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# Squire and Partners





Twyman House, London NW1

Air Quality Assessment

By WSP Group

For CIT Developments Ltd

# QUALITY MANAGEMENT

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# CONTENTS

1	INTRODUCTION	1
2	RELEVANT LEGISLATION AND GUIDANCE	2
3	SCOPE AND METHODOLOGY	6
4	EXISTING CONDITIONS	11
5	ASSESSMENT OF IMPACTS, MITIGATION AND RESIDUAL EFFECTS	12
6	CONCLUSIONS	15

## FIGURE & APPENDICES

Figure 1	Location of Assessment Receptors	17
Appendix A	Glossary of Terms	19
Appendix B	Air Quality Standards & Objectives	20
Appendix C	Windrose - London City Airport 2010	23
Appendix D	Summary of Traffic Data used in the Assessment	24
Appendix E	Model Verification Calculations	25
Appendix F	Assessment Results	26

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# 1 INTRODUCTION

## 1.1 PROJECT BACKGROUND

1.1.1 WSP Environmental Ltd (WSPE) has been commissioned by CIT Development Limited to carry out an assessment of the potential air quality impacts arising from the proposed redevelopment of Tywman House in Camden to provide 55 residential dwellings plus some retail and office space.

1.1.2 The proposals do include a 30kWt gas fired CHP, however following consultation with the London Borough of Camden (LBC), a quantitative assessment of emissions to air from this boiler has been scoped out of the assessment given the small size of the CHP. Separate information regarding emissions from the proposed CHP will be submitted separately as part of the planning application.

1.1.3 As the proposed redevelopment will generate very little traffic, this assessment focuses only on the exposure of future occupants of the development to air pollution. In addition, this report discusses the potential air quality impacts that may arise during the construction phase and describes the mitigation measures that should be employed to minimise these.

1.1.4 A glossary of terms used is provided in **Appendix A**.

## 2 RELEVANT LEGISLATION AND GUIDANCE

### 2.1 AIR QUALITY STRATEGY FOR ENGLAND, SCOTLAND, WALES & NORTHERN IRELAND

2.1.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007<sup>1</sup>. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.1.2 The AQS sets standards and objectives for nine main air pollutants to protect health, vegetation and ecosystems. These are benzene (C<sub>6</sub>H<sub>6</sub>), 1,3 butadiene (C<sub>4</sub>H<sub>6</sub>), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), sulphur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), and polycyclic aromatic hydrocarbons (PAHs).

2.1.3 The air quality standards are concentration limits which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). Above these limits sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.1.4 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

2.1.5 For some pollutants, (e.g. NO<sub>2</sub>), there is both a long-term (annual mean) standard and a short-term standard. In the case of NO<sub>2</sub>, the short-term standard is for a 1-hour averaging period, whereas for PM<sub>10</sub> it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

2.1.6 The AQS published in 2007 replaces the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (January 2000) and Addendum (February 2003). The majority of objectives set out in the previous version of the AQS have been retained; however, the provisional objectives previously proposed for PM<sub>10</sub> have been replaced in England, Wales and Northern Ireland with a new framework for considering the effects of a finer group of particles known as 'PM<sub>2.5</sub>'. The introduction of this framework is based on increasing evidence that this size of particles can be more closely associated with observed adverse health affects than PM<sub>10</sub>. For PM<sub>2.5</sub> the objectives will take the form of a limit value ('backstop objective') and an 'exposure reduction' target. Although a target for PM<sub>2.5</sub> is included in the AQS, these objectives have not yet been incorporated into the Regulations. Consequently there is currently no requirement for local authorities to assess this pollutant as part of their statutory obligations.

2.1.7 Of the pollutants included in the AQS, NO<sub>2</sub> and PM<sub>10</sub> will be particularly relevant to this assessment as road traffic is a major source and concentrations of these pollutants tend to be close to air quality objectives in urban locations such as the proposed redevelopment site. Local authorities undertaking review and assessments of air quality are finding that, where road traffic is the dominant source of air pollution, the objectives for these pollutants are likely to be the most difficult to achieve. It is also generally considered that, where concentrations of NO<sub>2</sub> and PM<sub>10</sub> meet their respective objectives, and there are no other local sources of air pollution, such as from industrial processes, objectives for the other pollutants included in the regulations will also be achieved.

### 2.2 AIR QUALITY (ENGLAND) REGULATIONS

2.2.1 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000<sup>2</sup> and the Air Quality (England) (Amendment) Regulations 2002<sup>3</sup> for the purpose of Local Air Quality Management (LAQM). The standards and objectives for each pollutant in the AQS and the Regulations are given in **Appendix B**.

<sup>1</sup> The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) – July 2007.

<sup>2</sup> The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

<sup>3</sup> The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043

## 2.3 THE ENVIRONMENTAL PROTECTION ACT 1990 - CONTROL OF DUST AND PARTICULATES ASSOCIATED WITH CONSTRUCTION

2.3.1 Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

- 'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance', and
- 'any accumulation or deposit which is prejudicial to health or a nuisance'.

2.3.2 Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.3.3 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

## 2.4 LOCAL AIR QUALITY MANAGEMENT (LAQM)

2.4.1 Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives by the years defined in the Regulations. Where the objectives of the Air Quality Regulations are not likely to be achieved by the objective year, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

2.4.2 The Department for Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their review and assessment work<sup>4</sup>. This guidance, referred to in this report as LAQM.TG(09), has been used where appropriate in the assessment presented herein.

### London Borough of Camden's review and assessment of air quality

2.4.3 LBC has designated the whole Borough an AQMA due to measured and predicted exceedences of the AQS objectives for NO<sub>2</sub> and PM<sub>10</sub>. The conclusions of their most recent Updating and Screening Assessment, published in 2009, were that the AQS objective for annual mean NO<sub>2</sub> concentrations is still being exceeded across the Borough, and that there is the potential for exceedences of the objective for hourly mean NO<sub>2</sub> concentrations at locations adjacent to busy roads; however the objective for daily mean PM<sub>10</sub> concentrations was being achieved.

### The Mayor's Air Quality Strategy

2.4.4 In 2010 the GLA/Mayor of London published a new Mayor's Air Quality Strategy for London<sup>5</sup>. This strategy is focused on improving London's air quality and it explains the current air quality experienced across London and gives predictions of future levels of pollution. The sources of this pollution are outlined and a comprehensive set of policies and proposals are set out that will improve air quality in the London Boroughs.

2.4.5 The strategy sets out a framework for delivering improvements to London's air quality and includes measures aimed at reducing emissions from transport, homes, offices and new developments, promoting smarter more sustainable travel, as well as raising awareness of air quality issues.

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<sup>4</sup> Department for Environment, Food and Rural Affairs (DEFRA): *Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09)* (Feb 2009).

<sup>5</sup> Mayor of London: *Cleaning London's air, The Mayor's Air Quality Strategy* (December 2010)

## 2.5 NATIONAL PLANNING POLICY

### **Planning Policy Statement 23 (PPS23): Planning and Pollution Control**

2.5.1 Policy guidance for local planning authorities (in England only) regarding local air quality and new development is provided in PPS23<sup>6</sup>. PPS23 advises on the policies and practices that should be taken into account by those involved in the planning of any development that has the potential to cause pollution.

2.5.2 With regard to emissions to air, and specifically local air quality management, Appendix 1G of Annex 1 in PPS23 states that 'any air quality consideration that relates to land use and its development is capable of being a material planning consideration'. This is most likely to be the case in situations where the proposed development could produce an exceedance of the AQS objectives and result in an AQMA designation, or where development is proposed in an AQMA, or where a proposed development renders a Local Authority's AQAP unworkable. PPS23 also re-iterates that the presence of an AQMA should not result in the sterilisation of a site from development.

## 2.6 LOCAL PLANNING POLICY

### **London Borough of Camden Core Strategy (November 2010)**

2.6.1 Policy DP32 – Air Quality and Camden's Clear Zone states that:

*'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.'*

*The Council will also only grant planning permission for development in the Clear Zone region that significantly increases travel demand where it considers that appropriate measures to minimise the transport impact of development are incorporated. We will use planning conditions and legal agreements to secure Clear Zone measures to avoid, remedy or mitigate the impacts of development schemes in the Central London Area.'*

### **Camden Planning Guidance (2006)**

2.6.2 The Camden Planning Guidance document provides examples of cases where air quality assessments are required as part of planning application submissions, and the level of information that the assessment report should contain.

### **The London Plan (Consolidated with Alterations since 2004)**

2.6.3 Policy 4A.19 Improving air quality states:

*'The Mayor will and boroughs should, implement the Mayor's Air Quality Strategy and achieve reductions in pollutant emissions and public exposure to pollution by:*

- *improving the integration of land use and transport policy and reducing the need to travel especially by car;*
- *promoting sustainable design and construction;*
- *promoting sustainable construction to reduce emissions from the demolition and construction of buildings;*
- *ensuring at the planning application stage, that air quality is taken into account along with other material considerations, and that formal air quality assessments are undertaken where appropriate, particularly in designated Air Quality Management Areas;*
- *seeking to reduce the environmental impacts of transport activities by supporting the increased provision of cleaner transport fuels, including hydrogen, particularly with respect to the refuelling infrastructure;*
- *working in partnership with relevant organisations, taking appropriate steps to achieve an integrated approach to air quality management and to achieve emissions reductions through improved energy efficiency and energy use.*

*The Mayor will work with strategic partners to ensure that the spatial, transport and design policies of this plan support his Air Quality Strategy'.*

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<sup>6</sup> Communities and Local Government: *Planning Policy Statement 23: Planning and Pollution Control* (Oct 2004).

## **Consolidated Draft Replacement London Plan (December 2010)**

2.6.4 Policy 7.14 of the Draft Replacement Plan is specific to air quality and states that development proposals should promote sustainable design and construction in order to reduce emissions associated with the demolition and construction of buildings. The policy also states a detailed air quality assessment is required where biomass boilers are included within the development proposals and that developments should aim to be 'air quality neutral' and not lead to further deterioration of existing poor air quality, such as areas designated as AQMAs.

### **London Councils Guidance for Air Quality Assessments**

2.6.5 The London Councils have published guidance<sup>7</sup> for undertaking air quality assessments in the London Boroughs, the majority of which have declared AQMAs. The guidance sets out suggested methods for undertaking such an assessment within the London area and provides a methodology to assist in determining the impacts of a development proposal on air quality. The main message of the document is, as above, that the factor of greatest importance will generally be the difference in air quality as a result of the proposed development.

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<sup>7</sup> London Councils (January 2007) *Air Quality and Planning Guidance – Revised version*.



# 3 SCOPE AND METHODOLOGY

## 3.1 SCOPE

3.1.1 The scope of the assessment has been determined in the following way:

- consultation with the Environmental Health Department of LBC to discuss the availability of monitoring data, the assessment methodology to be applied and obtain a copy of their latest review and assessment report;
- review of air quality data for the area surrounding the site, including data from DEFRA's<sup>8</sup> website;
- desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and
- review of the traffic flow data provided by TTP Consulting, which has been used as an input to the air quality assessment.

## 3.2 METHODOLOGY

### Construction phase

3.2.1 During the construction phase, activities undertaken on the application site may cause dust and particulate matter to be emitted to the atmosphere.

3.2.2 Dust comprises particles typically in the size range 1-75 micrometres ( $\mu\text{m}$ ) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity to the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

3.2.3 The smaller particles of dust (typically less than  $10\mu\text{m}$  in aerodynamic diameter) are known as particulate matter ( $\text{PM}_{10}$ ) and represent only a small proportion of total dust released. As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, and can therefore be transported by wind over a wider area.  $\text{PM}_{10}$  is small enough to be drawn into the lungs during breathing, which in sensitive members of the public could cause an adverse reaction. As a result of this potential impact on health, standards and objectives for  $\text{PM}_{10}$  are defined in the AQS and Regulations.

3.2.4 A qualitative assessment of the potential impacts due to the generation and dispersion of dust and  $\text{PM}_{10}$  during the construction phase has been undertaken using information in guidance documents produced by the following organisations:

- Building Research Establishment (BRE)<sup>9</sup>;
- Quality of Urban Air Review Group (QUARG)<sup>10</sup>; and
- Department of the Environment (DoE)<sup>11</sup>.

3.2.5 The Greater London Authority and London Councils have produced guidance<sup>12</sup> for the London Boroughs that looks at best practicable means to control dust and emissions from construction sites. This guidance has also been referred to in this assessment.

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<sup>8</sup> <http://laqm1.defra.gov.uk/review/tools/background.php>

<sup>9</sup> Kukadia, V., Upton, S. L. and Hall, D. J.; *Control of dust from Construction and Demolition Activities*. BRE (Feb 2003).

<sup>10</sup> Quality of Urban Air Review Group: *Airborne Particulate Matter in the United Kingdom – Third Report of the Quality of Urban Air Review Group*. Prepared for the Department of the Environment (May 1996).

<sup>11</sup> Arup Environmental and Ove Arup and Partners: *The Environmental Effects of dust from Surface Mineral Workings Volume 2*. Prepared for Department of the Environment Minerals Division (Dec 1995).

<sup>12</sup> London Councils and Greater London Authority: *The control of dust and emissions from construction and demolition – Best Practice Guidance* (November 2006).

3.2.6 As there are no formal assessment criteria for dust and PM<sub>10</sub> generation and dispersion during construction, the significance of impacts associated with this phase of the proposed redevelopment has been determined qualitatively by:

- identifying the construction activities associated with the proposed redevelopment which could generate dust and PM<sub>10</sub> and their likely duration;
- identifying sensitive receptors (e.g. schools, residential properties) within 200m of the construction site boundary; and
- the prevailing wind direction.

3.2.7 Exhaust emissions from construction vehicles will have an impact on local air quality both on-site and adjacent to the routes used by these vehicles to access the site. As information on the number of vehicles associated with construction phase is not available, a qualitative assessment of their impact on local air quality has been undertaken by considering:

- the level of construction traffic likely to be generated by this phase of the redevelopment;
- the number and distance of sensitive receptors in the vicinity of the site and along the likely routes to be used by construction vehicles; and
- the likely duration of the construction phase and the nature of the construction activities undertaken.

### **Operational phase**

#### *Exposure of future residents to air pollution*

3.2.8 The proposed redevelopment will generate very little traffic once operational. Therefore the assessment of the operational phase will only focus on the exposure of the future residents of the redevelopment to air pollution concentrations that may exceed the AQS objectives. LBC has declared the whole of the Borough as an AQMA due to predicted exceedences of the objectives for NO<sub>2</sub> and PM<sub>10</sub>. This air quality assessment will therefore only consider concentrations of these two pollutants at the Site.

3.2.9 For the prediction of pollution concentrations at the Site, the air pollutant dispersion model ADMS Roads has been used. This model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user.

3.2.10 Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the Met Office observing station at London City Airport. This station is considered to provide data representative of the conditions at the proposed redevelopment site. The meteorological data used for this assessment was from 2010; a windrose is shown in **Appendix C**.

3.2.11 For the assessment, two scenarios were modelled. These scenarios are as follows:

- 2010 “model verification”; and
- 2013 “future baseline”.

3.2.12 2013 is the anticipated opening year of the proposed redevelopment.

3.2.13 A summary of the traffic data and pollutant emission factors used in the assessment can be found in **Appendix D**. It includes details of Annual Average Hourly Traffic flows (AAHTs), average vehicle speeds and the percentage of Heavy Goods Vehicles (HGVs) for the local road network in all assessment years considered.

3.2.14 Annual mean oxides of nitrogen (NO<sub>x</sub>) concentrations predicted by the DMRB screening tool were converted to annual mean NO<sub>2</sub> concentrations using the methodology given in LAQM.TG(09) and the NO<sub>x</sub>:NO<sub>2</sub> calculator available from DEFRA’s website. The calculator provides a method of calculating NO<sub>2</sub> from NO<sub>x</sub> wherever NO<sub>x</sub> emissions from road traffic are predicted.

3.2.15 For PM<sub>10</sub>, the modelled annual mean concentrations were used to calculate the number of exceedences of the 24-hour mean objective for direct comparison with the relevant AQS objective, following the methodology given in LAQM.TG(09).

3.2.16 LAQM.TG(09) does not provide a method for the conversion of annual mean NO<sub>2</sub> concentrations to 1 hour mean NO<sub>2</sub> concentrations. However, research carried out in 2003<sup>13</sup>, determined that exceedences of the 1 hour mean objective were unlikely to occur where annual mean concentrations were below 60µg/m<sup>3</sup>. Further research carried out in 2008<sup>14</sup> generally supported this relationship and as a result this criterion has been adopted for the purposes of local air quality review and assessment.

3.2.17 Quantitative assessments of the impacts on local air quality from road traffic emissions associated with the operation of the redevelopment have been completed against the current statutory standards and objectives for NO<sub>2</sub> and PM<sub>10</sub> set out in **Appendix B**.

*Model validation and verification*

3.2.18 The ADMS Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose.

3.2.19 Model validation undertaken by the software developer will not have included validation in the vicinity of the development considered in this assessment. To determine the performance of the model at a local level it is therefore advisable to perform a comparison of modelled results with local monitoring data at one or more relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

3.2.20 Suitable local monitoring data for the purpose of model verification is available for concentrations of NO<sub>2</sub> at the location shown in Error! Reference source not found..

**Table 1 Local monitoring data sources suitable for model verification**

Location & Site Classification	O.S. Grid Reference	Distance to Site (metres)	2010 Monitored NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )
Camden Road (Roadside Diffusion tube)	529173, 184129	15	66.86

3.2.21 Model verification has been undertaken following the methodology specified in Annex 3 of LAQM.TG(09) using the NO<sub>x</sub>:NO<sub>2</sub> calculator available from DEFRA's website to calculate the roadside NO<sub>x</sub> component of the annual mean NO<sub>2</sub> concentrations measured at the diffusion tube site. Details of the verification calculations are presented in **Appendix CE**.

3.2.22 A factor of **4.72** was obtained during the verification process and this factor has been applied to the predicted NO<sub>x</sub> roads component before addition of the relevant background NO<sub>x</sub> concentrations and conversion to annual mean NO<sub>2</sub> concentrations.

3.2.23 Local monitoring data is not available for concentrations of PM<sub>10</sub>; as such final modelling results for this pollutant have been verified using the factor calculated for adjusting the modelled NO<sub>x</sub> roads concentrations. This approach is considered to be appropriate according to guidance given in LAQM.TG(09).

*Significance criteria*

3.2.24 In determining both the significance of exposure to air pollution and the levels of mitigation required, consideration has been given to the Air Pollution Exposure Criteria (APEC) published in the London Councils guidance and shown in **Table 2** below.

<sup>13</sup> D Laxen and B Marner: *Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites* (July 2003).

<sup>14</sup> A Cook: *Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective* (2008).

**Table 2: London Councils' Air Pollution Exposure Criteria**

APEC Level	Applicable Range	Applicable Range	Recommendation
	Annual average NO <sub>2</sub>	PM <sub>10</sub>	
A	> 5% below national objective	<b>Annual Mean</b> > 5% below national objective <b>24 hour mean</b> > 1 day less than the national objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national objective	<b>Annual Mean</b> Between 5% below or above national objective <b>24 hour mean</b> Between 1 day above or below the national objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., maximise distance from pollution source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised.
C	> 5% above national objective	<b>Annual Mean</b> > 5% above national objective <b>24 hour mean</b> > 1 day more than the national objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures.

*Sensitive Receptors*

3.2.25 Sensitive locations are those where the public may be exposed to pollutants from the Site. These will include locations sensitive to an increase in dust deposition as a result of on-site construction activities, or exposure to gaseous pollutants from exhaust emissions from construction site traffic and traffic associated with the proposed redevelopment, once it becomes operational.

3.2.26 Locations with a high sensitivity to dust generated by construction activities include hospitals and clinics, hi-tech industries, painting and furnishing and food processing. Locations classed as being moderately sensitive to dust include schools, residential areas and food retailers.

3.2.27 In terms of locations that are sensitive to gaseous pollutants emitted from engine exhausts, these will include places where members of the public will be exposed to pollution over the period of time that they are present, and therefore the most suitable AQS averaging period of the pollutant needs to be used for assessment purposes.

3.2.28 For instance, on a footpath where exposure will be transient (for the duration of passage along that path) comparison with a short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school or adjacent to a private dwelling, where exposure may be for longer periods, comparison with a long-term standard (such as 24 hour mean or annual mean) may be more appropriate. In general terms, long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

3.2.29 To complete the exposure assessment, pollution concentrations were predicted at a number of locations across the proposed redevelopment site. Details of these assessment receptors are provided in **Table 3** below and their locations are shown on **Figure 1**.

**Table 3: Details of Assessment Receptors**

Receptor	Description	Height above ground level (m)
1	Location A - Ground Floor	1.8
2	Location A - First Floor	5.0
3	Location A - Second Floor	8.0
4	Location B1 - Ground Floor	1.8
5	Location B1 - First Floor	5.0
6	Location B1 - Second Floor	8.0
7	Location B1 - Third Floor	11.0
8	Location B1 - Fourth Floor	14.0
9	Location B2 - Ground Floor	1.8
10	Location B2 - First Floor	5.0
11	Location B2 - Second Floor	8.0
12	Location B2 - Third Floor	11.0
13	Location B2 - Fourth Floor	14.0
14	Location C1 - Ground Floor	1.8
15	Location C1 - First Floor	5.5
16	Location C1 - Second Floor	8.5
17	Location C1 - Third Floor	11.5
18	Location C2 - Ground Floor	1.8
19	Location C2 - First Floor	5.5
20	Location C2 - Second Floor	8.5
21	Location C2 - Third Floor	11.5
22	Location D1 – Ground Floor	1.8
23	Location D1 – First Floor	5.0
24	Location D2 – Ground Floor	1.8
25	Location D2 – First Floor	5.5

## 4 EXISTING CONDITIONS

### 4.1 LOCAL EMISSION SOURCES

4.1.1 The proposed redevelopment site is located in an area where air quality is mainly influenced by emissions from road transport. There are no industrial pollution sources in the immediate vicinity of the site that will influence the local air quality.

### 4.2 BACKGROUND AIR QUALITY DATA

4.2.1 Background concentrations for the assessment have been taken from the London Borough of Brent's continuous urban background monitoring site at St Mary's Primary School (525173, 183297). Annual mean NO<sub>x</sub>, NO<sub>2</sub> and PM<sub>10</sub> concentrations have been obtained from this monitoring station for 2010 and factored forward to 2013 using scaling factors obtained from DEFRA's website.

4.2.2 **Table 4** shows the measured and estimated background concentrations of NO<sub>x</sub>, NO<sub>2</sub>, and PM<sub>10</sub> that were used in the assessment.

**Table 4: Background concentrations used in the assessment (µg/m<sup>3</sup>)**

Pollutant	2010	2013
NO <sub>x</sub>	50.59	44.23
NO <sub>2</sub>	35.37	31.78
PM <sub>10</sub>	20.12	19.37

4.2.3 The table above shows that for all years, the background concentrations of NO<sub>2</sub> are below the objective limit of 40µg/m<sup>3</sup> to be achieved by 2005 and thereafter. The background concentrations of PM<sub>10</sub> also meet the objective limit of 40µg/m<sup>3</sup> to be achieved by 2004 and thereafter.

### 4.3 LOCAL AIR QUALITY MONITORING DATA

4.3.1 Concentrations of NO<sub>2</sub> measured in the vicinity of the proposed redevelopment site by LBC for the last three full calendar years for which data is available are provided in **Table 5**.

**Table 5: LBC Monitoring Data (µg/m<sup>3</sup>)**

Site	Grid Reference	Type	2008	2009	2010
CA18 - North Bridge House	528672,183642	Kerbside	56.7	61.7	53.9
CA19 - Inverness St, nr Camden High St	528815,183909	Roadside	41.5	45.7	41.4
CA23 - Camden Road	529173,184129	Roadside	66.5	73.0	66.9

4.3.2 The results show that the AQS objective for annual mean NO<sub>2</sub> concentrations was exceeded at all monitoring stations within the vicinity of the proposed redevelopment site between 2008 and 2010. CA23 - Camden Road is the nearest monitoring station to the proposed redevelopment site. Annual mean NO<sub>2</sub> concentrations measured at this monitoring station over the last three years were above 60µg/m<sup>3</sup>. Consequently, exceedences of the AQS objective for hourly NO<sub>2</sub> concentrations could be occurring at this location.

4.3.3 No clear trend in concentrations was demonstrated at any of the monitoring stations between 2008 and 2010.

# 5 ASSESSMENT OF IMPACTS, MITIGATION AND RESIDUAL EFFECTS

## 5.1 IMPACT

### Construction phase

#### *Construction sources of dust and PM<sub>10</sub>*

5.1.1 The main sources of dust and PM<sub>10</sub> during construction activities include:

- haulage routes, vehicles and construction traffic;
- materials handling, storage, stockpiling, spillage and disposal;
- exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- site preparation and restoration after completion;
- demolition;
- construction and fabrication processes; and
- internal and external finishing and refurbishment.

5.1.2 The majority of the releases are likely to occur during the 'working-week'. However, for some potential release sources, e.g. exposed soil produced from significant earthwork activities, in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

5.1.3 Depending on wind speed and turbulence it is likely that the majority of dust generated by construction activities will be deposited in the area immediately surrounding the source (up to 200 metres away). The prevailing wind direction at the proposed redevelopment site is from the south-west with frequent winds from the north and east. Consequently, properties to the north-east of the proposed redevelopment site are the most likely to experience an increase in dust deposition during the construction phase, followed by properties to the south and west, respectively.

5.1.4 There a number of residential properties located within 200m of the proposed redevelopment site, which will be sensitive to an increase in dust deposition, including properties along Camden Road, Camden Street, Royal College Street, Lyme Street, Ivor Street, Baynes Street and Rousden Street.

5.1.5 By consideration of the factors described above the overall impact of dust deposition would therefore be temporary, short-medium term, local in effect and of a **moderate adverse** significance. Any adverse impacts resulting from the generation and dispersion of PM<sub>10</sub> during construction are likely to be temporary, short-term and of **moderate adverse** significance.

#### *Release of emissions to air from construction traffic*

5.1.6 The impact on air quality from traffic associated with this phase of the proposed redevelopment will be in the areas immediately adjacent to the principal means of site access for construction traffic. The impacts are therefore considered to be temporary, short-medium term, local and of **moderate to minor adverse** significance.

### Operational phase

5.1.7 Full results of the dispersion modelling are presented in **Appendix F**, and a summary is provided below.

#### *Annual mean NO<sub>2</sub> concentrations*

5.1.8 The objective for annual mean NO<sub>2</sub> concentrations is 40µg/m<sup>3</sup> to be achieved by the end of 2005 and thereafter.

5.1.9 The results of the assessment show that in 2013, the anticipated opening year of the proposed redevelopment, exceedences of the objective are predicted to occur up to and including the second floor for Blocks A,

B and C. At Block D, exceedences are predicted to occur on both the ground and first floors. The highest concentration on the proposed redevelopment site is  $52.74\mu\text{g}/\text{m}^3$ , predicted at Location B1 on the ground floor.

5.1.10 These results agree with the review and assessment work undertaken by LBC which concluded that exceedences of the AQS objective for annual mean  $\text{NO}_2$  concentrations were occurring across the Borough

5.1.11 According to the London Councils' Air Pollution Exposure Criteria (APEC), the exposure of future occupants to annual mean  $\text{NO}_2$  concentrations ranges from APEC C to APEC A depending upon the height above ground and distance away from Camden Road.

#### *Hourly mean $\text{NO}_2$ concentrations*

5.1.12 The annual mean  $\text{NO}_2$  concentrations predicted across the proposed redevelopment were all below  $60\mu\text{g}/\text{m}^3$ , and therefore exceedences of the hourly mean  $\text{NO}_2$  concentration objective are considered unlikely to occur in 2013.

#### *Annual mean $\text{PM}_{10}$ concentrations*

5.1.13 The objective for annual mean  $\text{PM}_{10}$  concentrations is a concentration of  $40\mu\text{g}/\text{m}^3$  to be achieved by the end of 2004 and thereafter. The results of the assessment show that in 2013 this objective is predicted to be met across the whole of the proposed redevelopment site. The highest concentration is  $24.40\mu\text{g}/\text{m}^3$ , predicted at Location B1 on the ground floor.

5.1.14 These results agree with the review and assessment work undertaken by LBC which concluded that exceedences of the AQS objectives for  $\text{PM}_{10}$  concentrations were no longer occurring within the Borough.

5.1.15 The exposure of future occupants of the proposed redevelopment to annual mean  $\text{PM}_{10}$  concentrations is considered to be APEC A.

#### *24 hour mean $\text{PM}_{10}$ concentrations*

5.1.16 The objective for 24 hourly mean  $\text{PM}_{10}$  concentrations is  $50\mu\text{g}/\text{m}^3$  to be exceeded no more than 35 times a year by the end of 2004 and thereafter. The results of the assessment show that this objective is predicted to be met at all locations across the proposed redevelopment site. In 2013 the maximum number of days of exceedence is 11, which is below the objective.

5.1.17 These results agree with the review and assessment work undertaken by LBC, which concluded that exceedences of the AQS objectives for  $\text{PM}_{10}$  concentrations were no longer occurring within the Borough.

5.1.18 The exposure of future occupants of the proposed redevelopment to 24 hour mean  $\text{PM}_{10}$  concentrations is considered to be APEC A.

## 5.2 MITIGATION

### **Construction phase**

5.2.1 A number of mitigation methods should be implemented, as appropriate including:

- vehicles carrying loose aggregate and workings should be sheeted at all times;
- implementation of design controls for construction equipment and vehicles and use of appropriately designed vehicles for materials handling;
- completed earthworks should be covered or vegetated as soon as is practicable;
- regular inspection and, if necessary, cleaning of local highways and site boundaries to check for dust deposits (and removal if necessary);
- minimise surface areas of stockpiles (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up;
- use of dust-suppressed tools for all operations;
- ensuring that all construction plant and equipment is maintained in good working order and not left running when not in use;
- restrict on-site movements to well within site and not near the perimeter, if possible; and



- no unauthorised burning of any material anywhere on site.

5.2.2 The most effective mitigation for construction traffic will be achieved by ensuring vehicles are kept clean (through the use of wheel washers, etc) and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

### Operational phase

5.2.3 Given that the objective for annual mean NO<sub>2</sub> concentrations is predicted to be exceeded at a number of locations on the proposed redevelopment site, mechanical ventilation will be required to be fitted to all residential units on the ground, first, and second floors of the proposed redevelopment. The intakes for the mechanical ventilation system should either include filters to remove NO<sub>2</sub> from the air being drawn in or be located outside of the predicted area of exceedence so as to draw 'clean' air into the units.

## 5.3 RESIDUAL EFFECTS

### Construction phase

5.3.1 The greatest potential for an increase in dust deposition to occur will be within 200 metres of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance. With appropriate use of mitigation measures and good site management the residual effects of dust generation and deposition would be **minor adverse**.

5.3.2 The potential for short-term releases of PM<sub>10</sub> from materials handling and site plant will remain following mitigation. However, reducing the use of site plant and equipment near sensitive receptors and implementing the mitigation measures outlined above would result in **minor adverse** residual effects.

5.3.3 The residual effects of emissions from construction vehicles will be **minor adverse to negligible**.

### Operational phase

5.3.4 According to the Air Pollution Exposure Criteria produced by the London Councils, the proposed redevelopment is considered to be APEC A to C for NO<sub>2</sub> concentrations and APEC A for PM<sub>10</sub> concentrations.

5.3.5 However, the potential exposure of future occupants of the proposed redevelopment will be reduced through the installation of a whole house mechanical ventilation system, and consequently is considered to accord with local planning policy, which states that '*Mitigation measures will be expected in developments that are located in areas of poor air quality*'.

## 6 CONCLUSIONS

6.1.1 A qualitative assessment of the potential impacts on local air quality from construction activities on the proposed redevelopment has been carried out. This showed that during site activities releases of dust and PM<sub>10</sub> were likely to occur. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM<sub>10</sub> releases will be reduced and excessive releases prevented. The residual effects of the construction phase on air quality are considered to be **minor adverse to negligible**.

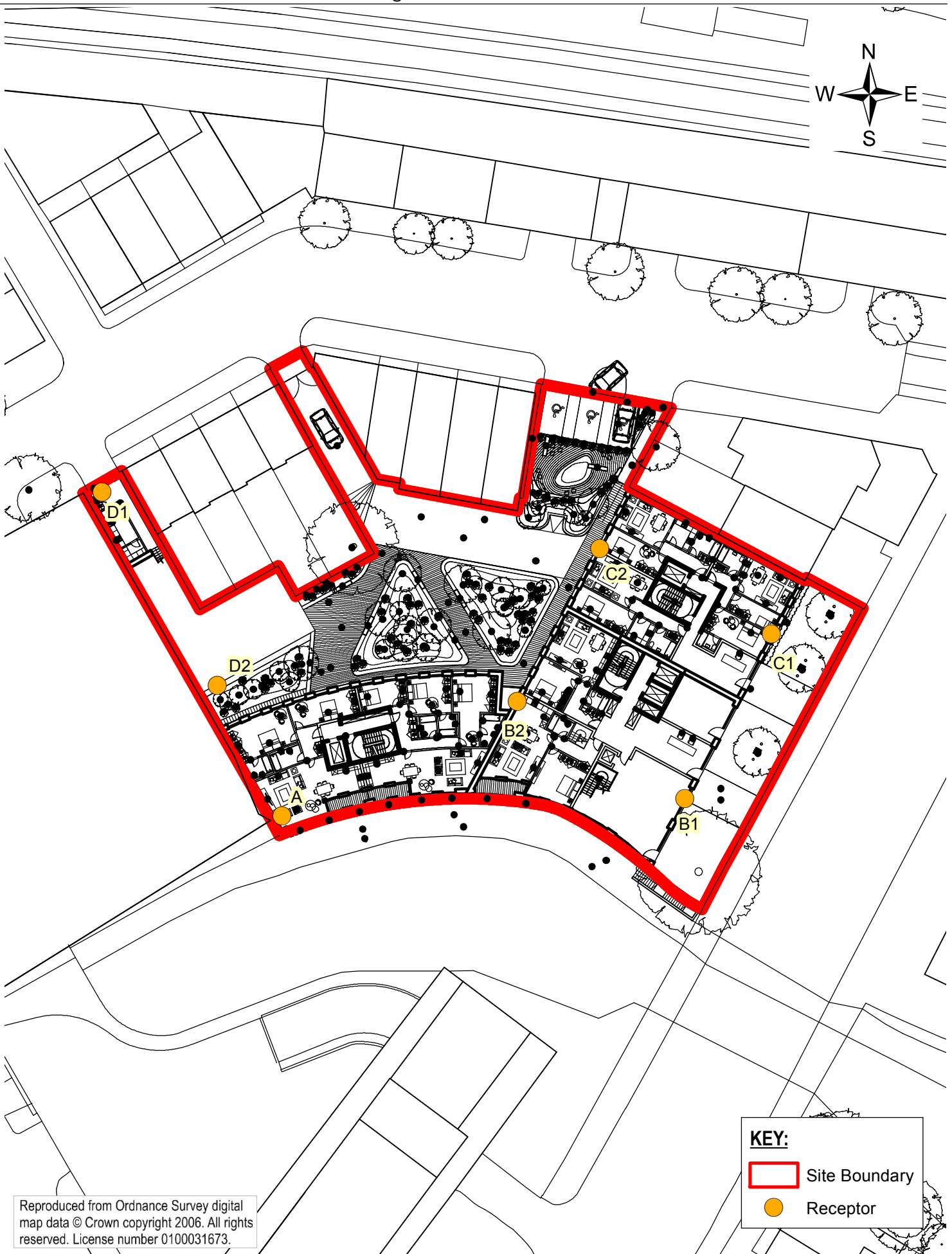
6.1.2 In addition, a quantitative assessment of the potential exposure of future occupants of the proposed redevelopment to air pollution was undertaken using the detailed dispersion model ADMS Roads. The results of the modelling show that the AQS objectives for PM<sub>10</sub> would be met across the whole of the proposed redevelopment site but that exceedences of the annual mean objective for NO<sub>2</sub> concentrations may occur at a number of locations on the proposed redevelopment site. In Blocks A, B and C, these exceedences are predicted up to and including the second floor. In Block D, exceedences are predicted on both the ground and first floors.

6.1.3 According to the Air Pollution Exposure Criteria produced by the London Councils, the proposed redevelopment is considered to be APEC A to C for NO<sub>2</sub> concentrations and APEC A for PM<sub>10</sub> concentrations.

6.1.4 However, the potential exposure of future occupants of the proposed redevelopment will be reduced through the installation of a whole house mechanical ventilation system, and consequently is considered to accord with local planning policy, which states that '*Mitigation measures will be expected in developments that are located in areas of poor air quality*'.



# FIGURE & APPENDICES

# FIGURE 1 – LOCATION OF ASSESSMENT RECEPTORS



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**KEY:**

-  Site Boundary
-  Receptor

## Appendix A Glossary of Terms

Term	Definition
<b>AADF/T Annual Average Daily Flow/Total</b>	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
<b>Air quality objective</b>	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
<b>Air quality standard</b>	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
<b>Annual mean</b>	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
<b>AQMA</b>	Air Quality Management Area.
<b>DEFRA</b>	Department for Environment, Food and Rural Affairs.
<b>Emission rate</b>	The quantity of a pollutant released from a source over a given period of time.
<b>Exceedence</b>	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
<b>HDV/HGV</b>	Heavy Duty Vehicle/Heavy Goods Vehicle.
<b>LAQM</b>	Local Air Quality Management.
<b>Model adjustment</b>	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
<b>NO<sub>2</sub></b>	Nitrogen dioxide.
<b>NO<sub>x</sub></b>	Nitrogen oxides.
<b>PM<sub>10</sub></b>	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
<b>µg/m<sup>3</sup> microgrammes per cubic metre</b>	A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m <sup>3</sup> means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
<b>Validation (modelling)</b>	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
<b>Verification (modelling)</b>	Comparison of modelled results versus any local monitoring data at relevant locations.

## Appendix B Air Quality Standards & Objectives

A summary of the current air quality objectives for the seven pollutants detailed in the *Air Quality Regulations 2000 and (Amendment) Regulations 2002* for the purpose of Local Air Quality Management is provided below.

Air Quality Objectives currently included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	Applies to	Standard		Objective		EU AQ Daughter Directive
		Concentration	Measured as	Annual exceedences allowed	Target date	
Benzene (C <sub>6</sub> H <sub>6</sub> )	All UK	16.25µg/m <sup>3</sup>	running annual mean		31.12.2003	
	England and Wales	5µg/m <sup>3</sup>	annual mean		31.12.2010	As standard. target: 01.01.2010
	Scotland	3.25µg/m <sup>3</sup>	running annual mean		31.12.2010	
1,3-Butadiene (C <sub>4</sub> H <sub>6</sub> )	All UK	2.25µg/m <sup>3</sup>	running annual mean		31.12.2003	
Carbon monoxide (CO)	All UK	10mg/m <sup>3</sup>	maximum daily running 8 hour mean		31.12.2003	As standard. target: 01.01.2005
Lead (Pb)	All UK	0.5µg/m <sup>3</sup>	annual mean		31.12.2004	As standard. target: 01.01.2005 <sup>8</sup>
	All UK	0.25µg/m <sup>3</sup>	annual mean		31.12.2008	
Nitrogen dioxide (NO <sub>2</sub> )	All UK	200µg/m <sup>3</sup>	1 hour mean	18	31.12.2005	As objective. target: 01.01.2010
	All UK	40µg/m <sup>3</sup>	annual mean		31.12.2005	As standard. target: 01.01.2010
Particulate Matter (PM <sub>10</sub> ) (gravimetric) <sup>1</sup>	All UK	40µg/m <sup>3</sup>	annual mean		31.12.2004	As standard. target: 01.01.2005
	All UK	50µg/m <sup>3</sup>	24 hour mean	35	31.12.2004	As objective. target: 01.01.2005
	Scotland	50µg/m <sup>3</sup>	24 hour mean	7	31.12.2010	As objective. target: 01.01.2010
	Scotland	18µg/m <sup>3</sup>	annual mean		31.12.2010	
Sulphur dioxide (SO <sub>2</sub> )	All UK	266µg/m <sup>3</sup>	15 minute mean	35	31.12.2005	
	All UK	350µg/m <sup>3</sup>	1 hour mean	24	31.12.2004	As objective. target: 01.01.2005
	All UK	125µg/m <sup>3</sup>	24 hour mean	3	31.12.2004	As objective. target: 01.01.2005

**Provisional Air Quality Objectives currently NOT included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)**

Pollutant	Applies to	Standard		Objective		EU AQ Daughter Directive
		Concentration	Measured as	Annual exceedences allowed	Target date	
Polycyclic aromatic hydrocarbons (PAHs) <sup>2</sup>	All UK	0.25ng/m <sup>3</sup> B[a]P <sup>3</sup>	annual mean		31.12.2010	
Particulate Matter (PM <sub>2.5</sub> ) (gravimetric) <sup>1,2</sup>	UK (except Scotland)	25µg/m <sup>3</sup>	annual mean	-	2020	As standard Target 2010
	Scotland	12µg/m <sup>3</sup>	annual mean	-	2020	25µg/m <sup>3</sup> Target 2015
	UK urban areas	Target of 15% reduction in concentrations at urban background	annual mean	-	Between 2010 and 2020	Target 20% reduction in concentrations at urban background Target Between 2010 and 2020

**Other Air Quality Strategy Objectives**

Pollutant	Applies to	Standard		Objective		EU AQ Daughter Directive
		Concentration	Measured as	Annual exceedences allowed	Target date	
For the protection of human health						
Ozone (O <sub>3</sub> ) <sup>4</sup>	All UK	100µg/m <sup>3</sup>	maximum daily running 8 hour mean	10	31.12.2005	As objective; but 25 annual exceedences target: 01.01.2010
For the protection of vegetation and ecosystems <sup>5</sup>						
Nitrogen oxides (NO <sub>x</sub> ) <sup>6</sup>		30µg/m <sup>3</sup>	annual mean		31.12.2000 <sup>7</sup>	As standard. target: 19.07.2001
Sulphur dioxide (SO <sub>2</sub> )		20µg/m <sup>3</sup>	annual mean		31.12.2000 <sup>7</sup>	As standard. target: 19.07.2001
		20µg/m <sup>3</sup>	winter mean (1 October to 31 March)		31.12.2000 <sup>7</sup>	As standard. target: 19.07.2001



**Explanation:**

ng/m<sup>3</sup> = nanogram per cubic metre;

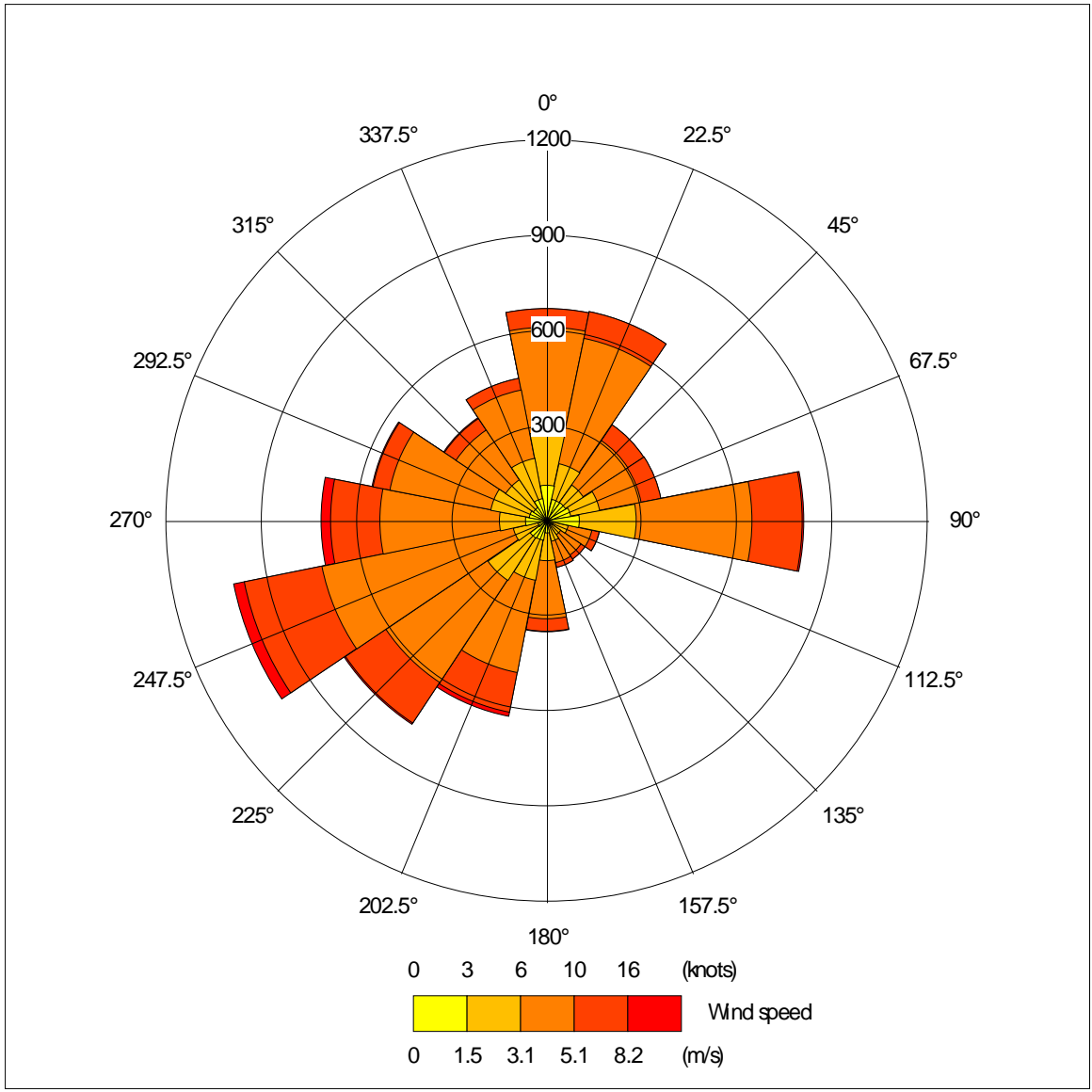
µg/m<sup>3</sup> = microgram per cubic metre;

mg/m<sup>3</sup> = milligrams per cubic metre (i.e. microgram per cubic meter x 1,000);

- 1 Measured using the European gravimetric transfer sampler or equivalent.
- 2 Objective to be set in regulations in the future.
- 3 Concentration of Benzo[a]pyrene (B[a]P) to be measured as a marker for the total mixture of PAHs.
- 4 The objective for this pollutant is provisional and must be tackled at a national level due to its trans-boundary nature.
- 5 Only applies to those parts of the UK > 20km from an agglomeration; and > 5km from Part A processes, motorways and built up areas of > 5,000 people.
- 6 Assuming NO<sub>x</sub> is taken as NO<sub>2</sub>.
- 7 These objectives have successfully been achieved.
- 8 Also an EU AQ Directive Limit Value of 1µg/m<sup>3</sup> to be achieved by 01.01.2010 in the immediate vicinity (1000 m) of certain named industrial sources situated on sites contaminated by decades of industrial activities.

The Air Quality Strategy states that further review and assessment and consultation in relation to air quality will be a rolling process, with additional revisions to the objectives for selected pollutants as appropriate, or where there is new evidence in relation to the effects of pollutants on health or ecosystems. New pollutants may be introduced through future reviews.

# Appendix C Windrose – London City Airport 2010



## Appendix D Summary of Traffic Data used in the Assessment

The tables below show the data that was used in the assessment of traffic impacts on local air quality. Given the location of the proposed redevelopment, it has been assumed that there will be no traffic growth on the local road network between 2010 and 2013.

### 2010 Verification and 2013 Future Baseline

Road link	Speed (km/hour)	Annual Average Hourly Flows (AAHT)	%HGV
Royal College Street (north of St Pancras Way)	32	614	6.1
Royal College Street (north of Camden Road)	40	299	7.1
St Pancras Way	40	482	7.0
Royal College Street (south of Camden Road)	40	499	3.8
Kentish Town Road (north of Camden Street)	40	798	9.0
Camden Street	32	858	11.5
Camden Road (east of Camden Street)	40	1353	6.3
Camden Road (west of Camden Street)	40	1164	12.2
Kentish Town Road (South of Camden Street)	40	350	11.1
Camden High Street	40	520	7.4

## Appendix E Model Verification Calculations

Model verification has been undertaken following the methodology specified in Annex 3 of the Technical Guidance LAQM.TG(09). The NO<sub>x</sub>:NO<sub>2</sub> calculator available from DEFRA's website was used to calculate the roadside NO<sub>x</sub> component of the annual mean NO<sub>2</sub> concentrations measured at the diffusion tube site summarised in the table below.

A correction factor of **4.72** was obtained during the verification process. This factor has been applied to the predicted Road-NO<sub>x</sub> contribution before addition of the appropriate background concentration to determine total predicted annual mean NO<sub>2</sub> concentrations.

Monitoring Site	Type	2009 Monitored Annual Mean NO <sub>2</sub> Conc. (µg/m <sup>3</sup> )	Background		Monitored Road-NO <sub>x</sub> (µg/m <sup>3</sup> )	Modelled Road NO <sub>x</sub> (µg/m <sup>3</sup> )	Ratio
			NO <sub>x</sub>	NO <sub>2</sub>			
Camden	Roadside	66.86	50.59	35.37	100.53	21.31	4.72

## Appendix F Assessment Results

Receptor	Description	Height above ground level (m)	Concentrations (ug/m <sub>3</sub> )					
			Annual mean NO <sub>2</sub>	APEC	Annual mean PM <sub>10</sub>	APEC	24 Hour mean PM <sub>10</sub>	APEC
1	Location A - Ground Floor	1.8	<b>43.85</b>	C	21.76	A	6	A
2	Location A - First Floor	5.0	<b>42.81</b>	C	21.54	A	6	A
3	Location A - Second Floor	8.0	<b>41.25</b>	B	21.21	A	5	A
4	Location B1 - Ground Floor	1.8	<b>52.74</b>	C	24.40	A	11	A
5	Location B1 - First Floor	5.0	<b>47.72</b>	C	22.98	A	8	A
6	Location B1 - Second Floor	8.0	<b>42.80</b>	C	21.71	A	6	A
7	Location B1 - Third Floor	11.0	39.80	B	21.00	A	5	A
8	Location B1 - Fourth Floor	14.0	37.89	A	20.57	A	4	A
9	Location B2 - Ground Floor	1.8	<b>43.83</b>	C	21.90	A	6	A
10	Location B2 - First Floor	5.0	<b>42.70</b>	C	21.63	A	6	A
11	Location B2 - Second Floor	8.0	<b>41.09</b>	B	21.26	A	5	A
12	Location B2 - Third Floor	11.0	39.37	B	20.87	A	5	A
13	Location B2 - Fourth Floor	14.0	37.82	A	20.55	A	4	A
14	Location C1 - Ground Floor	1.8	<b>51.92</b>	C	24.20	A	11	A
15	Location C1 - First Floor	5.5	<b>46.32</b>	C	22.65	A	7	A
16	Location C1 - Second Floor	8.5	<b>41.92</b>	B	21.53	A	6	A
17	Location C1 - Third Floor	11.5	39.23	B	20.89	A	5	A
18	Location C2 - Ground Floor	1.8	<b>43.25</b>	C	21.80	A	6	A
19	Location C2 - First Floor	5.5	<b>41.96</b>	B	21.49	A	5	A
20	Location C2 - Second Floor	8.5	<b>40.41</b>	B	21.13	A	5	A
21	Location C2 - Third Floor	11.5	38.82	B	20.78	A	4	A
22	Location D1 – Ground Floor	1.8	<b>41.86</b>	B	21.29	A	5	A
23	Location D1 – First Floor	5.0	<b>41.10</b>	B	21.14	A	5	A
24	Location D2 – Ground Floor	1.8	<b>42.80</b>	B	21.51	A	6	A
25	Location D2 – First Floor	5.5	<b>41.73</b>	B	21.29	A	5	A