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PROLOGIS PARK PHASE 3

AIR QUALITY ASSESSMENT

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PROLOGIS PARK PHASE 3

AIR QUALITY ASSESSMENT

16/04/2013

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Executive Summary

SCOPE

WSP Environmental Ltd (WSPE) has been commissioned by Prologis (Hayes) Ltd. to undertake an air quality impact assessment to support the planning application for the proposed Phase 3 of Prologis Park in Stockley Road in Hayes, Greater London.

This report presents the findings of the assessment which addressed the potential air quality impacts during both the construction and operational phases of the proposed development. For both phases the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed.

METHODS

A qualitative assessment of construction-related impacts associated with fugitive dust and PM_{10} emissions has been undertaken in line with recent Institute of Air Quality Management (IAQM) guidance and suitable mitigation measures recommended.

The assessment of the potential air quality impacts associated with the operational phase of the proposed development was completed by WSPE following Department of Environment, Food and Regional Affairs' (Defra) most recent guidance on local air quality management and the significance of impacts evaluated using IAQM guidance. The main air quality pollutants of concern (nitrogen dioxide (NO_2) and particulate matter (PM_{10})) in association with the operation of the development result from road traffic emissions associated with changes in the traffic volume, vehicle speed and fleet composition at the road network in the local area.

Detailed air quality dispersion modelling using ADMS Roads software was undertaken, taking into account the effects of the likely changes in road traffic characteristics associated with the proposed development. Meteorology data were supplied by the Met Office for the Heathrow meteorological station and used in the model setup. Local air pollution data measured by continuous monitoring and diffusion tube methods were provided by London Borough of Hillingdon and used for model verification purposes.

The methodology followed in this study was agreed at the outset with the Environmental Health Officer of London Borough of Hillingdon, follow's current best practice, and used the most up to date tools and data released by Defra for air quality assessment undertakings.

FINDINGS

Assessment of the construction related impacts indicated that these will be local to the site, temporary in nature and of a slight adverse to negligible significance prior to mitigation.

Analysis of the modelled results indicate that no exceedences of the Annual Mean Air Quality Objective for NO_2 and PM_{10} are predicted for the Do-Minimum and/or Do-Something Scenarios in the opening year (2015).

Overall, this Air Quality Assessment concluded the proposed development is likely to present temporary, local, negligible impacts on local air quality during the construction phase after mitigation measures are applied, and permanent, local, long term negligible impacts, during its operation phase.

RECOMMENDATIONS

Based on the results presented in this assessment, it is recommended to that dust suppression/containment techniques are applied as well as traffic management measures as mitigation measures during the construction phase of the Proposed Development.

With the recommended mitigation measures in place, the Proposed Development will comply with European and National air quality legislation, and local planning policy.

1Introduction

1.1 Objectives

1.1.1 WSP Environmental Ltd (WSPE) has been commissioned by Prologis (Hayes) Ltd to carry out an assessment of the potential air quality impacts arising from the proposals (Phase 3) at Stockley Road in Hayes, Greater London (from here on referred to as the Proposed Development or Application Site).

1.1.2 The site is located within the London Borough of Hillingdon (LBH) to the East of the A408. The site, including the newly developed Prologis Park, originally benefitted from outline planning permission (ref: 18399/APP/2004/2284, dated 19th August 2005) for the phased redevelopment for mixed use development comprising use classes B1(a), B1 (c), B2 and B8, employment uses and C3 residential, with associated access, parking and landscaping. The first phases have now been built, including four warehouse/office units and the KingsOak residential development; however, planning permission for the remaining phase, Phase 3, has expired, and as such a new application is submitted.

1.1.3 This report presents the findings of the assessment of the potential air quality impacts of the Phase 3 development during both the construction and operational phases to support the new planning application. For both phases the type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these impacts described.

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

1.2 Description of the Relevant Components of the Proposed Development with Relevance to the Current Assessment

1.2.1 The application site comprises 15,742m^2 industrial use and is located approximately 0.5km north of Junction 4 of the M4 motorway, to the east of the A408 Stockley Road. Heathrow Airport is located approximately 2km to the south of the site. Hayes town centre lies 2km to the east and West Drayton town centre 2km to the west. The location of the site is shown in **Figure 1**.

1.2.2 Prologis Park is bounded to the north by the Paddington to Bristol railway line whilst the Heathrow Express rail link runs to the west. To the east it is bounded by residential development and a new access road from the A408 running along the south of Prologis Park. It is situated in a mixed use area, with existing industrial uses to the north and north-west, whilst the areas to the east and west are predominantly residential with open Green Belt Land to the south and south-west.

1.2.3 The application site is part of the former MOD site, part of which has been re-developed in recent years. The re-development included the construction of the access road from the A408 and the construction of Phases 1 and 2 of Prologis Park.

1.2.4 The Proposed Development has the potential to give rise to changes in air quality ambient levels at sensitive receptors in the vicinity of the site through fugitive dust emissions associated with the construction phase, and increased traffic emissions on local roads during its operation phase.

1.2.5 It is considered that the Proposed Development may have a temporary effect on local air quality during construction, with earth-moving works and the storage of aggregates at the site posing the greatest risk with respect to the occurrence of ‘nuisance dust’. Construction activities are likely to increase the risk of dust entrainment and possible nuisance occurrence from increased deposition to surrounding surfaces. The assessment of construction phase impacts will focus on likely impacts of

airborne and deposited particulate matter in the vicinity of the site. Potential control measures will be evaluated and recommended to mitigate any estimated risks associated with this phase of the Proposed Development.

1.2.6 Road traffic emits a number of air pollutants, including nitrogen dioxide (NO2) and particulate matter (PM10/PM2.5). The quantity of each pollutant emitted from the vehicle exhaust depends on the type of fuel used, engine size, speed of the vehicle, age, driving conditions and the type of emissions abatement equipment fitted, if any. Therefore changes in local traffic characteristics resulting from the operation of the Proposed Development may also have an impact on local air quality.

1.2.7 This report addresses potential air quality impacts of the Phase 3 development during both its construction and operational phases.

2 Legislation, Policy and Guidance

2.1 Legislative Framework

2.1.1 The applicable legislative framework is summarised as follows:

a) Air Quality Directive 2008/50/EC (**Ref. 1**);

b) The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928 (**Ref. 2**);

c) The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043 (**Ref. 3**);

d) The Air Quality Standards Regulations 2010 - Statutory Instrument 2010 No. 1001 (**Ref. 4**);

e) The Environmental Protection Act 1990 (**Ref. 5**); and

f) The Environment Act 1995 (**Ref. 6**).

2.1.2 These are detailed below.

Air Quality Directive 2008/50/EC

2.1.3 The Air Quality Directive 2008/50/EC came into force on the 11th June 2008. This directive merged three existing Directives and one Council Decision into a single Directive on air quality. It sets air quality limit values, target values, and critical levels for a number of air pollutants established by the European Parliament and Council for the protection of human health, vegetation and ecosystems. These are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), oxides of nitrogen (NO_X) particulate matter smaller than 10µm in aerodynamic diameter (PM_{10} and $PM_{2.5}$), lead (Pb), benzene (C_6H_6), carbon monoxide (CO) and ozone (O_3). These have been transposed into UK legislation by the 2010 Regulations.

2.1.4 It also sets new standards and target dates for reducing concentrations of fine particles. Under the Directive Member States (MS) are required to reduce exposure to $PM_{2.5}$ in urban areas by an average of 20% by 2020 based on 2010 levels. The magnitude of the required reduction depends on national average concentrations between 2009 and 2011. For the UK, from the 47 $PM_{2.5}$ stations

used in a study by DEFRA in 2011, it is likely that average $PM_{2.5}$ concentrations for 2009-2011 will be between 13-14 µg/m_3. This would require the UK to comply with a 15% reduction target for 2020, equating to a required reduction in average concentrations of around 2.0 µg/m^3.

2.1.5 The directive also obliges MS to meet a Limit Value of 25µg/m^3 by 2015 and a Limit Value of 20µg/m^3 by 2020.

The Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002

2.1.6 The UK Government and the devolved administrations published the latest Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland in July 2007 defining both the standards and objectives for each of a range of air pollutants.

2.1.7 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM). These set a series of air quality standards and air quality objectives with the aim of protecting human health.

2.1.8 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.

2.1.9 The objectives set out the extent to which the UK Government and EU expect the standards to be achieved by a certain date and maintained thereafter. They take account of the costs, benefits, feasibility and practicality of achieving the standards. Air Quality Objectives (AQO) which are relevant to the current study (NO_2, PM_{10} and $PM_{2.5}$) for the protection of human health are outlined in **Appendix B.**

2.1.10 The Regulations require that likely exceedences of Air Quality Objectives are assessed in relation to:

"…the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"

(Stationery Office, 2000 and 2002)

2.1.11 The AQO apply only where members of the public are likely to be regularly present for the averaging time of the objectives (i.e. where people will be exposed to pollutants). The annual mean objectives apply to all locations where members of the public might be regularly exposed; these include building façades of residential properties, schools, hospitals, care homes etc. The 24 Hour Mean Objectives apply to all locations where the annual mean objective would apply, together with hotels and gardens of residential properties. The 1 Hour Mean Objectives also apply at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1 hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

2.1.12 These periods reflect the varying effects 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.

The Air Quality Standards Regulations 2010

2.1.13 These Regulations transpose 2008/50/EC in to the UK legislation and also incorporate the 4th air quality daughter directive (2004/107/EC) that sets targets for levels in outdoor air of certain toxic

heavy metals (Arsenic (Ar), Cadmium (Cd), Nickel (Ni), Mercury (Hg)), Benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAHs).

The Environmental Protection Act 1990 - Control of dust and particulates associated with construction

2.1.14 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'

2.1.15 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.

2.1.16 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.

Environment Act 1995

2.1.17 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.

2.2 Policy Framework

2.2.1 The applicable policy framework is summarised as follows:

a) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) July 2007 (**Ref.7**);

b) National Planning Policy Framework (**Ref.8**);

c) Local Planning Policy – Hillingdon Local Plan (November 2012) (**Ref.9**).

Air Quality Strategy for England, Scotland, Wales and Northern Ireland

2.2.2 The Government's policy on air quality within the UK is set out in the AQS published in July 2007. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed. The AQS sets standards and objectives for nine main air

pollutants to protect health, vegetation and ecosystems, notably NO_2, PM_{10} and $PM_{2.5}$, SO_2, O_3, C_6H_6, 1,3-butadiene (C_4H_6), CO, Pb, and PAHs.

2.2.3 Out of the pollutants included in the AQS, NO_2 and PM_{10} are of relevance to this assessment, as they will be emitted from the traffic generated by the Proposed Development. **Appendix B** presents the limit values and objectives for these pollutants applicable where members of the public are likely to be regularly exposed for the averaging period legislated.

National Planning Policy Framework

2.2.4 The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied. It promotes sustainable development and opportunities for local communities to engage in plan making at a neighbourhood level. The core underpinning principle of the framework is the presumption in favour of sustainable development, defined as:

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'

2.2.5 One of the 12 core planning principles in the NPPF is that planning should 'contribute to conserving and enhancing the natural environment and reducing pollution.'

2.2.6 In relation to air quality, the document states 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';*

- *'The planning system should contribute to and enhance the natural and local environment by:…preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soils, air, water, or noise pollution..';*

- *'In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity values, where consistent with other policies in this Framework.'*

- *'..local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities'; and*

- *'Local Planning authorities should consider where otherwise unacceptable development could be made acceptable though the use of conditions or planning obligations. Planning Obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.'*

Local Planning Policy

Hillingdon Local Plan (November 2012)

2.2.7 The Council's (LBH) Local Plan (January 2004) contains Policy EM8: Land, Water, Air and Noise specific to air quality which states that:

- *All development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors.*

- *All major development within the Air Quality Management Area (AQMA) should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum.*

2.3 Guidance

2.3.1 The following guidance documents and publications have been used in this assessment:

Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09) (DEFRA, February 2009)(Ref. 10)

2.3.2 The Department for Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their review and assessment work. This guidance, referred to in this document as LAQM.TG(09), has been used where appropriate in the assessment presented herein. This guidance contains a table (Box 1.4) providing examples of where the air quality objectives should/should not apply.

Local Air Quality Management Review and Assessment Policy Guidance LAQM.PG(09) (DEFRA, February 2009) (Ref. 11)

2.3.3 This Policy Guidance is principally for local authorities in England to have regard to in carrying out their local air quality management under Part IV of the Environment Act 1995. The Environment Act 1995 introduced the Local Air Quality Management (LAQM) process to deal with localised 'hotspots' of poor air quality. A principle of LAQM is for local authorities to integrate air quality considerations with other policy areas, such as planning. LAQM.PG(09) states that 'any consideration of the quality of land, air or water and potential impacts arising from development, possible leading to impacts on health, is a material planning consideration where it arises from or affects land use.

Development Control: Planning for Air Quality (2010 Update) Environmental Protection UK, April 2010 (Ref. 12)

2.3.4 This air quality guidance produced by Environmental Protection UK (EPUK) offers comprehensive advice on when an air quality assessment may be required, what should be included in an assessment, how to determine the significance of any air quality impacts associated with a development and the possible mitigation measures which may be implemented to minimise these impacts.

Institute of Air Quality Management: Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance (January 2012) (Ref. 13)

2.3.5 This document was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of

the methodology is on classifying sites according to the risk of effects and to identify mitigation measures appropriate to the risks.

Air Quality Supplementary Planning Guidance: May 2002) (Ref. 14)

2.3.6 Guidance produced by the Planning & Transportation Services of London Borough of Hillingdon to identify those circumstances when an air quality assessment will be required to accompany a development proposal, to provide technical guidance on the process of air quality assessment, and to provide guidance on the circumstances when air quality conditions and S106 planning obligations will be sought in accordance with national guidance and Hillingdon's UDP policies for air quality. The guidance is aimed at ensuring that air quality has been considered in enough depth and to help minimise any potential impacts.

3 Methodology

3.1 Scope

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

a) Review of LBH latest review and assessment report and monitoring data;

b) review of air quality data for the area surrounding the site, including data from DEFRA and the Environment Agencys' websites (EA) ;

c) desk study to confirm the location of nearby areas that may be sensitive to changes in local air quality; and

d) review of the traffic data provided by WSP UK, which has been used as an input to the air quality assessment.

3.1.2 The scope of the current assessment includes the assessment of the effects resulting from:

a) dust generated by on-site activities on nearby environment during the construction phase;

b) particulate matter (PM_{10}) generated by on-site activities on local air quality during the construction phase;

c) increases in pollutant concentrations (namely NO_2 and PM_{10}) as a result of exhaust emissions arising from construction traffic and plant on local air quality; and

d) increases in pollutant concentrations (namely NO_2 and PM_{10}) as a result of exhaust emissions from road traffic generated by the operation of the Proposed Development on local air quality.

3.2 Extent of the Study Area

3.2.1 The air quality assessment considers the Application Site of the Proposed Development and the immediate surrounding area including roads likely to be affected by the proposals.

3.2.2 For the purpose of assessing the effect of dust and particulate matter arising from the on-site preparation, earthworks and construction activities on local air quality, an area of up to 350m from the Site boundary and 500m from the Application Site entrance has been considered in accordance with guidance published by IAQM **(Ref. 13).**

3.2.3 For the assessment of the effect of traffic related emissions resulting from traffic associated with the Proposed Development, traffic data have been provided for the surrounding road network (details of which are provided in **Appendix C**). These include those roads likely to have a significant change in traffic volume as a result of the Proposed Development.

3.3 Methods

Method of baseline data collection

3.3.1 A desk study was undertaken to obtain baseline data to inform the assessment. This study incorporated the following:

a) Collation and review of local monitoring data and local air quality review and assessment reports available from LBH **(Ref. 15)**;

b) Review of available air quality data for the area surrounding the Application Site, including data from the DEFRA's online Local Air Quality Management support pages **(Ref. 16)** and the Environment Agency (EA)'s website **(Ref. 17)**; and

c) A study of local mapping data available for the study area and the development plan to identify local receptors that may be sensitive to a change in local air quality.

Assessment of Dust and PM_{10} generated by on-site activities on nearby environment and on local air quality

3.3.2 A qualitative assessment of the likely significant effects of the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using guidance produced by the IAQM.

3.3.3 Details of the assessment procedure given in this guidance are summarised in **Appendix D** and include the consideration of potential dust and PM_{10} impacts from earthworks, general construction activities and track-out.

3.3.4 The effects associated with this phase of the Proposed Development have been assessed qualitatively by identifying:

a) The size of the site and the area of which construction activities are likely to take place;

b) The construction activities associated with the Proposed Development that could generate dust and their likely duration;

c) The proximity and type of sensitive receptors (e.g. schools, residential properties, etc.) to the construction Application Site boundary;

d) The prevailing wind direction in the area in which the Application Site is located and local precipitation patterns;

e) The presence of vegetation surrounding the Application Site, which might act as a buffer; and

f) The potential distance which the construction traffic will travel across unpaved roads on the construction Site, prior to accessing the local road network (referred to as 'trackout').

3.3.5 The following potential effects of increased dust and PM_{10} generated during the construction phase have been considered:

a) Annoyance due to dust soiling;

b) Harm to ecological receptors; and

c) The risk of health effects due to a significant increase in exposure to PM_{10}.

Assessment of the Increase in pollutant concentrations (NO_2 and PM_{10}) as a result of exhaust emissions arising from construction traffic and plant on local air quality

3.3.6 Exhaust emissions from construction vehicles may have an effect on local air quality both on-site and adjacent to the routes used by these vehicles to access the Application Site. A quantitative evaluation of their overall effect on local air quality has been undertaken by considering:

a) the level of construction traffic likely to be generated by this phase of the Proposed Development; the construction year assumed was 2014;

b) the number and distance of sensitive receptors in the vicinity of the Application Site and along the likely routes to be used by construction vehicles; and

c) the likely duration of the construction phase and the nature of the construction activities undertaken.

Assessment of effects of Road Traffic emissions generated by the operation of the Proposed Development on local air quality (NO_2 and PM_{10})

3.3.7 The traffic generated by the use of the Proposed Development may have an effect on local air quality concentrations, both within and around the Application Site. The main pollutants of concern for road traffic are generally considered to be NO_2, PM_{10}, carbon monoxide (CO) and Benzene (C_6H_6). Of these pollutants, emissions of NO_2 and PM_{10} are most likely to result in exceedences of the relevant air quality standards or objectives in urban areas. This air quality assessment will therefore only consider these two pollutants.

3.3.8 For the prediction of effects due to emissions arising from road traffic during operation, the advanced dispersion model ADMS Roads has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness, and local meteorological conditions to predict pollutant concentrations at selected relevant locations.

3.3.9 Meteorological data, such as wind speed and direction, are used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model were obtained from the Met Office observing station at Heathrow. This station is considered to provide data representative of the conditions at the Application Site. The meteorological data used for this assessment were from 2011 and 2012.

3.3.10 For the assessment, six scenarios were modelled. These are as follows:

a) 2011 “model verification”;
b) 2012 “baseline conditions”;
c) 2014 “without construction”;
d) 2014 “with construction”;
e) 2015 “without development”; and
f) 2015 “with development”.

3.3.11 2014 was considered as the construction year for the proposed development and ADMS roads was run for traffic predictions accounting for the with and without scenarios for the construction phase of the Proposed Development. 2015 is the proposed opening year of the development and traffic data used in the assessment refer to 2015 estimates. 2011 was used as the model verification year, as this is the latest year for which complete monitoring data were available for use in the verification process. In addition, for a conservative approach, the baseline year conditions were assumed as 2012.

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

3.3.13 The traffic flows for the “without development” scenario include flows for committed developments in the locality of the Application Site but does not include any contribution to road traffic from the Proposed Development itself. The traffic flows for the “with development” scenario includes flows for committed developments and contributions to road traffic from the Proposed Development.

Processing of background concentrations

3.3.14 Local background concentrations were available from LBH to represent levels at the Application Site. The background site of London Harlington was used and its values compared with background

concentrations of NO_2 and PM_{10} within the study area derived from national maps (1 km x 1 km spatial resolution) available from DEFRA (Ref. 16). The mapped values were used to ascertain the background sector contribution for the roads explicitly modelled so these could be deducted from total background concentrations.

Model verification, adjustment, and processing of results

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

3.3.16 Model validation undertaken by the software developer will not have included validation in the vicinity of the Proposed Development considered in this assessment. To determine the performance of the model at a local level a comparison of modelled results with local monitoring data at two relevant locations was undertaken. This process of verification aimed to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

3.3.17 Model verification has been undertaken following the methodology specified in Annex 3 of LAQM.TG(09) using the NO_x:NO_2 calculator available from DEFRA's website to calculate the roadside NO_x component of the annual mean NO_2 concentrations measured at the diffusion tube site. Details of the verification calculations are presented in **Appendix E**.

3.3.18 To provide a worst case approach to the assessment, 2011 background levels were assumed to be constant up to 2015 to reflect the results of a recent analysis of historical monitoring data collected within a number of sites in England by DEFRA that has identified background levels may not be declining in line with national projections.

3.3.19 A factor of 0.83 was obtained during the verification process which indicated that the model was slightly over predicting results. However, the Root Mean Square Error (RMSE) of the model was lower without adjustment (see Appendix E) and therefore this factor has not been applied to the modelled NO_x roads component.

3.3.20 Following model verification, the modelled road contribution to NO_x concentrations were converted to annual mean NO_2 concentrations using the methodology given in LAQM.TG(09) and the NO_x:NO_2 calculator available from DEFRA's website **(Ref. 16).** The calculator provides a method of calculating NO_2 from NO_x wherever NO_x emissions from road traffic are predicted using dispersion modelling.

3.3.21 For PM_{10}, the modelled road contribution to annual mean PM_{10} concentrations were added to the relevant background concentrations, which were then 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).

3.3.22 LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1 hour mean NO_2 concentrations. However, research carried out in 2003 **(Ref 18),** determined that exceedences of the 1 hour mean objective were unlikely to occur where annual mean concentrations were below 60µg/m^3. Further research carried out in 2008 **(Ref. 19)** generally supported this relationship and as a result this criterion has been adopted in the current assessment.

3.4 Significance Criteria

Construction Phase

3.4.1 The significance of effects associated with the construction phase of the Proposed Development has been determined qualitatively and involved the following tasks:

a) Evaluation of the proposed Application Site layout, to evaluate size of the site and possible site construction activities that could generate dust and PM_{10}, their likely location and duration. No information on the precise construction plan was available at the time of undertaking the current assessment and hence assumptions were made;

b) Collection and appraisal of meteorological data related to wind speed, direction and frequency, and precipitation for the local and wider area;

c) Identification of any natural shelters, such as trees, likely to reduce the risk of wind-blown dust;

d) In the case of PM_{10}, mapping of local background concentrations;

e) Assessing the potential distance which the construction traffic will travel across unpaved roads on the construction site, prior to accessing the local road network (referred to as 'trackout');

f) Identification of the location and type of sensitive receptors within 350 m of the boundary of the site and/or within 100 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s) (at-risk receptors). The location of sensitive receptors has involved use of Ordnance Survey data;

g) Indication of the number of receptors and sensitivity types at different distances from the site boundary (or dust generating activities wherever known);

h) Assessment of the risk of dust effects arising using three risk categories: low risk, medium risk, and high risk. The site was allocated to a risk category based on two factors:

   i. the scale and nature of the works, which determined the risk of dust arising (i.e. the magnitude of potential dust emissions) classed as: small, medium or large; and
   ii. the proximity of receptors, considered separately for ecological and human receptors (i.e. the potential for effects).

3.4.2 Activities on construction site have been divided into four types to reflect their different potential effects. These were:

a) Demolition;

b) Earthworks;

c) Construction; and

d) Trackout.

3.4.3 The following terms have been used to define the significance of the effects identified:

a) **Major effect:** where the Proposed Development could be expected to have a very significant effect (either positive or negative) on local air quality;

b) **Moderate effect:** where the Proposed Development could be expected to have a noticeable effect (either positive or negative) on local air quality;

c) **Minor effect:** where the Proposed Development could be expected to result in a small, barely noticeable effect (either positive or negative) on local air quality; and

d) **Negligible:** where no discernible effect is expected as a result of the Proposed Development on local air quality.

3.4.4 The IAQM methodology **(Ref. 13)** follows a four tier approach to determining the significance of construction phase related effects comprising the following steps:

a) **Step One:** determination of the sensitivity of the surrounding area to dust deposition and changes in PM_{10} concentration;

b) **Step Two**: determination of the dust emission class for the proposed construction work;

c) **Step Three**: determination of the risk of the site giving rise to impacts from dust generation and PM_{10} concentrations using the dust emission class and the distance to the nearest sensitive receptor;

d) **Step Four:** determination of the significance of the effects based on the sensitivity of the surrounding area (determined in Step One) and the risk of the site giving rise to effects (determined in Step Three) using **Table 1** (pre-mitigation).

Table 1 - Significance of Effects of Each Activity Without Mitigation

Sensitivity of surrounding area	Risk of site giving rise of dust effects		
	High	Medium	Low
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight adverse	Negligible	Negligible

Operation Phase

3.4.5 The effects of the Proposed Development on local air quality once operational have been evaluated against the significance criteria published by EPUK **(Ref. 12)** and presented in **Appendix F**.

3.4.6 The approach to determining the sensitivity for air quality assessments outlined in the EPUK guidance considers the change in pollutant concentration (magnitude of impact) and the overall pollutant concentrations in the area when compared to the relevant standard. There is no distinction in the sensitivity of different human receptors to air quality. Guidance provided by the IAQM recommends that all population exposure receptors i.e. dwellings, hospitals or schools should all be considered to be of equal sensitivity to air pollution.

3.4.7 The magnitude of impact is determined quantitatively by establishing the change in pollutant concentration at each receptor as predicted by the detailed modelling. The definitions for the magnitude of impact categories for each pollutant are defined by the size of the change in pollutant concentration in relation to the objective level and are presented in **Table 2**.

Table 2 - Magnitude of Impact

Magnitude of Impact	Quantitative Definition
Imperceptible	Increase or decrease of <1% of AQS objective level
Small	Increase or decrease of between 1 - 5% of AQS objective level
Medium	Increase of decrease of between 5 - 10% of AQS objective level
Large	Increase of decrease of > 10% of AQS objective level

3.4.8 Following the recommendations within the EPUK guidance, the overall pollutant concentration change with the development in place is considered in terms of the percentage of the Objective /Limit Value. The significance matrix used to assess the operation phase effects is presented in **Table 3**.

Table 3 - Significance of Effects Matrix

Concentration in Relation to Objective / Limit Value	Change in Concentration			
	Negligible or No Change	Small	Medium	Large
Increase with scheme				
Above Objective/Limit Value with scheme (>40 µg/m^3)	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with scheme (36-40 µg/m^3)	Negligible	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with scheme (30-36 µg/m^3)	Negligible	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with scheme (<30 µg/m^3)	Negligible	Negligible	Negligible	Slight Adverse
Decrease with scheme				
Above Objective/Limit Value without scheme (>40 µg/m^3)	Negligible	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value without scheme (36-40 µg/m^3)	Negligible	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value without scheme (30-36 µg/m^3)	Negligible	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value without scheme (<30 µg/m^3)	Negligible	Negligible	Negligible	Slight Beneficial

3.4.9 Further details of these significance criteria are included within **Appendix F**.

3.4.10 In addition to these quantitative criteria, the Environmental Protection UK report outlines a method that uses textual descriptors to identify the differing levels of relative priority that should be afforded

to the air quality considerations of a development proposal in the planning process. A summary of the method is given in **Table 4**.

Table 4 - Summary of method for Assessing the Significance of Air Quality in the Planning Process

Effect of Development	Outcome
Development would lead to a breach or significant(1) worsening of a breach of an EU limit value; cause a new breach to occur, or introduce of new exposure into an exceedence area.	Air Quality an overriding consideration.
Lead to a breach or significant (1) worsening of a breach of an AQ Objective, or cause a new AQMA to be declared, or introduce new exposure into an area of exceedence (2).	Air Quality a high priority consideration.
Development would interfere significantly with or prevent the implementation of actions within an AQ action plan	Air Quality a high priority consideration.
Development would interfere significantly with the implementation of a local AQ strategy.	Air Quality a medium priority consideration.
Development would lead to a significant increase in emissions, degradation in air quality or increase in exposure, below the level of a breach of an objective.	Air Quality a medium priority consideration.
None of the above.	Air Quality a low priority consideration.

(1) Where the term significant is used, it will be based on the professional judgement of the Local Authority officer.

(2) This could include the expansion of an existing AQMA or introduction of new exposure to cause a new AQMA to be declared. Where new exposures is introduced this should be with reference to the exceedence area, and not the AQMA boundary.

3.5 Sensitive Receptors

3.5.1 Sensitive locations are those where the public or sensitive ecological habitats may be exposed to pollutants from the Proposed Development. 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 Development, once it becomes operational.

3.5.2 Examples of ratings of areas in terms of sensitivity to dust and particulate matter generated by construction activities are shown in **Table 5**, which is based on a table of examples provided in the guidance published by the IAQM.

Table 5 - Examples of Receptor Sensitivity to Construction Phase Effects

Sensitivity of Area	Examples	
	Human Receptors	**Ecological Receptors(1)**
Very High	Very densely populated area More than 100 dwellings within 20m Local PM_{10} concentrations exceed the objective Very sensitive receptors nearby (e.g. hospitals) Construction works continuing in one area of the site for more than 1 year	European Designated site
High	Densely populated area 10-100 dwellings with 20m of the site Schools, Hi Tech & Food Processing industries nearby Local PM_{10} concentrations are within 10% of the objective Commercially sensitive horticultural land within 20m	Nationally Designated site
Medium	Suburban of edge of town area Less than 10 receptors within 20m Local PM_{10} concentrations between 10-25% below the objective	Locally Designated site
Low	Rural area/industrial area No receptors within 20m Local PM_{10} concentrations are below 75% of the objective Wooded area between site and receptors	No Designations
(1) Only if there are ecological habitats present that may be sensitive to an increase in dust and particulate deposition.		

3.5.3 In terms of locations that are sensitive to gaseous pollutants emitted from engine exhausts, these will include places where sensitive members of the public are likely to be regularly present and are likely to be exposed to air pollution over the relevant period of time prescribed in current legislation and in the UK Air Quality Objectives (AQO) specified in the UK Air Quality Strategy (AQS) **(Ref. 7).**

3.5.4 Examples of areas representative of public exposure in terms of sensitivity to NO_2 and PM_{10} resulting from exhaust emissions from construction site traffic and traffic associated with the Proposed Development, over the relevant averaging periods for these pollutants, are shown in **Table 6**.

3.5.5 A number of locations were selected to represent relevant public exposure receptors at which pollution concentrations were predicted. The locations of the assessment receptors are shown on **Appendix G.** They include locations adjacent or near to the routes that are likely to experience the greatest change in traffic volume as a result of the Proposed Development.

3.5.6 The relevant receptors were selected from Ordnance Survey (OS) base map and moved to represent the location of the façade of the building they would represent, which was the nearest to the road sources modelled.

Table 6 - Examples of Relevant Public Exposure Sensitive Locations

Averaging Period	Relevant Public Exposure Locations
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.
1-hour mean	All locations where the annual mean and 24 -hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expected to spend one hour or longer.

3.5.7 No ecosystem locations were found in the vicinity of the Proposed Site that are sensitive to the gaseous pollutants addressed in the current assessment, and therefore no further consideration was given to these type of receptors.

4 Baseline Conditions

4.1 AQMAs

4.1.1 LBH has designated one AQMA within their administrative as part of their review and assessment work due to exceedences of the annual mean NO_2 objective.

4.1.2 The extent of the current AQMA comprises the area from the southern boundary north to the border defined by the A40 corridor from the western borough boundary, east to the intersection with the Yeading Brook north until its intersection with the Chiltern-Marylebone railway line and then east along the railway line to the eastern borough boundary.

4.1.3 The Application Site does lie within this AQMA.

4.2 Local Emission Sources

4.2.1 The proposed development site is located in an area where air quality is mainly influenced by emissions from road transport. The main road is the A408 which passes west to the site.

4.2.2 There are no industrial pollution sources in the immediate vicinity of the site that will influence the local air quality.

4.3 Background Air Quality Data

4.3.1 **Table 7** shows the estimated background concentrations for NO_x, NO_2 and PM_{10} that were used in the assessment.

Table 7 - Estimated Background Concentrations Used in the Assessment (µg/m^3)

London Hillingdon With Sector Removal	2011 Annual Mean Concentration (µg/m^3)		
	NO_x	NO_2	PM_{10}
Mean	55.5	29.9	18.3

4.3.2 **Table 7** shows that annual mean background concentrations for NO_2 and PM_{10} within the study area are all well below the annual mean Objective for each of the pollutants (40µg/m^3 for NO_2 and PM_{10}).

4.4 Local Air Quality Monitoring Data

4.4.1 LBH manages a network of diffusion tubes measuring NO_2 concentrations across their area of jurisdiction. Three monitoring locations were within the vicinity of the modelled network and were therefore considered suitable for the purpose of model verification. These were evaluated in terms of distance to the road, site type, data quality and data capture.

4.4.2 **Table 8** and **Figure 1** in **Appendix G** present the description and geographic location of the diffusion tube monitoring sites considered.

Table 8 - Description of Local Authorithy Diffusion Tube Monitoring Sites

Site ID	Site Name	Site Type	X (m)	Y (m)	Suitable for Verification
HD55	Harold Avenue	Roadside	509917	179015	Yes
HD64	34 Hatch Lane	Roadside	505875	177610	Yes
HD72	2 Vineries Close	Roadside	507236	177927	Yes

4.4.3 **Table 9** shows the annual mean NO_2 concentrations measured at the three selected diffusion tube monitoring locations within the study area.

Table 9 - Diffusion Tube Monitoring - Annual Mean NO_2 Concentrations

Site ID	Within AQMA	Annual mean concentration (µg/m^3) (bias adjusted)				2011 Data Capture (%)
		2008 (Bias Adj. Factor = 0.93)	2009 (Bias Adj. Factor = 0.96)	2010 (Bias Adj. Factor = 0.99)	2011 (Bias Adj. Factor = 0.93)	
HD55	Y	**41.7**	**40.5**	**40.2**	37.8	92
HD64	Y	NA	32.8	32.6	31.7	92
HD72	Y	30.5	29.9	31.9	31.9	100

4.4.4 Analysis of the monitoring results in **Table 9** indicates that measured concentrations have either decreased (HD55) or remained fairly constant in the 2008-2011 period around the study area. It is observed that the annual mean NO_2 objective (40µg/m^3) was not exceeded at any of the locations in 2011, with exceedences observed at Harold Avenue from 2008 to 2010 only.

4.5 Identification of Sensitive Receptors

4.5.1 **Table 10** shows a summary of worst case sensitive receptors within the study area. It shows the number of properties identified for each sensitive category for long term public exposure in the vicinity of the Application Site, at worst case locations. **Figure 1** in **Appendix G** presents the locations of the modelled receptors representative of long term public exposure within and in the vicinity of the site.

Table 10 - Types of Receptors Modelled for Public Exposure

Type	Number of Properties
Residential	24
Schools	0
Children Nurseries	0
Care Homes	0
Hospitals	0
Total Modelled Sensitive Receptors	24

5 Likely Significant Effects

5.1 Construction Phase

5.1.1 During the construction phase of the Proposed Development, there will be a number of activities which have the potential to generate and/or re-suspend dust and PM_{10}.

5.1.2 The main sources of dust and PM_{10} during the construction phase will include:

a) Site clearance and preparation;

b) Preparation of temporary access/egress to the Application Site and haulage routes;

c) Earthworks;

d) Materials handling, storage, stockpiling, spillage and disposal;

e) Movement of vehicles and construction traffic within the Application Site (including excavators and dumper trucks);

f) Use of crushing and screening equipment/plant;

g) Construction of buildings, roads and areas of hardstanding alongside fabrication processes; and

h) Internal and external finishing and refurbishment.

5.1.3 It is anticipated that the working hours will be as set out below:

a) 07.30 – 17.30 Monday to Friday; and

i) 07.30 – 13.00 Saturday.

5.1.4 These working hours will be agreed with LBH prior to the commencement of the works. All work outside these hours will be subject to prior agreement, and/or reasonable notice, by LBH, who may impose certain restrictions. Night time working will be restricted to exceptional circumstances.

5.1.5 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.

5.1.6 Depending on wind speed and turbulence it is likely that the majority of dust would be deposited in the area immediately surrounding the source. Existing receptors located in the vicinity of the boundary of the Application Site are located 50m away to the east side.

5.1.7 Analysis of the 2012 wind rose data for Heathrow, which is provided in **Appendix H**, indicates that there is strong prevailing wind from the west and south-west. Therefore, receptors located to the east and northeast of the Application Site are more likely to be affected by any dust emitted/re-suspended from any construction activities and track-out.

5.1.8 197 receptors were identified within 350m of the proposed site. These comprise of a mixture of residential and commercial receptors. There are no properties within the site boundary.

5.1.9 From the total affected receptors, 81 dwellings are located downwind of the Proposed Site. These properties are considered to be most affected by the construction activities.

5.1.10 Background PM_{10} concentrations in the area in which the Application Site is located are well below the AQS objectives.

5.1.11 The IAQM assessment methodology considers the sources of dust and PM_{10} generation in four categories: demolition (not relevant in this case); earthworks; construction and trackout. The generation of dust during these phases of works are classed as large, medium or small. Criteria to determine which dust emission class the Application Site falls into are detailed in **Appendix D** and results summarised in sections below.

Demolition

5.1.12 The area of the Application Site is currently greenfield, and no demolition will therefore be undertaken on Site. No further consideration of demolition activities will therefore be considered within this assessment.

Earthworks

5.1.13 The area of the Application Site is 15,742m^2 in size, which is in excess of the IAQM threshold for large sites (10,000m^2), the soil type is assumed to be 'potentially dusty' and the total material moved is likely to be between 20,000 tonnes and 100,000 tonnes. Therefore the dust emission class for the earthworks phase is considered to be medium to large.

Construction

5.1.14 The total volume of buildings to be constructed on the Application Site is in between 25, 000 and 100,000m^3, the dust and PM_{10} emission class for the construction phase is therefore considered to be medium.

Trackout

5.1.15 Analysis of the information provided regarding the location and likely daily HGV trips during the construction phase has indicated that the number of HGVs will be below 25 vehicles per day during the construction period. Due to the size of the site, is also assumed that the length of unpaved road

within the site will be in between 50-100m. Therefore, the dust emission class for trackout is small /medium.

5.1.16 According to the IAQM assessment procedure summarised in **Appendix C**, and based on the available information on the construction phase, the Proposed Development is considered to be a Medium Risk Site overall given the size of the site and that the nearest receptor is within 20-50m of the site. **Table 11** provides a summary of the risk for each of the four sources of construction dust and PM_{10}.

Table 11 - Summary Risk Effects for Each Activity

Construction Phase	Details of Each Activity	Potential Dust Emis-sion Class	Distance to the nearest Receptors	Dust Risk Category
Demolition	N/A	N/A	N/A	N/A
Earthwork	Total site area >10,000m^2	Medium /Large	20-50m	Medium/High Risk
Construction Activities	Total building volume 25,000-100,000m^3	Medium /Large	20-50m	Medium/High Risk
Trackout	< 25 HDV trips per day and between 50-100m of unpaved surface	Small/Medium	20-50m	Medium/Low Risk
Summary	**Medium Risk Site**			

5.1.17 The site is adjacent to an urban area; however there are no dwellings within 20m of the construction site. Therefore the sensitivity of the surrounding area is classified as Medium (**Table 12**).

Table 12 - Sensitivity of the Study Area

Effects	Conditions of Study Area	Sensitivity of study area
Dust Soiling and PM_{10} Effects	Urban Area with 10-100 dwellings within 20-50m of site	Medium
Ecological*	No designations	Low
PM_{10} Effects	Local PM_{10} concentrations well below the objective	Low

*There are no sensitive ecological habitats located within 350m of the Application Site boundary and therefore there will be no significant impacts on statutory designated ecological sites.

5.1.18 Taking into account all of the above, the overall sensitivity of the surrounding area in terms of human receptors is medium, and the overall magnitude of change prior to mitigation is considered to be medium. Therefore, there is likely to be a direct, temporary, medium-term effect on nearby residential properties of slight adverse to negligible significance prior to the implementation of mitigation measures (**Table 13**).

Table 13 - Construction Phase Summary Significance Table with No Mitigation

	Dust Soiling and PM_{10} Effects	Ecological	PM_{10} Effects
Demolition	N/A	N/A	N/A
Earthwork	Slight Adverse	None	Slight Adverse
Construction Activities	Slight Adverse	None	Slight Adverse
Trackout	Negligible	None	Negligible
Overall Significance	**Slight Adverse/Negligible**		

Construction Traffic

5.1.19 Exhaust emissions from site preparation, earthworks and construction traffic and plant will contribute to local pollutant concentrations. The greatest potential for effects on air quality from traffic associated with the construction activities will be in the areas immediately adjacent to the principal means of site access for construction/site traffic.

5.1.20 In addition, there will also be a requirement to deliver equipment and materials to and from the Site and additional vehicle trips associated construction staff/workers travelling to and from the Application Site. The greatest impact on air quality from traffic associated with the construction phase will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will mainly access the site via A408.

5.1.21 Annual mean NO_2 and PM_{10} concentrations have been predicted at 24 relevant receptors located within 200m of the modelled road network for the without and with construction scenarios in the construction year (2014). The effects of traffic emissions on local air quality of PM10 levels were classified as negligeable.

5.1.22 Analysis of the effects of traffic emissions on local air quality and residential properties located along this road has indicated that the magnitude of change will range from imperceptible overall to small with the highest increase for NO_2 being 0.9µg/m^3 observed at receptor 4, a worst case property adjacent to the A408 road.

5.1.23 As the highest predicted concentrations are 38.9µg/m^3 and 39.8µg/m^3 "without" and "with development" respectively at receptor number 4, according to the EPUK significance criteria, the effect of the Proposed Development on annual mean NO_2 concentrations prior to mitigation is during the construction phase ranges from negligible to slight adverse. **Table 14** summarises the construction phase significance of effects for this pollutant.

Table 14 - Predicted NO_2 Significance Effect at Existing Receptors in DM and DS in relation to the construction phase

Significance	Number of Receptors	%
Substantial Adverse	0	0.0
Moderate Adverse	0	0.0
Slight Adverse	2	8.3
Negligible	22	91.7
Slight Beneficial	0	0.0

5.1.24 In the light of the results presented above, the traffic related impacts associated with the construction phase of the proposed development are considered to be temporary, short-term, local in effect and of slight adverse to insignificant, prior to mitigation.

5.2 Operation Phase

5.2.1 Annual mean NO_2 and PM_{10} concentrations have been predicted at 24 relevant receptors located within 200m of the modelled road network for the without and with development scenarios in the opening year (2015).

5.2.2 Summaries of estimated results are presented in **Tables 15 to 18** and discussed in the following sub-sections. Results are evaluated in the light of current objectives and limit values for the relevant pollutants, and the significance of impacts rating presented.

Impact of Traffic emissions on Annual mean NO_2 concentrations

5.2.3 The objective for annual mean NO_2 concentrations is 40µg/m^3 to be achieved by the end of 2005 and thereafter. The results of the assessment show that in the 2012 baseline concentrations meet the objective at all of the assessment receptor locations. The highest predicted concentration is 40.0µg/m^3 at a worst case property facing A408 road (receptor number 4) which is bordering exceedence of the annual mean objective for this pollutant.

5.2.4 **Table 15** shows the number of relevant receptors per annual mean concentration ranges for both the without (DM) and with development (DS) scenarios at existing locations.

Table 15 - Predicted Annual Mean NO_2 Concentration at Existing Receptors in DM and DS

Annual Mean NO_2 Concentration (µg/m^3)	Number of Receptors DM	Number of Receptors DS
< 30	5	5
30 – 36	18	18
36 – 40	1	1
>40	**0**	**0**
Total	24	24

5.2.5 **Table 16** summarises the operation phase significance of effects for NO_2.

Table 16 - Predicted NO_2 Significance Effect at Existing Receptors in DM and DS in relation to the operation phase

Significance	Number of Receptors	%
Substantial Adverse	0	0.0
Moderate Adverse	0	0.0
Slight Adverse	0	0.0
Negligible	24	100.0
Slight Beneficial	0	0.0

5.2.6 The opening of the Proposed Development in 2015 will result in an imperceptible increase in annual mean NO_2 concentrations at all of the assessment receptors. These increases were considered to be imperceptible, with the greatest increase of 0.3µg/m^3 observed at receptor 4. This increase is likely to be attributed to changes in the in AADT flows.

5.2.7 It is observed there will be no exceedences of the annual mean objective as the highest predicted concentrations are 37.9µg/m^3 and 38.1µg/m^3 "without" and "with development" respectively at a worst case property adjacent to the A408 road (receptor number 4).

5.2.8 According to the EPUK significance criteria, the effect of the Proposed Development on annual mean NO_2 concentrations prior to mitigation is negligible.

Hourly Mean NO_2 Concentrations

5.2.9 The objective for hourly mean NO_2 concentrations is a concentration of 200µg/m^3 as the 99.8th percentile of hourly mean concentrations to be achieved by the end of 2005 and every year thereafter.

5.2.10 The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3, and therefore exceedences of the hourly mean NO_2 concentration objective are unlikely to occur. These results again agree with the conclusions of the review and assessment work undertaken by LBH, which concluded that no AQMAs needed to be designated for this pollutant and objective.

Impact of Traffic emissions on Annual Mean PM_{10} Concentrations

5.2.11 The objective for annual mean PM_{10} concentrations is 40µg/m^3 to be achieved by the end of 2004 and thereafter. The results of the assessment show that in the 2012 baseline case concentrations meet the objective at all of the assessment receptor locations. The highest predicted concentration is 20.2µg/m^3 at a property facing the A408 (receptor number 4).

5.2.12 These results agree with the conclusions of the review and assessment work undertaken by LBH, which concluded that an AQMA designation for this pollutant and averaging period was not required.

5.2.13 **Table 17** shows the number of relevant receptors per annual mean concentration ranges for both the without (DM) and with development (DS) scenarios for this pollutant at existing locations.

Table 17 - Predicted Annual Mean PM_{10} Concentration at Existing Receptors in DM and DS

Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Number of Receptors DM	Number of Receptors DS
<30	24	24
30 – 36	0	0
36 – 40	0	0
>40	**0**	**0**
Total	24	24

5.2.14 **Table 18** summarises the operation phase significance of effects for PM_{10}.

Table 18 - Predicted PM_{10} Significance Effect at Existing Receptors in DM and DS in relation to the operation phase

Significance	Number of Receptors	%
Substantial Adverse	0	0.0
Moderate Adverse	0	0.0
Slight Adverse	0	0.0
Negligible	24	100.0
Slight Beneficial	0	0.0

5.2.15 The opening of Proposed Development in 2015 will result in an imperceptible increase in annual mean PM_{10} concentrations at all of the assessment receptors. These increases were considered to be imperceptible, with the greatest increase of 0.04µg/m^3 observed at receptor 4. This increase is likely to be attributed to changes in the in AADT flows.

5.2.16 It is observed there will be no exceedences of the annual mean objective as the highest predicted concentration being 20.1µg/m^3 for both the "without" and "with development" at a worst case property adjacent to the A408 road (receptor number 4).

5.2.17 According to the EPUK significance criteria, the effect of the Proposed Development on annual mean PM_{10} concentrations is negligible.

Daily Annual Mean PM_{10} Concentrations

5.2.18 The objective for 24 hourly mean PM_{10} concentrations is 50µg/m^3 to be exceeded no more than 35 times a year by the end of 2004 and thereafter. The results of the dispersion modelling show that in both the 2012 baseline and 2015 scenarios no exceedences occur.

5.2.19 These results again agree with the conclusions of the review and assessment work undertaken by LBH, which concluded that no AQMAs needed to be designated for this pollutant and averaging period.

5.2.20 According to the EPUK significance criteria, the effect of the Proposed Development on daily mean PM_{10} concentrations is neutral i.e. no significant effect.

6 Mitigation and Residual Effects

6.1 Construction Phase

6.1.1 A number of mitigation methods will be implemented, as appropriate including:

a) vehicles carrying loose aggregate and workings will be sheeted at all times;

b) implementation of design controls for construction equipment and vehicles and use of appropriately designed vehicles for materials handling;

c) completed earthworks will be covered or vegetated as soon as is practicable;

d) regular inspection and, if necessary, cleaning of local highways and site boundaries to check for dust deposits (and removal if necessary);

e) 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;

f) where appropriate, windbreak netting/screening will be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Application Site and the surroundings;

g) where practicable, stockpiles of soils and materials will be located as far as possible from sensitive properties, taking account of prevailing wind directions and seasonal variations in the prevailing wind;

h) during dry or windy weather, material stockpiles and exposed surfaces will be dampened down using a water spray to minimise the potential for wind pick-up;

i) use of dust-suppressed tools for all operations;

j) ensuring that all construction plant and equipment is maintained in good working order and not left running when not in use;

k) Restrict on-site movements to well within site and not near the perimeter, if possible; and

l) no unauthorised burning of any material anywhere on site.

6.1.2 Detailed mitigation measures to control construction traffic will be discussed with LBH to establish the most suitable access and haul routes for the site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that 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.

6.1.3 The overall significance of the effects arising from the construction phase of the Proposed Development following the implementation of the mitigation measures described above and good site practice is shown in the **Table 19**.

Table 19 - Construction Phase Summary Significance Table with Mitigation

	Dust Soiling and PM_{10} Effects	Ecological	PM_{10} Effects
Demolition	N/A	N/A	N/A
Earthwork	Negligible	None	Negligible
Construction Activities	Negligible	None	Negligible
Trackout	Negligible	None	Negligible
Overall Significance	**Negligible**		

6.1.4 With appropriate use of mitigation measures and good site management the overall residual effects of dust and PM_{10} generation and deposition are considered to be **negligible**.

6.1.5 Mitigation measures to reduce any adverse impacts associated with traffic emissions during the construction phase of the proposed development will include traffic management procedures to remove pressure from congested roads. Traffic management measures are to be agreed in advance with LBH. Once these mitigation measures are implemented, the residual effects of emissions from construction vehicles overall will be **negligible**.

6.2 Operation Phase

6.2.1 Based on the assessment results, and the resulting ambient air NO_2 and PM_{10} concentrations attributable to traffic emissions associated with the Proposed Development, mitigation for the operation phase is not considered to be required.

7 Cumulative Effects

7.1.1 It has been assumed that any other developments with construction phases concurrent with the construction period of the proposed development will also implement best practice mitigation measures to prevent construction dust.

7.1.2 Therefore, given the assumption, it is unlikely there will be significant cumulative construction phase effects on local air quality.

7.1.3 Traffic data used in the assessment have included flows associated with committed developments. Therefore the results for the “with development” scenario provide the total pollution concentrations for NO_2 and PM_{10} associated with these developments and the Proposed Development. As such it is considered that there will be a negligible cumulative effect as a result of the operation of the Proposed Development and other developments.

8 Summary and Conclusions

8.1.1 A qualitative assessment of the potential effects on local air quality from construction activities has been carried out for this phase of the Proposed Development based on the IAQM construction assessment procedure.

8.1.2 This assessment identified that the Proposed Development is considered to be a Medium Risk Site overall for earthworks, general construction activities and trackout. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM_{10} releases will be reduced and excessive releases prevented. The residual effects of the construction phase on air quality are therefore considered to be temporary, short term, local and of negligible significance according to IAQM's significance criteria.

8.1.3 A quantitative assessment of the potential effects during the operation phase was undertaken using advanced dispersion modelling to predict the changes in NO_2 and PM_{10} concentrations that would occur due to traffic generated by the Proposed Development.

8.1.4 The results show that the Proposed Development would cause imperceptible changes in NO_2 and PM_{10} concentrations at the assessment receptors. In addition, the predicted ambient air concentrations for the opening year are below the limit values and objectives for these pollutants. Therefore, the effects of the operation phase are considered to be negligible for NO_2 and annual mean PM_{10} concentrations, and neutral for daily mean PM_{10} concentrations according to the EPUK criteria. Therefore, there is likely to be a direct, permanent long-term effect on local air quality of negligible significance.

8.1.5 Overall, the Proposed Development and air quality are considered to be a low priority consideration in the planning process and no significant air quality effects are anticipated as a result of the construction or operation of the Proposed Development.

9 References

[1] Air Quality Directive 2008/50/EC

[2] The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

[3] The Air Quality (England) (Amendment) Regulations 2002- Statutory Instrument 2002 No.3043

[4] The Air Quality Standards Regulations 2010- Statutory Instrument 2010 No. 1001

[5] The Environmental Protection Act 1990

[6] The Environment Act 1995

[7] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2) July 2007

[8] National Planning Policy Framework

[9] London Borough of Hillingdon Local Plan (November 2012)

[10] Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09) (DEFRA, February 2009)

[11] Local Air Quality Management Review and Assessment Policy Guidance LAQM.PG(09)

[12] Development Control: Planning for Air Quality (2010 update) Environmental Protection UK, April2010

[13] Institute of Air Quality Management: Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance (January 2012)

[14] London Borough of Hillingdon Air Quality Supplementary Guidance

[15] London Borough of Hillingdon Local monitoring and air quality review and assessment reports. Available at http://www.hillingdon-air.info/monitoring.php

[16] DEFRA Local Air Quality Management (LAQM) Support Pages. Available at:http://laqm.defra.gov.uk/

[17] Environment Agency's 'What's in your backyard?' pollution register. Available at:http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

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

[19] A Cook (2008) Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective

10 Appendix A – Glossary

Term	Definition
AADF/T Annual Average Daily Flow/Total	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modeled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of DEFRA and the Devolved Administrations.
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
DEFRA	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport.
EIA	Environmental Impact Assessment.
Emission rate	The quantity of a pollutant released from a source over a given period of time.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.

HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
Line source	Emission source considered to be mobile and to follow a well defined path (e.g., road transport).
Minor roads	Non A roads of Motorways.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
True Value	The value (e.g., of a concentration), which is entirely consistent with the definition of the units in which it is given. This is the value that would be obtained by a perfect measurement.
µg/m^3 microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

11 Appendix B – EU Limit Values and UK Objectives

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**		
		Concentration	***Measured as***	***Annual exceedences allowed***	***Target date***	**2008/50/EC**
Nitrogen dioxide (NO_2)	All UK	200µg/m^3	1 hour mean	18	31.12.2005	01.01.2010
	All UK	40µg/m^3	annual mean		31.12.2005	
Particulate Matter (PM_{10}) (gravimetric)[1]	All UK	40µg/m^3	annual mean		31.12.2004	01.01.2005
	All UK	50µg/m^3	24 hour mean	35	31.12.2004	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) but included in the Air Quality Standards 2010						
Pollutant	**Applies to**	**Standard**		**Objective**		**2008/50/EC**
		Concentration	***Measured as***	***Annual exceedences allowed***	***Target date***	
Particulate Matter ($PM_{2.5}$) (gravimetric)[1]	UK (except Scotland)	25µg/m^3	annual mean	-	2020	As standard Target 2010
	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

Explanation
µg/m^3 = microgram per cubic metre; 1 Measured using the European gravimetric transfer sampler or equivalent.

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.

12 Appendix C – Traffic Data

2012 Baseline

Road Link	Road ID	Speed (kph)	Annual Average Hourly Traffic Flow	%HGVs	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Bourne Avenue	1	50.0	2774	6.0	0.017	0.001
Bourne Avenue	2	20.0	2774	6.0	0.029	0.002
Bourne Avenue	3	50.0	2774	6.0	0.017	0.001
A408	4	80.0	17344	15.0	0.137	0.011
A408	5	80.0	17344	15.0	0.137	0.011
A408	6	80.0	17344	15.0	0.137	0.011
A408	7	80.0	17344	15.0	0.137	0.011
A408	8	30.0	17344	15.0	0.241	0.012
A408	9	30.0	17344	15.0	0.241	0.012
A408	10	20.0	17344	15.0	0.317	0.014
Bourne Avenue	11	30.0	2774	6.0	0.023	0.002
A408	12	30.0	17344	15.0	0.241	0.012
A408	13	30.0	17344	15.0	0.241	0.012
Bourne Avenue	14	30.0	2774	6.0	0.023	0.002
Bourne Avenue	15	30	2774	6.0	0.023	0.002
A408	16	20	17344	15	0.317	0.014

2015 Without Development

Road Link	Road ID	Speed (kph)	Annual Average Hourly Traffic Flow	%HGVs	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Bourne Avenue	1	50.0	2799	6.0	0.014	0.001
Bourne Avenue	2	20.0	2799	6.0	0.025	0.001
Bourne Avenue	3	50.0	2799	6.0	0.014	0.001
A408	4	80.0	17501	15.0	0.106	0.011
A408	5	80.0	17501	15.0	0.106	0.011
A408	6	80.0	17501	15.0	0.106	0.011
A408	7	80.0	17501	15.0	0.106	0.011
A408	8	30.0	17501	15.0	0.191	0.011
A408	9	30.0	17501	15.0	0.191	0.011
A408	10	20.0	17501	15.0	0.254	0.012
Bourne Avenue	11	30.0	2799	6.0	0.019	0.001
A408	12	30.0	17501	15.0	0.191	0.011
A408	13	30.0	17501	15.0	0.191	0.011
Bourne Avenue	14	30.0	2799	6.0	0.019	0.001
Bourne Avenue	15	30	2799	6.0	0.019	0.001
A408	16	20	17501	15	0.254	0.012

2015 With Development

Road Link	Road ID	Speed (kph)	Annual Average Hourly Traffic Flow	%HGVs	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Bourne Avenue	1	50.0	2799	6.0	0.014	0.001
Bourne Avenue	2	20.0	2799	6.0	0.025	0.001
Bourne Avenue	3	50.0	2799	6.0	0.014	0.001
A408	4	80.0	17730	16.0	0.110	0.011
A408	5	80.0	17730	16.0	0.110	0.011
A408	6	80.0	17619	16.0	0.110	0.011
A408	7	80.0	17619	16.0	0.110	0.011
A408	8	30.0	17730	16.0	0.202	0.012
A408	9	30.0	17730	16.0	0.202	0.012
A408	10	20.0	17730	16.0	0.268	0.013
Bourne Avenue	11	30.0	2799	6.0	0.019	0.001
A408	12	30.0	17619	16.0	0.201	0.012
A408	13	30.0	17619	16.0	0.201	0.012
Bourne Avenue	14	30.0	2799	6.0	0.019	0.001
Bourne Avenue	15	30	2799	6.0	0.019	0.001
A408	16	20	17619	16	0.267	0.012

13 Appendix D – Summary of IAQM Construction Phase Impact Assessment Procedure

Step 1 – Screening the need for a Detailed Assessment

An assessment will normally be required where there are sensitive receptors within 350m of the site boundary and/or within 100m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is "negligible".

Step 2 – Assess the Risk of Dust Effects Arising

The tables below show the risk categories for the potential dust and PM_{10} impacts from demolition; earthworks; general construction activities and trackout. They assume that no mitigation measures are applied and are dependent on the available information on the construction phase and professional judgement. The risk categories should be used as guidance for determining the level of mitigation that must be applied.

1) Demolition

The following are examples of the potential dust emission classes (note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment:

- 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 000m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- Small: Total building volume <20 000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

The potential dust emission class determined above should be used in the matrix in Table D1 to determine the demolition risk category with no mitigation applied (high, low or medium risk) based on the distance to the nearest receptors. This varies depending on the different effects under consideration.

Table D1: Risk Category from Demolition Activities

Distance to nearest receptor (m) [(a)]		Dust Emission Class		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 100	<20	High Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 - 40	Medium Risk Site	Low Risk Site	Low Risk Site
200 - 350	40 - 100	Medium Risk Site	Low Risk Site	Negligible

(a) Distance from dust emission source. Where this is not known then the distance should be taken from the site boundary. The risk is based on the distance to the nearest receptor.

2) Earthworks and Construction Activities

The following are examples of the potential dust emission classes (note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment:

Earthworks

- Large: Total site area >10 000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to 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; and,
- 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 Activities

- 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; and
- Small: Total building volume <25 000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The potential dust emission class determined above should be used in the matrix in Table D2 to determine the earthworks and construction activities risk categories with no mitigation applied (high, low or medium risk) based on the distance to the nearest receptors.

Table D2: Risk Category from Earthworks & Construction Activities

Distance to nearest receptor (m) [(a)]		**Dust Emission Class**		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 - 40	Medium Risk Site	Low Risk Site	Negligible
200 - 350	40 - 100	Low Risk Site	Low Risk Site	Negligible

(a) Distance from dust emission source. Where this is not known then the distance should be taken from the site boundary. The risk is based on the distance to the nearest receptor.

3) Trackout

Factors which determine the magnitude class are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the magnitude categories. Only receptors within 100 m of the route(s) used by vehicles on the public highway and up to 500 m from the site entrance(s) are considered to be at risk and the risk classification distances shown below reflect this.

The following are examples of the potential dust emission classes (note that not all the criteria need to be met for a particular class); other criteria may be used if justified in the assessment:

- Large: >100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- Medium: 25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- Small / Medium: <25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

These potential dust emission classes should be used in Table D3 to determine the trackout risk category with no mitigation applied.

Table D3: Risk Category from Trackout

Distance to nearest receptor (m) [(a)]		Dust Emission Class		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
<20	-	High Risk Site	Medium Risk Site	Medium Risk Site
20 – 50	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
50 – 100	20 – 100	Low Risk Site	Low Risk Site	Negligible

(a) For the trackout the distance is from the roads used by construction traffic.

There is an extra dimension to the assessment of trackout, as the distance over which it might occur depends on the site. As general guidance, significant trackout may occur up to 500m from large sites, 200m from medium sites and 50m from small sites, as measured from the site exit. These distances assume no site-specific mitigation.

The 'distance to receptor' in Table C relates to the distance from the road where mud may be deposited. Therefore in determining the risk from trackout, both distances need to be taken into account.

Step 3 – Identify the need for Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is a low, medium or high risk site.

Step 4 – Define Effects and their Significance

The significance is best determined using professional judgement, taking account of the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks. The sensitivity of the area needs to be defined.

The sensitivity of the area surrounding the construction / demolition site is combined with the risk of the site giving rise to dust effects (from Step 2) to define the significance of the effects for each of the four activities (demolition, earthworks, construction and trackout).

The preference in the IAQM Guidance is to only assign significance to the impact with mitigation. The residual effects for most sites will be negligible as shown in Table D4 below.

Table D4: Significance of Effects of Each Activity with Mitigation

Sensitivity of surrounding area	Risk of site giving rise of dust effects		
	High	Medium	Low
Very High	Slight adverse	Slight adverse	Negligible
High	Negligible	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

13.1.1 When assessment of the significance of the effects without mitigation is required, the recommended significance criteria in Table D5 should be used.

Table D5: Significance of Effects of Each Activity without Mitigation

Sensitivity of surrounding area	Risk of site giving rise of dust effects		
	High	Medium	Low
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight adverse	Negligible	Negligible

The final step is to determine the overall significance of the effects arising from the construction phase of a proposed development. This will be based on professional judgement but should take account of the significance of the effects for each of the four activities.

14 Appendix E – Model Verification Calculations

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

a) estimates of background pollutant concentrations;

b) meteorological data uncertainties;

c) traffic data uncertainties;

d) model input parameters, such as 'roughness length'; and

e) overall limitations of the dispersion model.

Model Precision

Residual uncertainty may remain after systematic error or 'model accuracy' has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the 'precision' of the model predictions, i.e. how wide the scatter or residual variability of the predicted values compare with the monitored true value, once systematic error has been allowed for. The quantification of model precision provides an estimate of how the final predictions may deviate from true (monitored) values at the same location over the same period.

Suitable local monitoring data for the purpose of verification is available for concentrations of NO_2 at the locations shown in section XXX. This monitoring data have been used to validate the dispersion model prediction and obtain adjustment factors which can be applied to predictions of pollutant concentrations in the base and future years. NO_x adjustment factors were used as a proxy to adjust the PM_{10} and $PM_{2.5}$ output as no monitoring of PM has been undertaken close to the site.

Model Performance

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG(09) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. The statistical parameters used in this assessment are:

a) root mean square error (RMSE);

b) fractional bias (FB); and

c) correlation coefficient (CC).

A brief for explanation of each statistic is provided in Table E1, and further details can be found in LAQM.TG(09) Box A3.7. It can be seen that the model performance was good after adjustment.

Table E1 - Model Performance Statistics

Statistical Parameter	Comments	Ideal value	Value achieved
RMSE	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40 µg/m^3, if an RMSE of 10 µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4 µg/m^3 for the annual mean NO_2 objective.	0.01	0.04 Without adjustment versus 3.1 after adjustment
Fractional Bias	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00	0.00 Without adjustment versus 0.1 after adjustment
Correlation Coeficient	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.	1.00	1.00

These parameters estimate how the model results agree or diverge from the observations. These calculations have been carried out prior to, and after, adjustment and provide information on the improvement of the model predictions as a result of the application of the verification adjustment factors.

Assessment Verification Methodology

The model outputs of road-NO_x (i.e. the component of total NO_x coming from road traffic) were compared with the measured road-NO_x at the diffusion tube locations. A one stage model Verification process was applied in order to suitably correct any under or over estimations in the model, developing the method set out by Defra (2009) and taking into account the most recent guidance.

Total measured NO_x was calculated from the measured NO_2 concentrations at the monitoring locations using the recently updated NO_x from NO_2 calculator available on the Defra website. The measured road-NO_x contribution was then calculated as the difference between the total and the background value. The NO_x roads adjustment factor was determined as the multiplier between the calculated (measured) road contribution and the model derived road contribution.

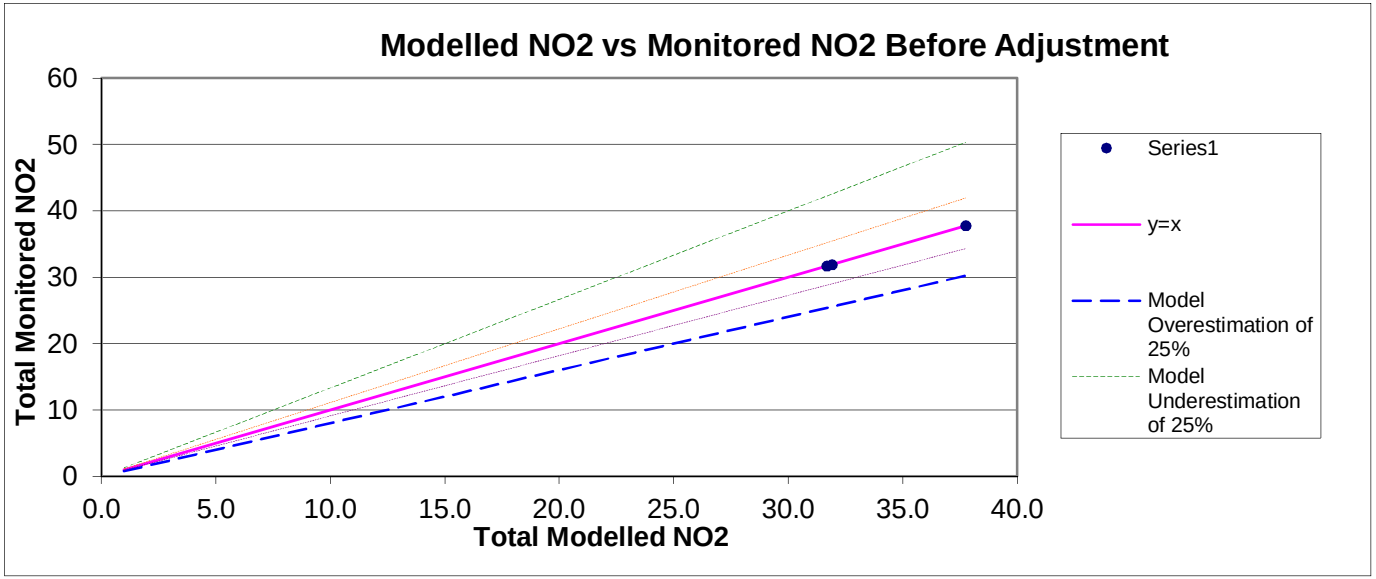
Detail of the verification process data is presented in Table E2. The adjustment factor (2.7) was applied to all modelled results and is presented in Table E3.

Table E2 – Verification Process Data

Site ID	Site Name	Monitored Total NO_2	Background NO_2	Background NO_x	Monitored Road NO_2 Contribution	Monitored Road NO_x Contribution	Modelled Road NOx Contribution
HD55	Harold Avenue	37.80	29.9	55.5	7.9	17.93	8.7
HD64	34 Hatch Lane	31.70	29.9	55.5	1.8	3.91	10.3
HD72	2 Vineries Close	31.90	29.9	55.5	2.0	4.35	10.4

Table E3 – Adjustment Factor

Site ID	Ratio of monitored NO_x road contribution /modelled road contribution NO_x	Adjustment factor for modelled road contribution	Modelled Total NO_2	Monitored Total NO_2	% Difference
HD55	2.1	0.83	37.7	37.80	-0.2
HD64	0.4		31.7	31.70	0.0
HD72	0.4		31.9	31.90	0.0



15 Appendix F – Summary of EPUK Assessment Significance Criteria

The following criteria relate to changes in annual mean NO_2/PM_{10} concentrations and 24-hour mean PM_{10} concentrations resulting from the development.

ANNUAL MEAN NO_2 AND PM_{10} CONCENTRATIONS

Significance criteria	Definition
NEUTRAL	The development causes no change in concentrations.
NEGLIGIBLE IMPACT	The development gives rise to a IMPERCEPTIBLE change in concentrations or; The development gives rise to a SMALL change in concentrations and predicted concentrations are below 36μg/m^3; or The development gives rise to a MEDIUM change in concentrations and predicted concentrations are below 30μg/m^3.
A SLIGHT ADVERSE IMPACT	The development gives rise to a SMALL increase in concentrations and predicted concentrations with the development in place are above 36μg/m^3; or The development gives rise to a MEDIUM increase in concentrations and predicted concentrations with the development in place are between 30-36μg/m^3; or The development gives rise to a LARGE increase in concentrations and predicted concentrations with the development in place are less than 36μg/m^3.
A MODERATE ADVERSE IMPACT	The development gives rise to a MEDIUM increase in concentrations and predicted concentrations with the development in place are above 36μg/m^3; or The development gives rise to a LARGE increase in concentrations and predicted concentrations with the development in place are between 36-40μg/m^3.
A SUBSTANTIAL ADVERSE IMPACT	The development gives rise to a LARGE increase in concentrations and predicted concentrations with the development in place exceed the objective level of 40μg/m^3.
A SLIGHT BENEFICIAL IMPACT	The development gives rise to a SMALL decrease in concentrations and predicted concentrations without the development in place are above 36μg/m^3; or The development gives rise to a MEDIUM decrease in concentrations and predicted concentrations without the development in place are between 30-36μg/m^3; or The development gives rise to a LARGE decrease in concentrations and predicted concentrations without the development in place are less than 36μg/m^3.
A MODERATE BENEFICIAL IMPACT	The development gives rise to a MEDIUM decrease in concentrations and predicted concentrations without the development in place are above 36μg/m^3; or The development gives rise to a LARGE decrease in concentrations and predicted concentrations without the development in place are between 36-40μg/m^3.
A SUBSTANTIAL BENEFICIAL IMPACT	The development gives rise to a LARGE decrease in concentrations and predicted concentrations without the development in place exceed the objective level of 40μg/m^3.

Where the magnitude of change in concentration for annual mean NO_2 and PM_{10} has been defined as follows:

An IMPERCEPTIBLE change is a change of <0.4μg/m^3;

A SMALL change is a change of less than 0.4 – 2μg/m^3;

A MEDIUM change is a change of 2 - 4μg/m^3; and

A LARGE change is a change of > 4μg/m^3.

DAILY MEAN PM_{10} CONCENTRATIONS

Significance criteria	Definition
NEUTRAL	The development causes no change in the number of days of exceedence.
NEGLIGIBLE IMPACT	The development gives rise to a IMPERCEPTIBLE change in the number of days of exceedence; or The development gives rise to a SMALL change and the predicted number of days of exceedence is below 32 days; or The development gives rise to a MEDIUM change and the predicted number of days of exceedence is below 26 days.
A SLIGHT ADVERSE IMPACT	The development gives rise to a SMALL increase and the predicted number of days of exceedence is above 32 days; or The development gives rise to a MEDIUM increase and the predicted number of days of exceedence is between 26 and 32 days; or The development gives rise to a LARGE increase and the predicted number of days of exceedence is below 32 days.
A MODERATE ADVERSE IMPACT	The development gives rise to a MEDIUM increase and the predicted number of days of exceedence is above 32 days; or The development gives rise to a LARGE increase and the predicted number of days of exceedence is between 32 and 35 days.
A SUBSTANTIAL ADVERSE IMPACT	The development gives rise to a LARGE increase and the number of days of exceedence with the development in place is above 35 days.
A SLIGHT BENEFICIAL IMPACT	The development gives rise to a SMALL decrease and the predicted number of days of exceedence without the development is above 32 days; or The development gives rise to a MEDIUM decrease and the predicted number of days of exceedence without the development is between 26 and 32 days; or The development gives rise to a LARGE decrease and the predicted number of days of exceedence without the development is between 32 and 35 days.
A MODERATE BENEFICIAL IMPACT	The development gives rise to a MEDIUM decrease and the predicted number of days of exceedence without the development is above 32 days; or The development gives rise to a LARGE decrease and the predicted number of days of exceedence without the development is between 32 and 35 days.
A SUBSTANTIAL BENEFICIAL IMPACT	The development gives rise to a LARGE decrease and the number of days of exceedence without the development in place is above 35 days.

Where the magnitude of change is defined as the number of days of exceedence of a daily mean PM_{10} concentration of 50μg/m^3:

An IMPERCEPTIBLE change is a change of < 1 day;

A SMALL change is a change of 1- 2 days;

A MEDIUM change is a change of 2 - 4 days; and

A LARGE change is a change of > 4 days.

16 Appendix G – Assessment Results

CONSTRUCTION PHASE – NO_2 Results

NO_2 Annual Mean	**2005**	**Source**
AQS Objective (µg/m^3)	40	UK Air Quality Strategy

Receptor Number	**Road Source Without Development**	**Road Source With Development**	**Change**
	2016	**2016**	**2016**
Existing Receptors			
1	32.77	32.82	0.05
2	32.75	32.80	0.05
3	31.11	31.15	0.04
4	38.87	39.78	0.91
5	34.61	35.11	0.50
6	34.97	35.51	0.54
7	34.66	35.16	0.50
8	34.77	35.29	0.52
9	36.41	37.09	0.68
10	31.95	32.00	0.05
11	33.34	33.40	0.06
12	33.44	33.49	0.05
13	32.38	32.43	0.05
14	32.00	32.04	0.04
15	31.43	31.48	0.05
16	31.07	31.10	0.03
17	31.08	31.13	0.05
18	30.78	30.83	0.05
19	30.59	30.64	0.05
20	30.51	30.56	0.05
21	30.45	30.50	0.05
22	30.28	30.32	0.04
23	30.33	30.37	0.04
24	30.36	30.39	0.03

OPERATION PHASE – NO_2 Results

NO_2 Annual Mean AQS Objective ($\mu g/m^3$)	2005 40	Source UK Air Quality Strategy

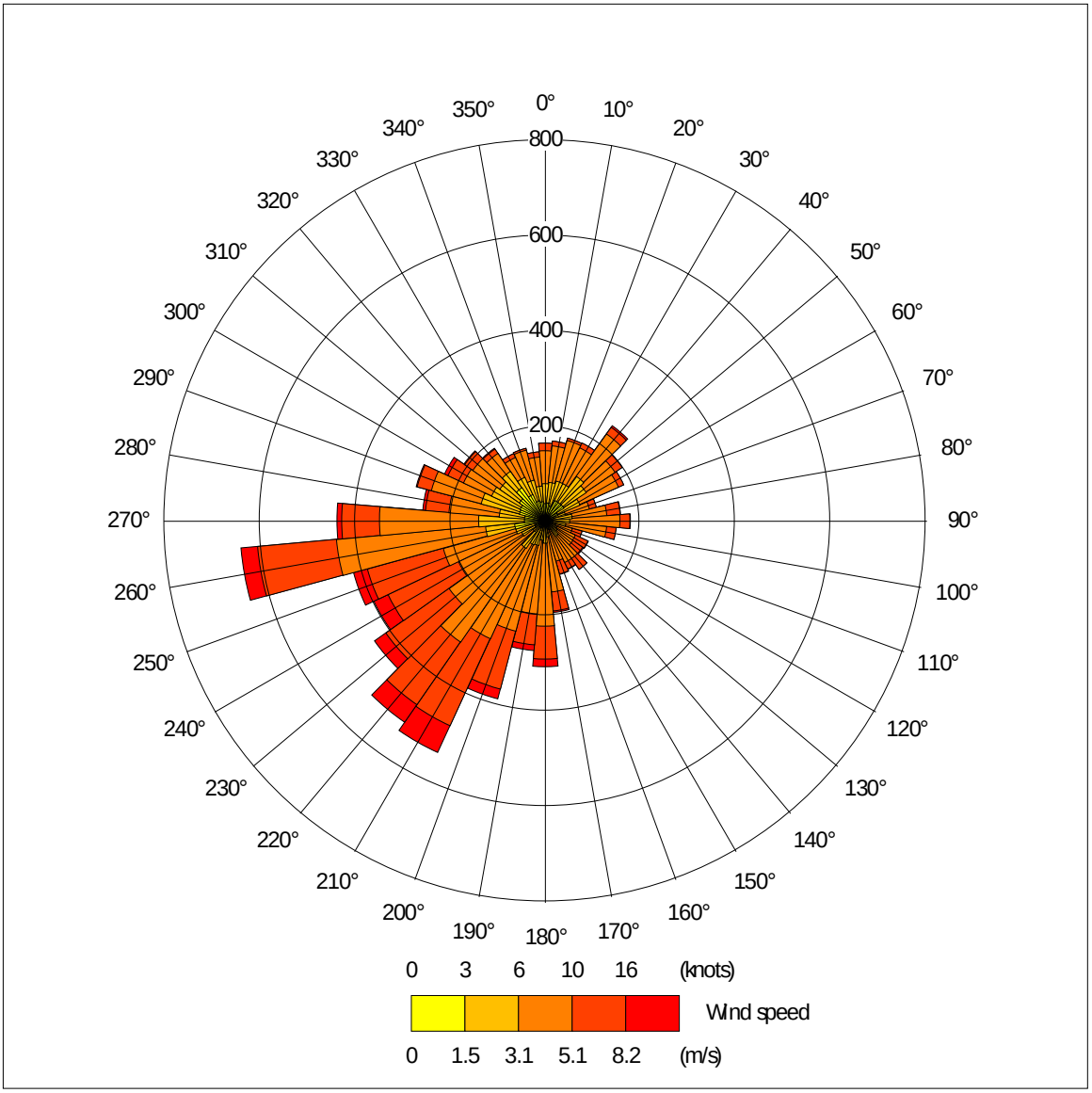
Receptor Number	Road Source Without Development	Road Source With Development	Change
	2016	2016	2016
Existing Receptors			
1	32.51	32.52	0.01
2	32.50	32.51	0.01
3	30.99	31.00	0.01
4	37.85	38.14	0.29
5	34.05	34.21	0.16
6	34.37	34.54	0.17
7	34.09	34.25	0.16
8	34.19	34.35	0.16
9	35.65	35.87	0.22
10	31.76	31.78	0.02
11	33.04	33.05	0.01
12	33.12	33.14	0.02
13	32.15	32.16	0.01
14	31.80	31.82	0.02
15	31.29	31.30	0.01
16	30.95	30.96	0.01
17	30.96	30.98	0.02
18	30.68	30.70	0.02
19	30.51	30.53	0.02
20	30.44	30.46	0.02
21	30.41	30.43	0.02
22	30.24	30.25	0.01
23	30.28	30.29	0.01
24	30.31	30.32	0.01

OPERATION PHASE – PM_{10} Results

PM10 Annual Mean AQS Objective (µg/m^3)	2005 40	Source UK Air Quality Strategy

Receptor Number	Road Source Without Development	Road Source With Development	Change
	2016	2016	2016
Existing Receptors			
1	18.83	18.83	0.00
2	18.83	18.83	0.00
3	18.52	18.52	0.00
4	20.06	20.10	0.04
5	19.19	19.22	0.03
6	19.26	19.29	0.03
7	19.20	19.23	0.03
8	19.23	19.25	0.02
9	19.56	19.59	0.03
10	18.67	18.67	0.00
11	18.94	18.95	0.01
12	18.96	18.97	0.01
13	18.76	18.76	0.00
14	18.69	18.69	0.00
15	18.58	18.58	0.00
16	18.51	18.51	0.00
17	18.50	18.51	0.01
18	18.45	18.45	0.00
19	18.41	18.42	0.01
20	18.40	18.40	0.00
21	18.39	18.39	0.00
22	18.37	18.37	0.00
23	18.37	18.37	0.00
24	18.38	18.38	0.00

17 Appendix H – Wind Rose for Heathrow



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