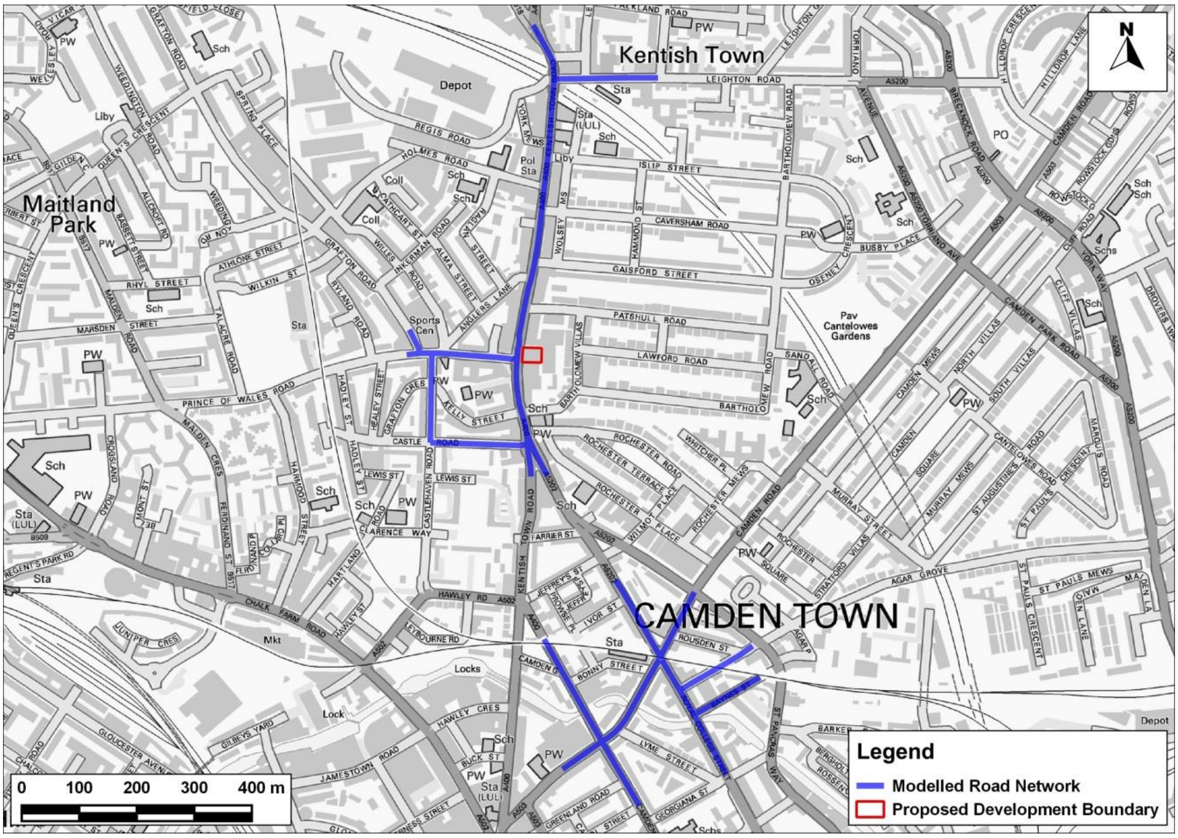

Figure A5.1: Modelled Road Network

Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

A5.6 As explained in Section 3, AQC has carried out a detailed analysis which showed that, where previous standards had limited on-road success in reducing nitrogen oxides emissions from diesel vehicles, the 'Euro VI' and 'Euro 6' standards are delivering real on-road improvements (AQC, 2016a). Furthermore, these improvements are expected to increase as the Euro 6 standard is fully implemented. Despite this, the detailed analysis suggested that, in addition to modelling using the EFT, a sensitivity test using elevated nitrogen oxides emissions from certain diesel should be carried out (AQC, 2016a). A worst-case sensitivity test has thus been carried out by applying the adjustments set out in Table A5.2to the emission factors used within the EFT[7]. The justifications for these adjustments are given in AQC (2016a). Results are thus presented for two scenarios: first the 'official prediction', which uses the EFT with no adjustment, and second the 'worst-case

[7] All adjustments were applied to the COPERT functions. Fleet compositions etc. were applied following the same methodology as used within the EFT.

sensitivity test', which applies the adjustments set out in Table A5.2. The results from this sensitivity test are likely to over-predict emissions from vehicles in the future and thus provide a reasonable worst-case upper-bound to the assessment.

Table A5.2: Summary of Adjustments Made to Emission Factor Toolkit

Vehicle Type		Adjustment Applied to Emission Factors
All Petrol Vehicles		No adjustment
Light Duty Diesel Vehicles	**Euro 5 and earlier**	No adjustment
	Euro 6	Increased by 60%
Heavy Duty Diesel Vehicles	**Euro III and earlier**	No adjustment
	Euro IV and V	Set to equal Euro III values
	Euro VI	Set to equal 20% of Euro III emissions [a]

[a] Taking account of the speed-emission curves for different Euro classes as explained in AQC (2016a).

Background Concentrations

A5.7 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030.

Background NO_2 Concentrations for Sensitivity Test

A5.8 The road-traffic components of nitrogen dioxide in the background maps have been uplifted in order to derive future year background nitrogen dioxide concentrations for use in the sensitivity test. Details of the approach are provided in the report prepared by AQC (2016b).

Model Verification

A5.9 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Background Concentrations

A5.10 The 2014 background concentrations for the diffusion tube sites have also been derived from the national maps, but are different to those at the proposed development site as the diffusion tubes lie in different grid squares. The background nitrogen dioxide concentration for 2014 used for site CA16 was 32.3 $\mu g/m^3$, while for site CA23 it was 35.5 $\mu g/m^3$.

Traffic Data

A5.11 Traffic data used in the model verification have also been derived from the LAEI and are presented in Table A5.3.

Table A5.3: 2014 AADT Traffic Data used in the Model Verification

Road Link	AADT	%Car	%Taxi	%LGV	%Rigid HDV	%Artic HDV	%Bus	%MC[a]
Kentish Town Road (North of Leighton Road)	18,067	61.8	4.2	15.4	4.5	0.2	6.4	7.5
Kentish Town Road (South of Leighton Road)	18,067	61.8	4.2	15.4	4.5	0.2	6.4	7.5
Leighton Road	7,877	81.2	3.2	8.9	4.3	0.9	0.0	1.5
Royal College Street (North of Camden Road)	8,076	69.6	3.5	15.2	2.9	0.1	3.8	4.9
Royal College Street (South of Camden Road)	11,161	70.6	3.6	15.0	5.1	0.1	1.3	4.3
Camden Road (North of Royal College Street)	27,549	69.4	3.5	13.3	4.3	0.2	3.0	6.4
Camden Road (South of Royal College Street)	27,672	68.5	3.4	14.0	3.6	0.1	4.0	6.4
Randolph Street	1,597	82.8	3.2	9.0	3.5	0.0	0.0	1.5
Baynes Street	1,869	69.5	2.6	7.5	8.9	2.0	8.5	1.1
Camden Street (North of Camden Road)	17,458	64.4	3.2	14.1	3.4	0.2	8.1	6.5
Camden Street (South of Camden Road)	20,392	74.3	3.6	11.9	1.8	0.1	1.0	7.3
Camden Road (South of Camden Street)	24,275	64.3	3.2	13.5	4.0	0.2	9.3	5.5

[a] Motorcycle.

Nitrogen Dioxide

A5.12 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 of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2014 at the CA16 and CA23 diffusion tube monitoring sites.

A5.13 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 4.1) available on the Defra LAQM Support website (Defra, 2016b).

A5.14 An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A5.2). The calculated adjustment factor of 2.412 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A5.15 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A5.3 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

A5.16 The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most road-traffic dispersion models, and was expected due to the canyon-like nature of the settings of these two diffusion tube monitors and the fact that they were not modelled as being within canyons (see Paragraphs 3.8 and 3.9).

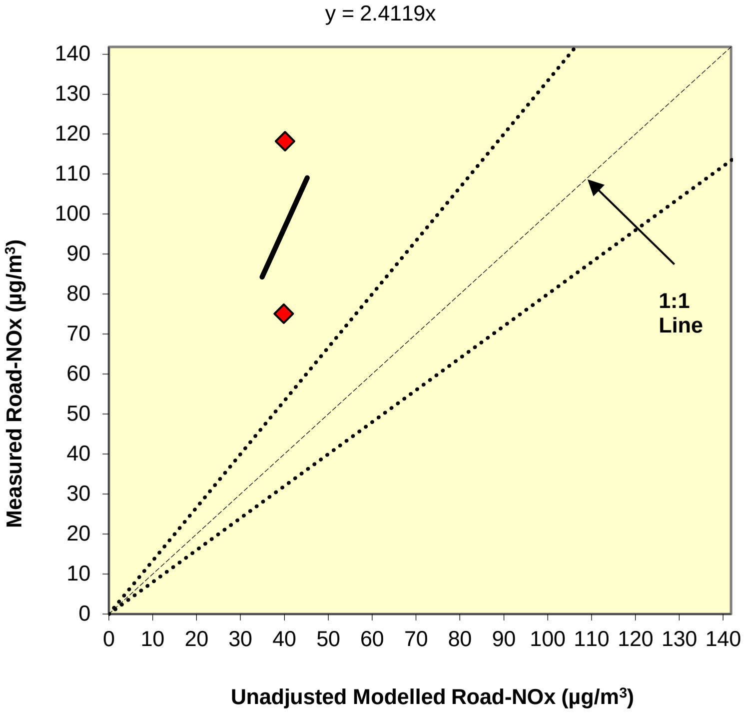

Figure A5.2: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

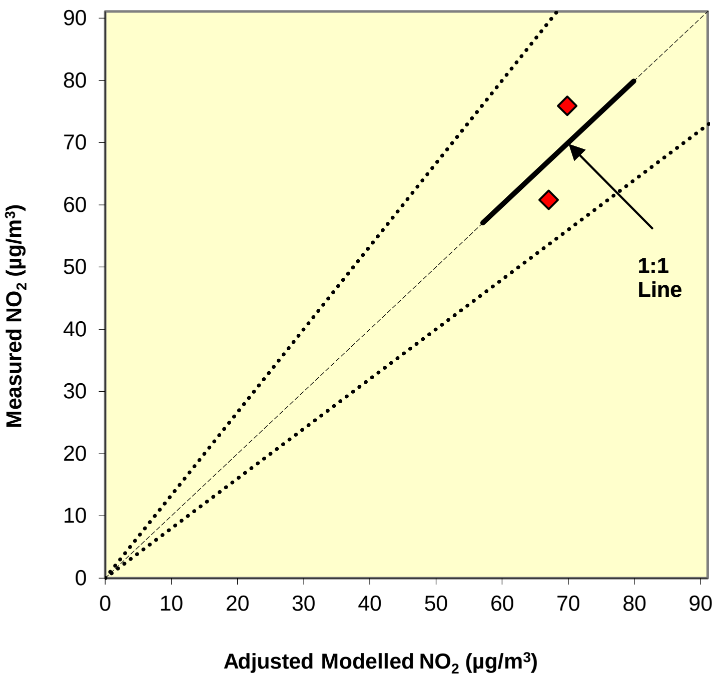

Figure A5.3: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

PM_{10} and $PM_{2.5}$

A5.17 There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor calculated for road NOx.

Model Verification for NOx and NO_2 Sensitivity Test

A5.18 The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 2.030, which has been applied to all modelled road-NOx concentrations within the sensitivity test.

Model Post-processing

A5.19 The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the adjustment factors set out above, which, along with the background NO_2, have been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2016b). The traffic mix within the calculator has been set to "All London traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

A6 'Air Quality Neutral'

A6.1 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a), and its accompanying Air Quality Neutral methodology report (AQC, 2014), provide an approach to assessing whether a development is air quality neutral. The approach is to compare the expected emissions from the building energy use and the car use associated with the proposed development against defined emissions benchmarks for buildings and transport in London.

A6.2 The benchmarks for heating and energy plant (termed 'Building Emissions Benchmarks' or 'BEBs') are set out in Table A6.1, while the 'Transport Emissions Benchmarks' ('TEBs') are set out in Table A6.2. In order to assess against the TEBs, it is necessary to combine the expected trip generation from the development with estimates of average trip length and average emission per vehicle. So as to ensure a consistent methodology, the report which accompanies the SPG (AQC, 2014) recommends that the information in Table A6.3 and Table A6.4 (upon which the TEBs are based) is used. Similarly, the information in Table A6.5 may be used if site-specific information are not available (AQC, 2014).

Table A6.1: Building Emissions Benchmarks (g/m^2 of Gross Internal Floor Area)

Land Use Class	NOx	PM_{10}
Class A1	22.6	1.29
Class A3 - A5	75.2	4.32
Class A2 and Class B1	30.8	1.77
Class B2 - B7	36.6	2.95
Class B8	23.6	1.90
Class C1	70.9	4.07
Class C2	68.5	5.97
Class C3	26.2	2.28
D1 (a)	43.0	2.47
D1 (b)	75.0	4.30
Class D1 (c -h)	31.0	1.78
Class D2 (a-d)	90.3	5.18
Class D2 (e)	284	16.3

Table A6.2: Transport Emissions Benchmarks

Land use	CAZ [a]	Inner [b]	Outer [b]
NOx (g/m²/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m²/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

[a] Central Activity Zone

[b] Inner London and Outer London as defined in the LAEI (GLA, 2013)

Table A6.3: Average Distance Travelled by Car per Trip

Land use	Distance (km)		
	CAZ	Inner	Outer
Retail (A1)	9.3	5.9	5.4
Office (B1)	3.0	7.7	10.8
Residential (C3)	4.3	3.7	11.4

Table A6.4: Average Road Traffic Emission Factors in London in 2010 (AQC, 2014)

Pollutant	g/vehicle-km		
	CAZ	Inner	Outer
NOx	0.4224	0.370	0.353
PM_{10}	0.0733	0.0665	0.0606

Table A6.5: Average Emissions from Heating and Cooling Buildings in London in 2010 (AQC, 2014)

	Gas (kg/kWh)		Oil (kg/kWh)	
	NOx	PM_{10}	NOx	PM_{10}
Domestic	0.0000785	0.00000181	0.000369	0.000080
Industrial/Commercial	0.000194	0.00000314	0.000369	0.000080

A7 Construction Mitigation

A7.1 The following is a set of measures that should be incorporated into the specification for the works:

Site Management

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- develop a Dust Management Plan (DMP);
- display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary;
- display the head or regional office contact information;
- record and respond to all dust and air quality pollutant emissions complaints;
- make a complaints log available to the local authority when asked;
- carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions are being carried out and during prolonged dry or windy conditions; and
- record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and ensure that the action taken to resolve the situation is recorded in the log book.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;

- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site; and
- carry out regular dust soiling checks of buildings within 100 m of site boundary and provide cleaning if necessary.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone;
- ensure all Non-road Mobile Machinery (NRMM) comply with the standards set within the GLA's Control of Dust and Emissions During Construction and Demolition SPG. This outlines that, from 1st September 2015, all NRMM of net power 37 kW to 560 kW used on the site of a major development in Greater London must meet Stage IIIA of EU Directive 97/68/EC (Directive 97/68/EC of the European Parliament and of the Council, 1997) and its subsequent amendments as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum. From 1st September 2020 NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum, while NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum;
- 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;
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using recycled water where possible and appropriate;
- use enclosed chutes, conveyors and covered skips;

- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- ensure water suppression is used during demolition operations;
- avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout

- avoid dry sweeping of large areas; and
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.