BUROHAPPOLD ENGINEERING

TfL Landholdings at Northwood

Air Quality Assessment

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Revision 03

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Glossary

Term	Definition
AQMA	Air quality management area
CAZ	Central Area Zone
CHP	Combined heat and power
DN	Do Nothing
DS	Do Something
EPUK	Environmental Protection UK
GLA	Greater London Authority
LAQM TG.09	Local air quality management technical guidance
LBH	London Borough of Hillingdon
MAQS	Mayor's Air Quality Strategy
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NPPF	National Planning Policy Framework
NRMM	Non-road mobile machinery
PM_{10}	Particulate matter
SPG	Supplementary Planning Guidance

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Executive Summary

BuroHappold has been commissioned by Transport for London (TfL) to undertake an air quality assessment for the proposed development at Northwood in the London Borough of Hillingdon (LBH). The proposed development involves construction of 127 residential units and 1,440 m^2 of new A1-A5 retail floor space. Proposals also include provision for 298 car parking spaces and 306 cycle parking spaces.

Although the London Borough of Hillingdon (LBH) has declared an area to the south of the borough as an Air Quality Management Area (AQMA), the application site is not located within this AQMA.

LBH monitors air quality across the borough, however, no monitoring sites are located in the vicinity of the proposed development and therefore, LBH request an air quality monitoring survey to be undertaken. A three month monitoring survey was undertaken at four locations near the proposed development. Results demonstrate that air quality objectives are being met at all locations except one located on Green Lane. Monitoring will continue for additional three months in order to provide more robust results based on six months data set.

During construction and demolition, site activities will have the potential to affect local air quality in particular from dust deposition and an increase in particulate matter concentrations. Mitigation measures are recommended for implementation to ensure that any impact on local air quality is insignificant.

With regards to operational impacts, pollutant emissions from traffic generated as a result of the proposed development and from onsite energy generation have been assessed. The change in pollutant concentrations at surrounding residential receptors due to traffic emissions has been predicted using air dispersion modelling at receptor locations where the impact is likely to be greatest. The predicted impacts at all modelled receptors is considered is negligible except at one receptor, located on the corner of Green Lane and Station Approach, where the impact is considered slight adverse. The reason for this is the change in road layout, with station approach moving closer to this receptor. However, air quality objectives are predicted to be met at all modelled receptors.

The impact from emissions due to proposed onsite plant has been considered at onsite and offsite residential receptors. It is considered that the change in air quality as a result of plant emissions will be negligible at all considered receptors. Additionally all on site gas boilers will meet the Greater London Authority's emission limit.

As the site is located along a busy road, the impact of traffic emissions on proposed residential receptors has been considered at proposed residential properties. It is predicted that pollutant concentrations at all proposed residential receptors will meet relevant air quality objectives.

The assessment has considered the Mayor of London's 'air quality neutral' policy. The development will meet air quality neutral benchmarks for both transport and building emissions, therefore this policy is complied with.

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1 Introduction

1.1 Proposed development

This report describes the air quality impacts from the proposed development at TfL's Landholdings, Northwood in the London Borough of Hillingdon (LBH). The site is 1.91 ha, and located on the junction of Green Lane (B469) and Eastbury Road (see Figure 1—1). The site comprises land north and south of Green Lane including part of the highway.

The area of land north of Green Lane comprises single story retail units over the railway bridge with a two-story adjoining unit on the corner of Eastbury Road. The northern part of the site is bounded by the Eastbury Surgery to the north; Green Lane to the south; Eastbury Road to the east and the retail units on the bridge to the west.

The majority of the site lies south of Green Lane and comprises the existing underground station and a mix of A-Class uses, residential flats, some industrial use, dental practice and area of surface car parking. The southern part of the site is bounded by Green Lane to the north; the London Underground compound to the south; the railway line to the east; and the rear boundaries of the Northwood Central Club, St John's United Reformed Church and residential properties to the west.

Application proposal is a hybrid planning application for comprehensive redevelopment of the site comprising full planning permission involving demolition of existing buildings to provide 93 residential units (C3) and associated car parking, 1,440 m^2 of new retail (A1-A5), a new operational railway station (Sui Generis) with step free access and associated station car parking; new bus interchange, and a new piazza. Outline planning consent for up to 34 residential units, car parking (all matters reserved apart from access) and refurbishment works to existing retail units along Station Approach.

Appendix B illustrates the application boundaries and the proposed development blocks.

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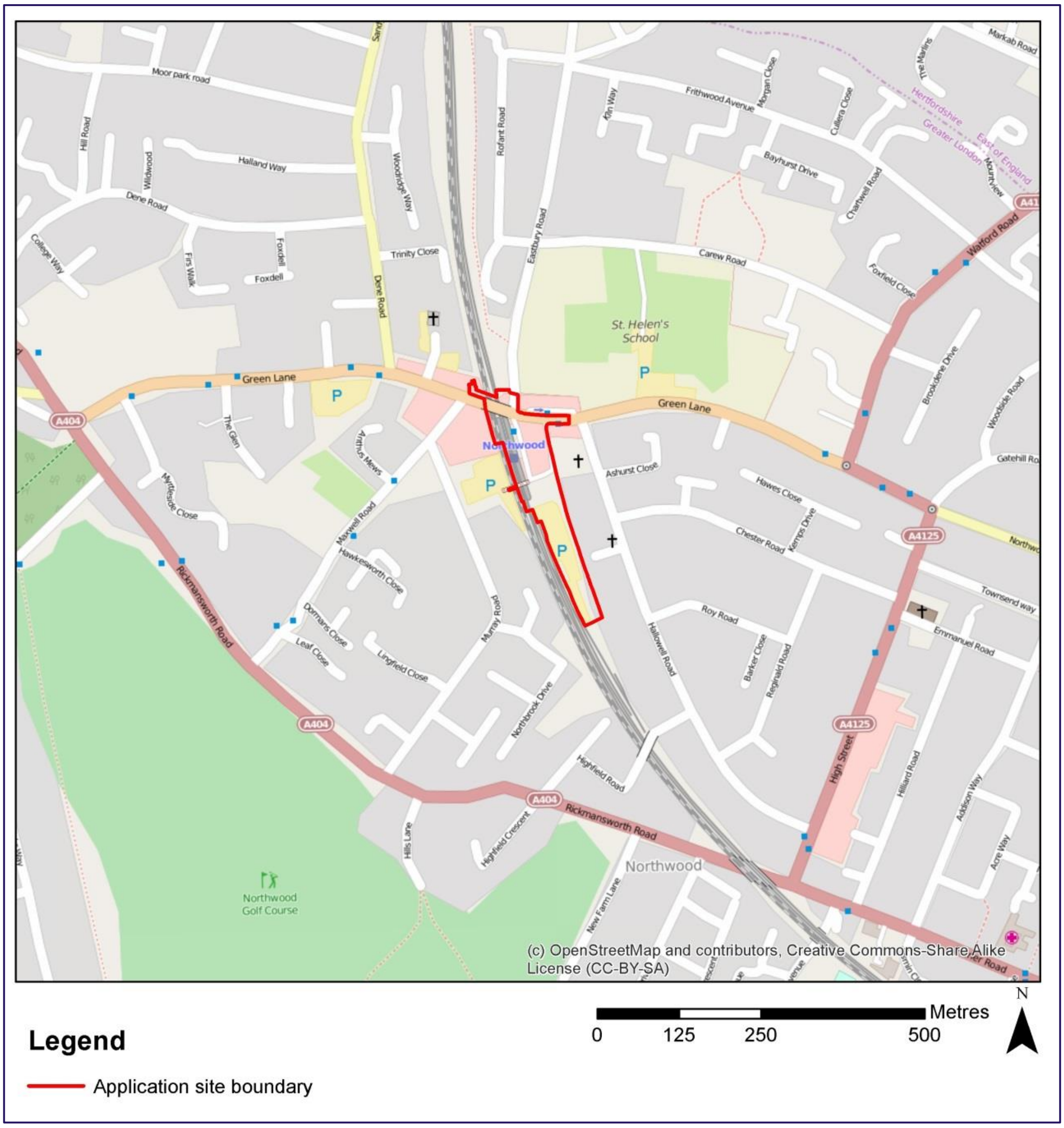
Figure 1—1 Site location



1.2 Scope of assessment

This assessment considers the potential air quality impacts associated with both the construction and operation of the proposed development. Likely changes to air quality in the area, as a result of the proposed development have been considered. The assessment also considers mitigation measures to reduce the impact of the proposed development on local air quality where necessary.

The development proposal will give rise to dust and particulate matter (PM_{10}) emissions during the construction phase, which will have the potential to affect local air quality.

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With regards to operational impacts, traffic generated as a result of the development will give rise to nitrogen oxides (NOx) and PM_{10} emissions. Additionally, the use of onsite CHP and boilers will give rise to NOx emissions. These emissions will have the potential to affect local air quality.

The assessment also considers the GLA 'air quality neutral' policy, by comparing emissions from the development with emissions benchmarks for buildings and transport.

1.3 Consultation

The scope of assessment has been agreed with the LBH Air Quality Officer, following email and phone conversations from 29/05/2015. It was requested by the Officer that an air quality monitoring study be carried out at four locations for a period of six months. This assessment presents the preliminary results for the monitoring undertaken between 01/06/2015 and 01/10/2015. Monitoring locations, methodology and results are detailed in section 3.2.

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2 Air Quality Legislation and Policy

2.1 European legislation

The 2008 Ambient Air Quality Directive (2008/50/EC) sets legally binding limits for pollutant concentrations. This directive was made law in England through the Air Quality (Standards) Regulations 2010.

2.2 UK legislation

Part IV of the Environment Act 1995 places a duty on the Secretary of State for the Environment to develop, implement and maintain an Air Quality Strategy (AQS) with the aim of reducing atmospheric emissions and improving air quality. The latest AQS for England, Scotland, Wales and Northern Ireland was published in 2007, and provides the framework for ensuring the air quality limit values are complied with based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundaries against a series of objectives, and appraise development and transport plans against these assessments.

In areas where air quality objectives are not likely to be met by the relevant target date, local authorities are required to declare an AQMA and develop an air quality action plan in pursuit of the air quality objectives. The national air quality objectives relevant to this assessment are detailed in Table 2-1.

Table 2-1 NO_2 and PM_{10} National Air Quality Objectives included in the Air Quality (England) Regulations 2000

Pollutant	Objective	Date to be achieved and maintained thereafter
Nitrogen dioxide (NO_2)	200 µg/m^3 measured as a 1-hour mean, not to be exceeded more than 18 times a year	31st December 2005
	40 µg/m^3 measured as an annual mean	
Particulate Matter (PM_{10})	50 µg/m^3 measured as a 24-hour mean, not to be exceeded more than 35 times a year	31st December 2004
	40 µg/m^3 measured as an annual mean	

LBH has carried out a phased review and assessment of local air quality within the borough. LBH currently has one AQMA within its administrative area which has been declared for exceedences of the annual mean nitrogen dioxide (NO_2) air quality objective. This AQMA however is located in the south of LBH approximately 5 km from the proposed development site. The whole of the London Borough of Harrow has been declared an AQMA due to exceedences of both the annual mean NO_2 air quality objective and also the 24-hour mean PM_{10} objective. The London Borough of Harrow borders LBH approximately 1.5 km to the east of the proposed site and is therefore the closest AQMA to the site. Figure 2—1 shows the location of the closest AQMAs to the proposed site area.

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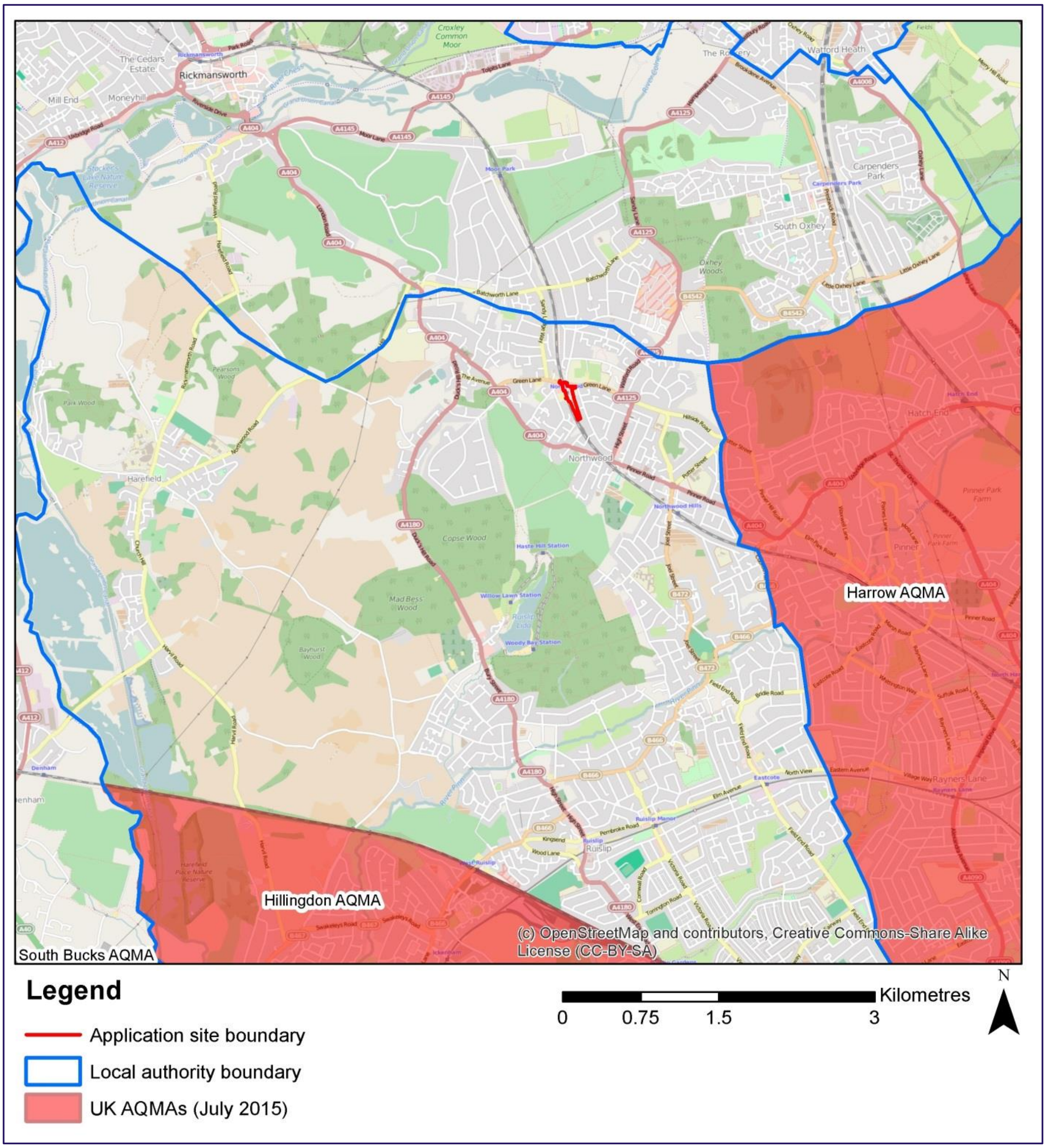
Figure 2—1 Location of closest AQMAs to proposed site (source: Defra, 2015)



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2.3 National planning policy

The National Planning Policy Framework (NPPF) (March 2012) Policy 11 notes that planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of AQMAs and the cumulative impacts on air quality from individual sites in local areas. It also states that planning decisions should ensure that any new development in an AQMA is consistent with the local air quality action plan.

National Planning Practice Guidance[1] (NPPG) (2014) has been developed in order to support the NPPF. Paragraph 005 of the Air Quality Guidance provides a concise outline as to how air quality should be considered in order to comply with the NPPF. Guidance states when air quality is considered relevant to a planning application, which includes proposals which:

- *'significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads';*
- *'introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area';*
- *'give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations'; or*
- *'expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality'.*

2.4 Regional planning policy and guidance

The London Plan and Mayor's Air Quality Strategy

The London Plan[2] provides the strategic regional planning policy framework London. Policy 7.14 deals with improving air quality, and states that London Boroughs should seek reductions in levels of pollutants referred to in the Government's national AQS having regard to the Mayor's Air Quality Strategy (MAQS)[3].

The Mayor has a legal responsibility to prepare and keep under review an air quality strategy for Greater London. Under the Greater London Authority Act, the Mayor is required to include in the strategy policies and proposals which help implement the National Air Quality Strategy in Greater London, and help achieve standards and objectives as outlined in the national strategy. The MAQS introduces a number of interventions measures, broken down into transport or non-transport disciplines, which aim to improve air quality by achieving EU air quality limit values, and subsequently UK air quality objectives as soon as practically possible.

[1] Department for Communities and Local Government, 2013. Available at http://planningguidance.planningportal.gov.uk/
[2] GLA (2015) *The London Plan: Spatial Development Strategy for London Consolidated with Alterations Since 2011*, March 2015.
[3] GLA (2010) *Clearing the air: The Mayor's Air Quality Strategy,* December 2010

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The GLA's Sustainable Design and Construction Supplementary Planning Guidance (SPG)[4] provides guidance to developers and local authorities on measures which can be taken in order to achieve sustainable development, aligned with objectives set out in the London Plan. Section 4.3 of this SPG is related to air quality and highlights the Mayor's priorities:

- developers are to design their schemes so that they are at least 'air quality neutral';
- developments should be designed to minimise the generation of air pollution;
- developments should be designed to minimise and mitigate against increased exposure to poor air quality;
- developers should select plant that meets the standards for emissions from combined heat and power and biomass plants; and
- developers and contractors should follow the guidance set out in the emerging 'Minimising dust and emissions from construction and demolition' SPG when constructing their development.

2.5 Local planning policy and guidance

The LBH published Supplementary Planning Guidance on air quality[5], which aims to:

- identify when an air quality assessment will be required;
- provide technical guidance on the air quality assessment process;
- ensure that air quality has been considered in enough depth to help minimise any potential impacts; and
- provide guidance on the use of air quality conditions and S106 planning obligations.

The Hillingdon Local Plan: Part 1 – Strategic Policies[6] was adopted in November 2012 and includes the following Strategic Objectives in relation to air quality:

- *SO10: Improve and protect air quality, reduce noise levels, reduce the impacts of contaminated land and safeguard quiet areas from noise pollution.*
- *SO11: Address the impacts of climate change, and minimise emissions of carbon and local air quality pollutants from new development and transport.*

The Local Plan Policy EM8: Land, Water, Air and Noise, states:

<u>*Air Quality*</u>

"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 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.

[4] GLA (2014) Sustainable Design and Construction Supplementary Planning Guidance, April 2014
[5] LBH (2002) Planning & Transportation Services – Air Quality: Supplementary Planning Guidance to the Hillingdon Unitary Development Plan
[6] LBH (2012) Local Plan: Part 1 – Strategic policies

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The Council seeks to reduce the levels of pollutants referred to in the Government's National Air Quality Strategy and will have regard to the Mayor's Air Quality Strategy. London Boroughs should also take account of the findings of the Air Quality Review and Assessments and Actions plans, in particular where Air Quality Management Areas have been designated.

The Council has a network of Air Quality Monitoring stations but recognizes (SIC) that this can be widened to improve understanding of air quality impacts. The Council may therefore require new major development in an AQMA to fund additional air quality monitoring stations to assist in managing air quality improvements."

The LBH has proposes amendments to Part 2 of the Local Plan (subject to public consultation), more specifically Policy DMAI18: Air Quality which states that:

"Development proposals should as a minimum be at least "air quality neutral". Where air quality levels are above national and European regulated levels, proposals will be required to demonstrate appropriate reductions in emissions to ensure that local air quality levels for both proposed and existing receptors are met in accordance with the relevant European Union (EU) limit values".

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3 Baseline Conditions

3.1 Baseline assessment methodology

Baseline data were gathered from the following sources:

- air quality monitoring carried out in the vicinity of the site;
- LBH's air quality progress reports and monitoring data; and
- Defra's national air quality background maps[7].

3.2 Air quality monitoring study

In order to gain a more accurate understanding of baseline conditions within the vicinity of the site, a three month air quality monitoring study was carried out between 01/06/2015 and 01/10/2015, as agreed with LBH. Diffusion tubes were used to measure NO_2 concentrations at four roadside locations as agreed with LBH. At each location, diffusion tubes were set up in triplicate and exposed for a month at a time, laboratory analysis was carried out by Gradko Ltd.

The four monitoring sites are located to the north of the application site, where the impact of traffic emissions is expected to be greatest (i.e. at busy junctions and areas where congestion occurs). These locations are at the junction of Green Lane and Station Approach and Eastbury Road, at a height of approximately 2.5 m. No monitoring is required at the south of the application site because it is not affected by traffic emissions. Figure 3—1 shows the location of the monitoring sites.

[7] Defra (2012) Air quality background maps: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

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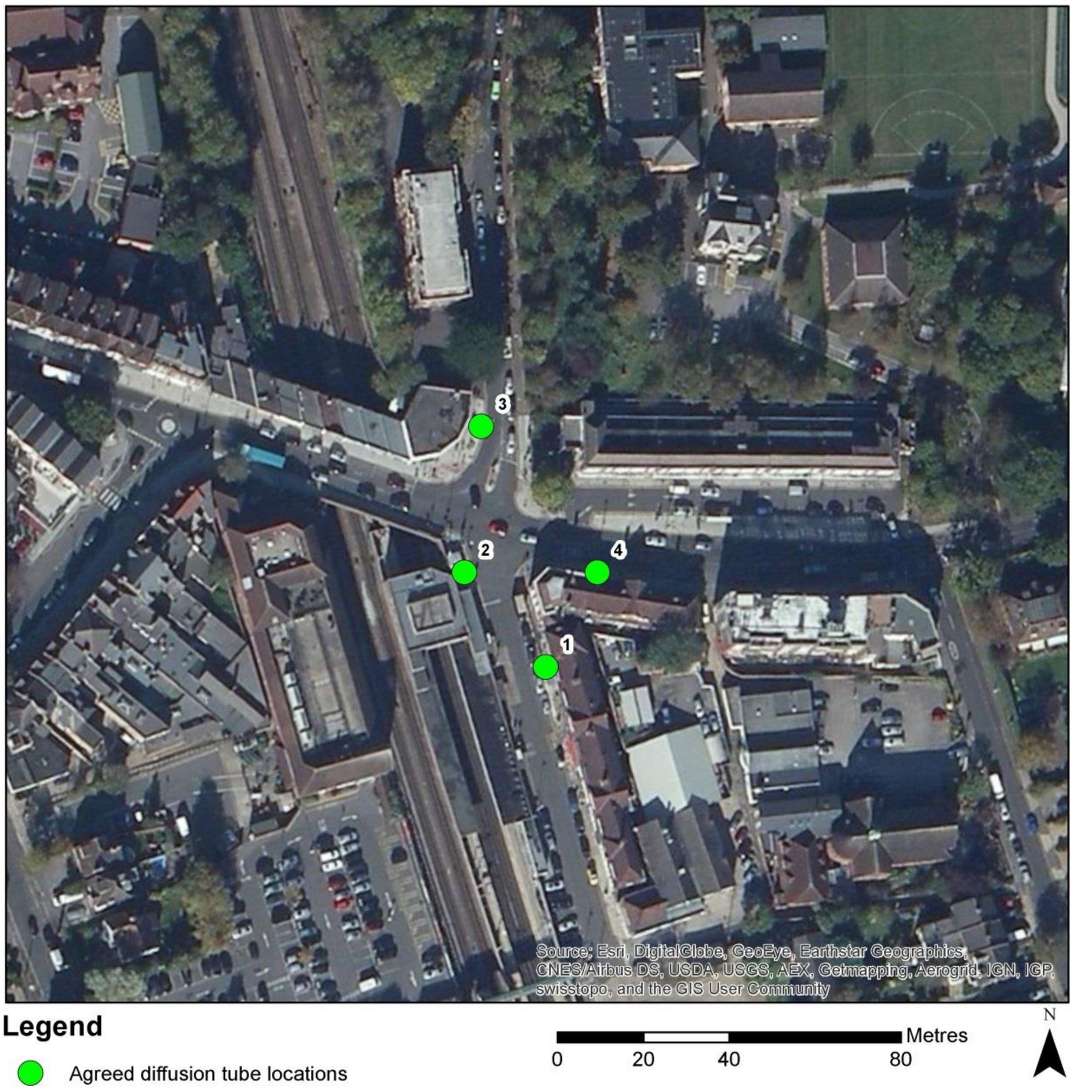
Figure 3—1 Agreed air quality monitoring locations



Results from the three months monitoring study have been annualised (see Table 3-1) following Defra guidance[8] and bias adjusted using Defra national bias adjustment factors[9] (a bias adjustment factor of 0.92 has been applied) in order to provide a comparison with the annual mean objective. Monitoring results are presented in Table 3-2. The locations for the diffusion tubes at site 1,2, and 3 are predicted to be below the annual mean objective of 40µg/m^3, however, site 4 is predicted to be above the objective. This receptor location is directly affected by emissions from traffic congestion on Green Lane.

As agreed with LBH, monitoring will continued for an additional three months in order to inform the baseline study.

[8] Defra (2009) Part of the Environment Act 1995: Local Air Quality Management: Technical Guidance (LAQM.TG(09)), Department for Environment Food and Rural Affairs, February 2009

[9] Defra National Diffusion Tube Bias Adjustment Factor Spreadsheet (version 09/15). Available at: http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

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Table 3-1 Calculation of annualisation ratio

Site	Site type	Annual mean 2014 (Am)	Period mean 2014 (Pm)	Ratio (Am/Pm)
Ealing, Southall	Urban Background	29	24.2	1.19
Harrow, Stanmore	Urban Background	25	17.9	1.39
Hillingdon, Harlington	Urban Background	37	30.5	1.21
Kensington and Chelsea, North Kensington	Urban Background	34	29.1	1.16
Richmond, Barnes Wetland	Suburban	25	22.7	1.1
Reading, New Town	Urban Background	25	24.5	1.02
			Average (Ra)	**1.18**

Table 3-2 Diffusion tube monitoring results (annualised and bias adjusted)

Site number	Location	Indicative grid reference		Average monthly NO_2 concentration, $\mu g/m^3$			Annualised mean NO_2 concentration, $\mu g/m^3$
		X	Y	July	August	September	
1	Station Approach, East	509261	191432	24.5	27.5	36.4	32.0
2	Station Approach, West	509242	191454	30.3	29.5	38.5	35.5
3	Eastbury Road, West	509246	191488	32.6	31.0	40.0	37.5
4	Green Lane, South	509273	191454	33.7	39.5	39.3	**40.7**

3.3 LBH Air quality monitoring data

The LBH monitors NO_2 within the borough using automatic monitors and diffusion tubes, these are concentrated in the AQMA to the south of the borough. None of these locations are located within close proximity to the development site. The closest is the background diffusion tube site in Harefield Hospital, 2 km to the west of the site (see Figure 3—2). Table 3-3 provides the latest available annual mean NO_2 concentrations since 2011. These results show that the annual mean objective of 40 $\mu g\ m^{-3}$ has been achieved in recent years. Other monitoring sites in the LBH and adjoining boroughs are located >5 km from the proposed site, and are therefore, not considered representative of conditions at the development site and have therefore not been considered.

Table 3-3 Nearby diffusion tube monitoring data (Source: LBH Air Quality action Plan Progress Report 2014)

Site number	Location	Site type	Distance from site (km)	OS Grid Reference		Annual Mean NO_2 concentration ($\mu g/m^3$)		
				X	Y	2011	2012	2013
HD70	Harefield Hospital, Hill End Road	Background	2.0	505291	190935	23.9	25.4	23.8

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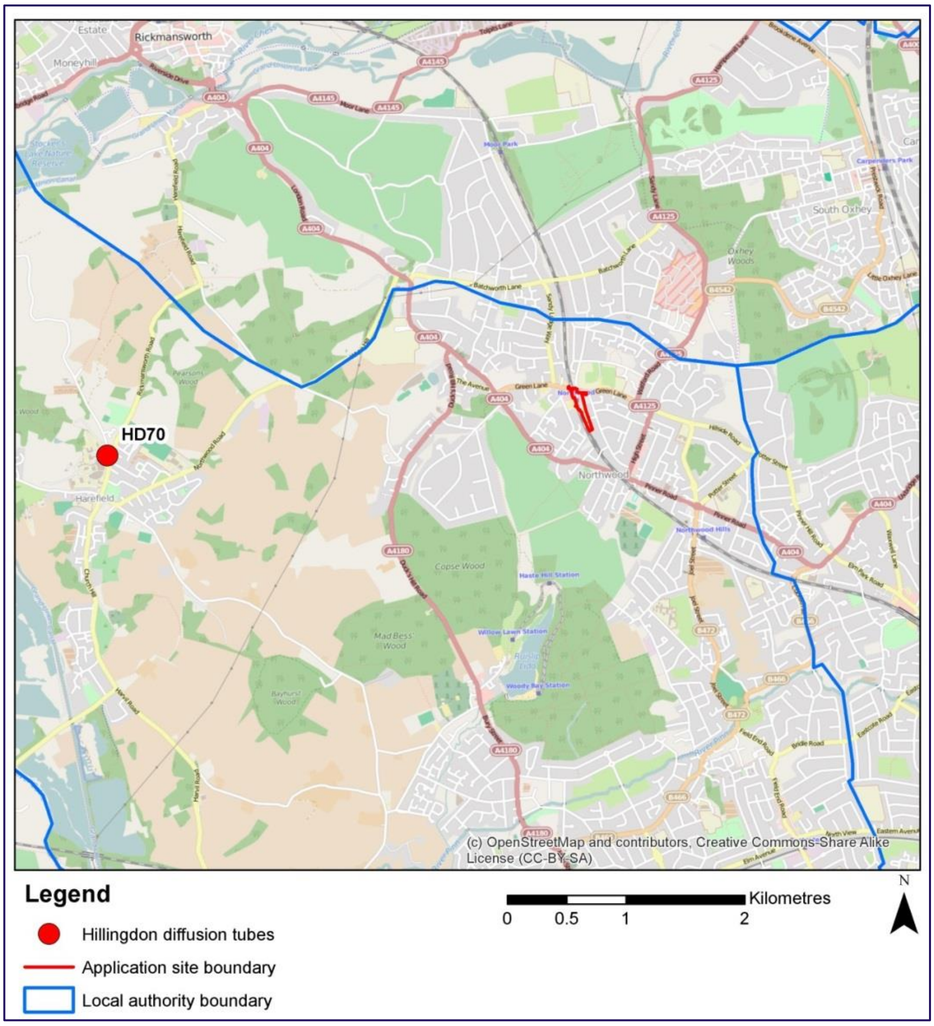
Figure 3—2 Hillingdon diffusion tube monitoring



3.4 National background mapping

Defra website includes estimated background air pollution data for NOx, NO_2 and PM_{10} for each 1km by 1km OS grid square. Background pollutant concentrations are modelled from the base year of 2011 based on ambient monitoring and meteorological data from 2011, the website also includes projections for future years. Estimated pollutant concentrations for 2015 in the OS grid square in which the proposed development site lies (centred at 509500, 191500) are shown in Table 3-4. None of the pollutant background concentration levels are predicted to exceed relevant objectives.

Table 3-4 Predicted Defra mapped background concentrations of NOx, NO_2 and PM_{10} for 2015

Pollutant	Annual mean background concentrations ($\mu g/m^3$)
Nitrogen oxides, NOx	32.0
Nitrogen dioxide, NO_2	20.8
Particulate matter, PM_{10}	19.1

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4 Construction Impact Assessment

4.1 Assessment methodology

Potential construction impacts have been assessed in accordance with Institute of Air Quality Management (IAQM) best practice guidance[10]. This guidance provides a methodology for assessing air quality impacts from demolition, earthworks, construction and trackout[11] activities which may be associated with a development.

The IAQM dust assessment methodology involves the following steps:

1. A screening assessment to identify the need for detailed assessment. Detailed assessment will be required where there is:
    - a human receptor within:
        - 350 m of the site boundary; or
        - 50 m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).
    - an ecological receptor within:
        - 50 m of the site boundary; or
        - 50 m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).
2. Assess the risk of dust impacts by: (a) defining the potential dust emission magnitude, (b) defining the sensitivity of the area, and (c) assessing the risk of impacts. Criteria for defining the dust impacts are shown in Appendix A.
3. Determine site-specific mitigation for each of the four possible construction activities; and
4. Examine residual effects to determine whether or not these are significant.

This assessment will focus on demolition, earthworks, construction, and trackout. IAQM guidance suggests that the significance of any adverse effects are reported post-mitigation, assuming all actions to avoid or reduce environmental effects are an inherent part of the proposed development.

4.2 Construction assessment

The IAQM guidance criteria used to assess the potential impacts from construction activities is detailed in Appendix A. The following steps explain the assessment in the context of the IAQM criteria detailed in Appendix A.

[10] Holman et al (2014). *IAQM Guidance on the assessment of dust from demolition and construction*, Institute of Air Quality Management, London. www.iaqm/wpcontent/uploads/guidance/dust_assessment.pdf.

[11] Trackout refers to the transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

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Step 1: Screen the Need for a Detailed Assessment

In accordance with screening criteria in the IAQM guidance, an assessment is required as receptors are located within 350 m of the site boundary. The nearest receptors are those located on Green Lane approximately 5 m from the site boundary.

Step 2A: Define the Potential Dust Emission Magnitude

IAQM dust emission magnitudes for relevant construction activities are shown in Table 4-1.

Table 4-1 Dust emission magnitudes

Activity	Dust emission magnitude
Demolition	Medium (demolition activities will be <20 m above ground level)
Earthworks	Large (site area >10,000m^2)
Construction	Medium (total building volume between 25,000-100,000m^3)
Trackout	Medium (max. no. vehicles between 10-50 HDV per day)

Step 2B: Define the sensitivity of the area

The sensitivity of the surrounding area is defined using a number of factors, including receptor sensitivity, number of receptors, distance from the site, and existing PM_{10} concentrations. Sensitivity of the surrounding area to potential construction impacts are shown in Table 4-2. The main receptors which may be affected are off site residential and commercial properties.

Table 4-2 Area sensitivity

Potential impact	Sensitivity of surrounding area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust soiling	Medium	Medium	Medium	Medium
Human health	Medium	Medium	Medium	Medium
Ecological	n/a	n/a	n/a	n/a

The site comprises a London Underground station which means commuters as well as local businesses and residents may be exposed to the increased levels of dust generated by the site during construction works. A small number of residents live adjacent to the site within approximately 30 m, however, the majority of residential properties lie further than 80 m from the site. There are no ecological receptors (defined as areas with local or national environmental land designation e.g. nature reserves, sites of special scientific interest (SSSIs)), within 50 m of the site boundary, therefore an assessment of dust emissions on the ecological receptors was not considered necessary.

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Step 2C: Define the risks of impacts

The risk of dust impacts for relevant construction activities are summarised in Table 4-3. These results take into account both the potential dust emission magnitude and the sensitivity of the area. Results show that the impact is considered medium, however it is acknowledged these activities are temporary in nature and will be mitigated through implementation of good industry practices, appropriate to the level of risk. These mitigation measures will be set out in a Construction Management Plan which will be agreed with the LBH before works commence on the site. Section 7.1 sets out appropriate mitigation measures to ensure the impact from construction activities will not be significant.

Table 4-3 Summary of risk from dust

Source	Dust soiling	Human health
Demolition	Medium	Medium
Earthworks	Medium	Medium
Construction	Medium	Medium
Trackout	Medium	Medium

4.3 Construction traffic emissions

EPUK guidance provides criteria for establishing when a detailed air quality assessment is considered necessary. An assessment is considered necessary for:

'Large, long-term construction sites that would generate large HGV flows (>200 movements per day) over a period of a year or more.'

The proposed development will result in no more than 20-30 HGVs arriving per day on site. In line with the EPUK guidance, as the peak number of HGV movements will be less than 200 movements per day, it is accepted that there will be no significant impact from construction vehicle emissions on local air quality.

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5 Operational Impacts

5.1 Traffic emissions

Vehicle emissions were predicted at sensitive receptor locations using the dispersion model ADMS-Roads. ADMS-Roads is a new generation dispersion modelling system produced by Cambridge Environmental Research Consultants which can be used to assess the impact of road vehicles on local air quality. Unlike simpler spreadsheet screening tools, it can include parameters such as variable meteorological conditions, complex road networks (including the combined contribution of multiple road links on single sensitive receptors) and the capability of including the effects of complex terrain, atmospheric chemistry and street-canyon effects. The model is widely used by Local Authorities in the UK as part of their review and assessment obligations.

This assessment considered traffic-related pollutant concentrations (NO_2 and PM_{10}) at existing receptors in the vicinity of the proposed site and future onsite receptors. Pollutant concentrations were predicted at existing receptors for the following scenarios:

- baseline 2015: current baseline;
- do nothing 2020: future baseline without the development; and
- do something 2020: future baseline with the development.

A comparison of results in future 'do nothing' and 'do something' scenarios allows for the impact of the proposed development to be determined. The exposure of future receptors were considered by looking at the future 'do something' scenario.

Traffic flows were input into the model as link flows and emissions were calculated using the UK emission factor toolkit version 6, which has its emissions database built in to the ADMS-Roads model. Emission factors from 2015 were used for the future scenario. Future emission factors take into account the likely improvement in pollutant emission performance of vehicles year on year, and therefore, by using existing emission factors, a worst case prediction can be made.

Receptors

Pollutant concentrations were predicted at selected locations where exposure to traffic emissions from vehicles associated with the development is potentially the greatest. In this instance, this is at nearby residential properties which have the potential to be impacted by traffic emissions. All receptors considered are at first floor level, therefore, a height of 3m has been assumed.

Receptor locations, as well as the road network used in the modelling assessment scenarios are shown in Figure 5—1 and Figure 5—2 . Receptor grid references are shown in Table 5-1

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Figure 5—1 Existing/'do nothing' 2020 road network and receptors

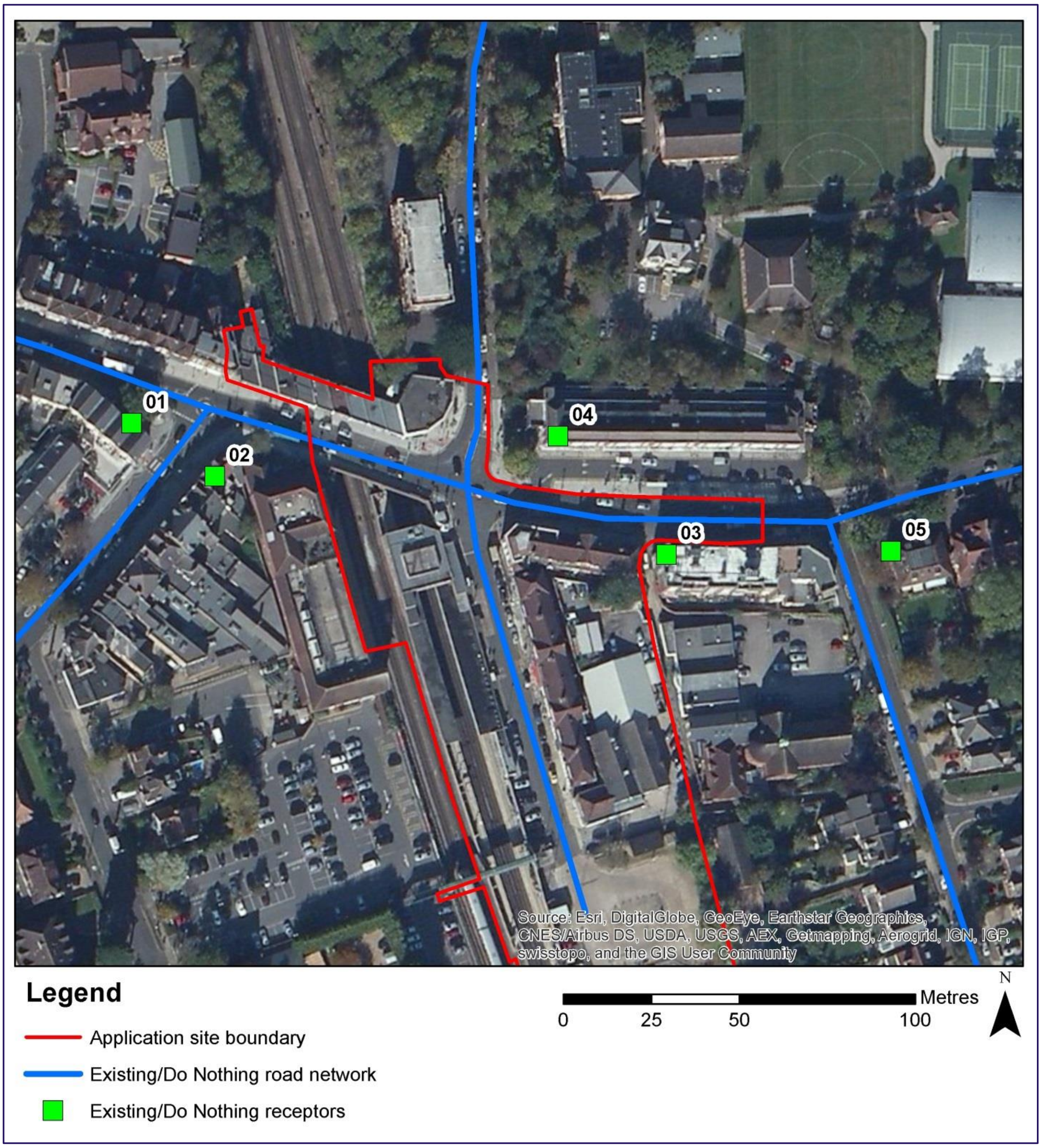

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Figure 5—2 Future 'do something' 2020 road network and receptors

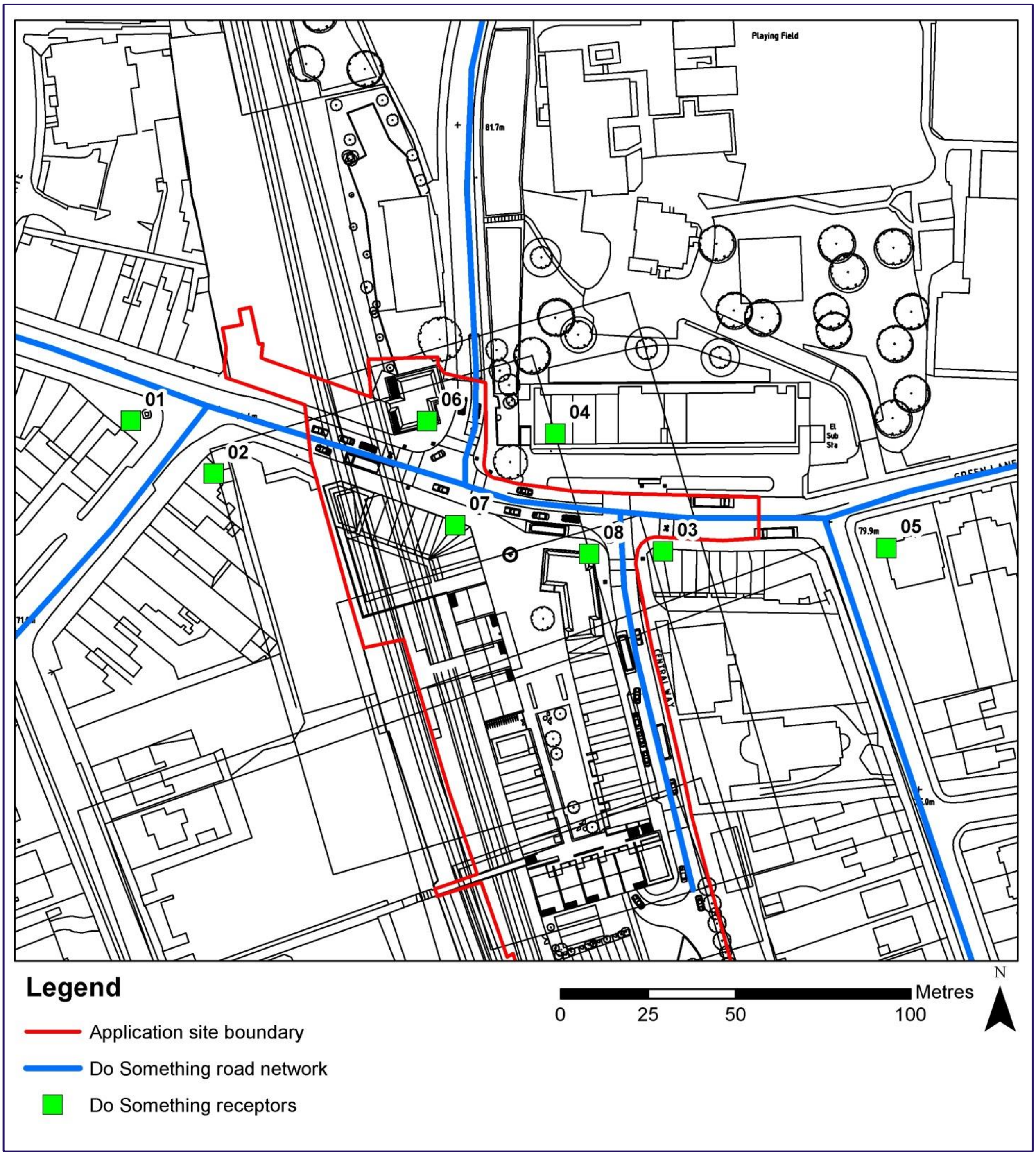

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Table 5-1 Receptor grid references and description

Receptor	Description	X(m)	Y(m)
1	Existing residential property	509152.1	191483.8
2	Existing residential property	509175.8	191468.7
3	Existing residential property	509304.2	191446.5
4	Existing residential property	509273.4	191480.1
5	Existing residential property	509368	191447.4
6	Future residential property (Block 7)*	509236.7	191483.7
7	Future residential property (Block 1)*	509244.7	191454
8	Future residential property (Block 6)*	509283	191445.7

*See Appendix B for Block Numbers

Meteorological data

Hourly sequential meteorological data set from Heathrow Airport meteorological station for 2014 was used in the dispersion modelling. The data set provides information on hourly wind speed, direction and the extent of cloud cover for 2014.

NOx – NO_2 conversion

The model predicts NOx and PM_{10} road contribution concentrations at the selected receptor points. These values are then added to relevant ambient background concentrations to enable the comparison with air quality objectives. NO_2 and PM_{10} background concentrations were obtained from Defra's website and these were added to the predicted road increment for all assessment scenarios. The NOx to NO_2 conversion spreadsheet, available from the UK Air Information Resources website[12], has been used to calculate NO_2 concentrations from established NOx.

Background concentrations

Background concentrations used in the assessment were taken from LBH's Harefield Hospital background monitoring site. Results from this site are shown in section 3.3.

Surface roughness

One of the modelling parameters is surface roughness which represents the extent of mechanical turbulence in the atmosphere caused by the roughness of the ground over which the air is passing. A surface roughness value of 1.5m was used at the study area which represents large urban areas compared to a value of 0.5 which was used at the meteorological station in Heathrow which represents open suburbia.

[12] Defra, 2015. Available at: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

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5.2 Energy plant emissions

The proposed development includes an energy centre comprising a $25kW_e$ gas-fired CHP and 3 x 500kW gas boilers. The energy centre will give rise to NOx emissions and it is therefore necessary to assess the impact upon local air quality. The gas boilers will comply with the GLA's NOx emission standard of <40mg/kWh, as detailed in the 'Sustainable Design and Construction' SPG.

The dispersion model ADMS-Roads has been used to predict the contribution from energy centre emissions. This model is designed to allow consideration of dispersion from both roads and industrial sources. The model was used to predict short-term and long-term NO_2 concentrations at sensitive receptors likely to be affected by energy centre emissions. Emission rates in g/s have been calculated using emission factors (mg/kWh) and energy usage (kWh/annum) data for input into the model. Emission factors were calculated for the CHP by multiplying the emission concentration (499mg/m3) by 0.857. This is in line with BREEAM guidance on calculating NOx emissions[13], and assumes worst case efficiencies, thus providing a conservative prediction.

The gas boilers will have one combined flue, whilst the CHP will have another separate flue. Both flues will be located on Block 4, 1 m above the finished roof level. The flues have been modelled as two separate point sources. The CHP plant has been modelled to run at full load all year round; this is considered a worst case assumption. Plant emission characteristics used in the model are shown in Table 5-2.

Table 5-2 Plant emission characteristics used in the model

Plant (total size)	Grid reference (x,y)	Discharge height (m)	Flue gas temperature (°C)	NOx emission rate (g/s)	Efflux velocity (m/s)	Effective stack diameter (m)
Gas-fired CHP ($25kW_e$)	509287.45, 191353.26	16.7	124	0.0065	10	0.3
Gas-fired boilers (3 x 500kW)	509288.67, 191353.62	16.7	100	0.00003	10	0.3

Building downwash

The building upon which stacks are located as well as other adjacent buildings can have a significant effect on plume dispersion in particular through building downwash. The ADMS-roads model allows for the inclusion of buildings which affect emission dispersion. Building locations and dimensions included in the model are presented in Table 5-3.

Table 5-3 Building input parameters

Building	Central point grid ref. (X,Y)	Height (m)	Length (m)	Width (m)	Angle from N (°)
1	509286.5, 191352.9	15.7	11.57	39.47	163.38
2	509285.28, 191407.57	15.7	79.91	10.3	347.42
3	509256.43, 191406.72	15.7	93.87	11.69	163.75

[13] BREEAM Pol 02 NOx emissions. Available at: http://www.breeam.org/BREEAMInt2013SchemeDocument/content/12_pollution/pol_02.htm

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Meteorological data

Hourly sequential meteorological data was used from Heathrow Airport meteorological station. A model sensitivity analysis was undertaken using meteorological data from 2010-2014 in order to identify the year which led to the prediction of the highest annual mean ground level NO_2 concentrations. Results from this analysis are shown in Table 5-4. Results indicate that there is very small variability in the maximum predicted concentrations, the highest NO_2 concentration was predicted using 2010 meteorological data. Wind roses showing meteorological data from Heathrow for 2010 to 2014 are presented in Table 5-4. The 2010 meteorological data set was subsequently used for all remaining modelling runs in order to provide a worst case prediction.

Table 5-4 Meteorological year sensitivity analysis

Meteorological year	Maximum annual mean NO_2 concentration, $\mu g/m^3$
2010	**0.93**
2011	0.91
2012	0.92
2013	0.92
2014	0.87

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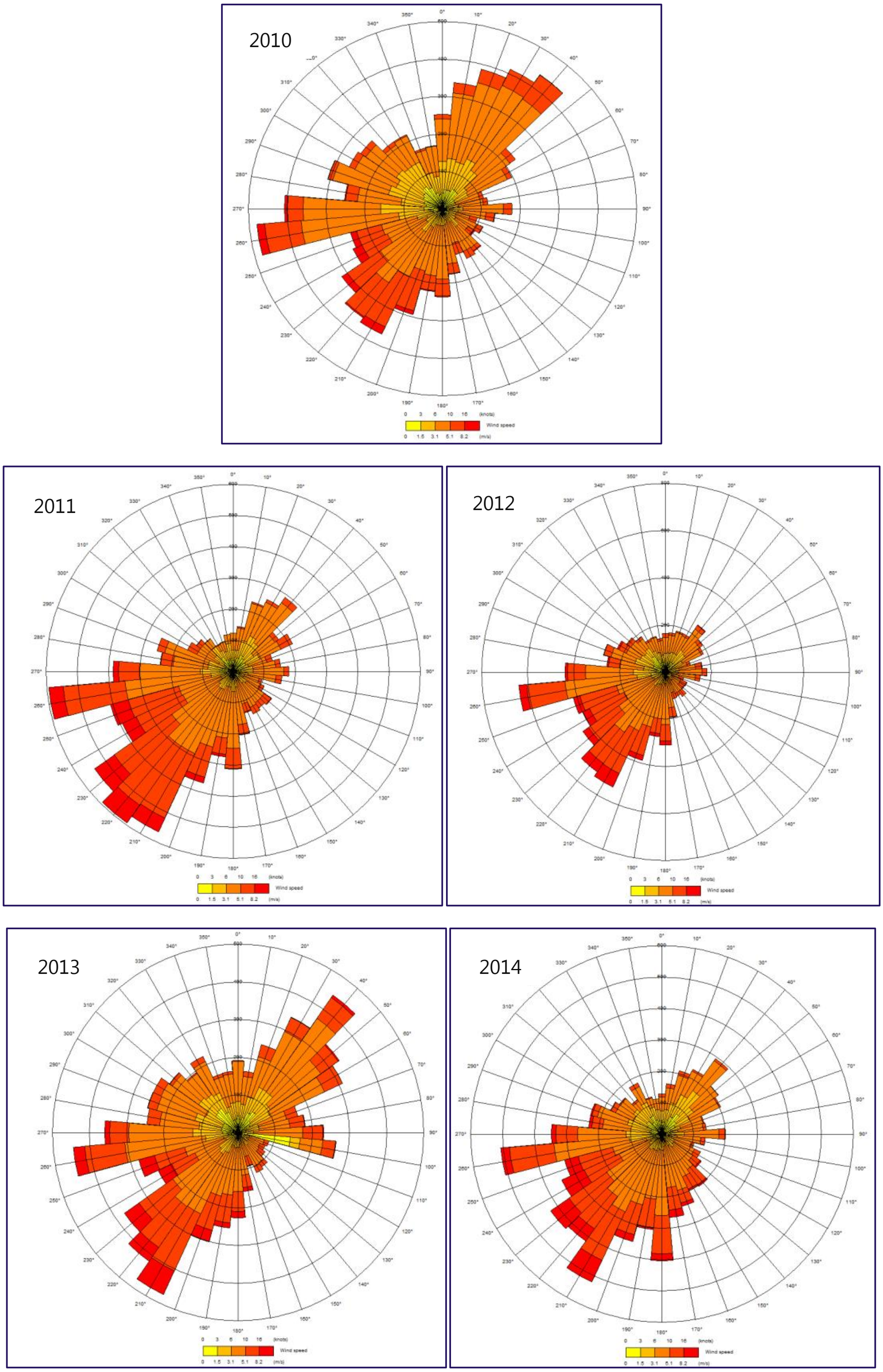

Figure 5—3 Wind roses for London Heathrow Airport from 2010-2014

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Surface roughness

The same surface roughness has been used as for the traffic modelling.

NOx - NO_2 conversion

The ADMS-Roads model predicts NOx concentrations, which are comprised principally of nitric oxide (NO) and a small percentage of NO_2. The emitted NO reacts with oxidants in the air, mainly ozone, to form more NO_2. Air quality standards for the protection of human health are based on NO_2 concentrations, and therefore, a suitable NOx:NO_2 conversion ratio needs to be applied to the modelled NOx concentrations. Research (Jansen *et al.*1988), indicates that when the oxidation reaction is dominated by ozone, NO_2/NOx ratio is a function of the distance from the source. In order to provide a worst case assumption, this assessment has assumed that 100% of NOx will be present as NO_2 however, NO2/NOx at short distances close to the stack are likely to be significantly lower

Background concentrations

For comparison with IAQM significance criteria, different sources of background concentrations have been considered. As they show a higher concentration, and therefore a worst case assumption, LBH monitoring data from the Harefield Hospital background site (ID:HD70) has been used for annual mean background concentrations.

It should be noted that the ground level background concentration will be assumed for receptors at height. This is considered a worst case assumption, as background concentrations decrease with height.

Receptors

A grid 1000m by 1000m, with a resolution of 10m, was used to predict ground level pollutant concentrations. Pollutant concentrations have also been predicted at selected locations where there is relevant exposure to pollutant emissions (residential properties). Receptor locations and other model inputs are presented in Figure 5—4. Receptor grid references are shown in Table 5-5.

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Figure 5—4 Receptor, building and point source model inputs

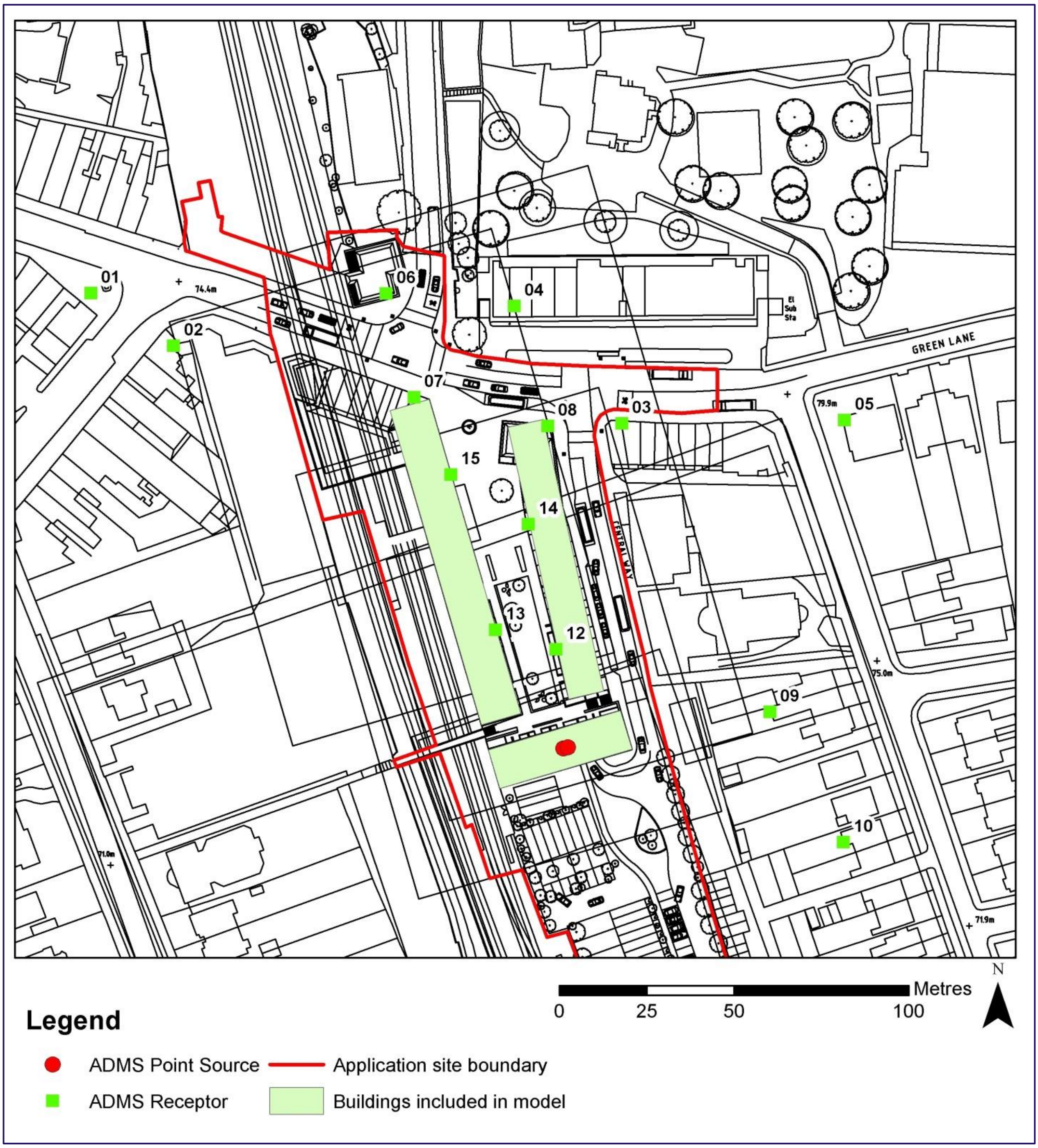

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Table 5-5 Receptor grid references

Receptor	Receptor description	X(m)	Y(m)	Height(m)
1	Existing residential property	509152.1	191483.8	3
2	Existing residential property	509175.8	191468.7	3
3	Existing residential property	509304.2	191446.5	3
4	Existing residential property	509273.4	191480.1	3
5	Existing residential property	509368	191447.4	3
6	Future residential property (Block 7)*	509236.7	191483.7	3
7	Future residential property (Block 1)*	509244.7	191454	3
8	Future residential property (Block 6)*	509283	191445.7	3
9	Existing residential property	509346.7	191363.8	3
10	Existing residential property	509367.7	191326.3	3
11	Existing residential property	509197.9	191288	3
12	Future residential property (Block 5)*	509285.3	191381.6	15.7
13	Future residential property (Block 3)*	509268	191387.3	15.7
14	Future residential property (Block 6)*	509277.4	191417.5	15.7
15	Future residential property (Block 2)*	509255.3	191431.8	15.7

*See Appendix B for Block Numbers

5.3 Significance criteria

Environmental Protection UK and the Institute of Air Quality Management have produced Guidance[14] to ensure adequate consideration of air quality matters in the development control process. This guidance provides a framework for describing the degree of impact (Table 5-6). Impact is described by expressing the magnitude of incremental change as a proportion of a relevant assessment level and then to examine this change in the context of the new total concentration and its relationship with the assessment criterion (or Air Quality Assessment Level (AQAL)).

Table 5-6 Long term impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	**2-5**	**6-10**	**>10**
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

[14] Moorcroft and Barrowcliffe. et al. (2015) Land-use Planning & Development Control: Planning for Air Quality. Institute of Air Quality Management, London

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With regards to short term impacts, the framework for describing significance is presented in Table 5-7. It should be noted that assessment of short term impacts is made without the need to take into account background or baseline conditions. This is due to the fact that on an annual average basis, background concentrations will be a much smaller quantity than the peak concentration from a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration.

Table 5-7 Short term impact descriptors for individual receptors

Short term peak concentration	Impact severity
<10% of AQAL	Negligible
10-20% of AQAL	Slight
20-50% of AQAL	Moderate
>50% of AQAL	Substantial

5.4 Results

5.4.1 Traffic emissions

Predicted pollutant concentrations at selected receptors are presented in Table 5-8. Results indicate that annual mean NO_2 and PM_{10} concentrations are predicted to be well below the relevant air quality objectives for NO_2 and PM_{10} at all existing and future receptors and for all scenarios. The maximum impact is slight adverse at one receptor, this is largely due to the change in road layout, with station approach moving closer to this receptor.

With regards to short term air quality objectives, in accordance with LAQM.TG(09), it is considered that as all annual mean NO_2 concentrations are below 60µg/m^3, the hourly objective will be met.

With regards to PM_{10}, dispersion models are inherently less accurate at predicting the number of exceedences of the 24-hour mean objective for PM_{10} than the annual mean objective. Accordingly, the relationship between annual mean and the number of 24-hour mean exceedences of 50 µg/m^3, devised by LAQM.TG(09), has been used for assessment of the short-term PM_{10} objective[15]. The maximum number of days exceeding the objective concentration is three, which is predicted at all receptors. This is well within the allowable 35 exceedences which are permitted in the objective.

Table 5-8 Predicted pollutant concentrations at receptors and impact descriptors

Receptor	Predicted total annual mean concentration (µg/m^3)			% of AQAL	%change relative to AQAL	Impact descriptor
	Baseline 2015	Do Nothing 2020	Do Something 2020			
Nitrogen dioxide (NO_2)						
1	29.7	30.2	30.2	75.6	0.0	Negligible
2	28.8	29.3	29.3	73.3	0.0	Negligible
3	29.4	29.9	30.9	77.3	2.7	**Slight adverse**
4	28.0	28.3	28.5	71.3	0.4	Negligible
5	27.4	27.8	27.9	69.9	0.4	Negligible
6	n/a	n/a	30.1	75.3	n/a	n/a
7	n/a	n/a	30.0	74.9	n/a	n/a

[15] No. 24-hour mean exceedences = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

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Receptor	Predicted total annual mean concentration (µg/m^3)			% of AQAL	%change relative to AQAL	Impact descriptor
	Baseline 2015	Do Nothing 2020	Do Something 2020			
8	n/a	n/a	30.0	75.0	n/a	n/a
Particulate matter (PM_{10})						
1	19.8	19.8	19.8	49.6	0.0	Negligible
2	19.7	19.7	19.7	49.3	0.0	Negligible
3	19.7	19.7	19.9	49.7	0.3	Negligible
4	19.6	19.6	19.6	49.1	0.0	Negligible
5	19.6	19.6	19.7	49.1	0.1	Negligible
6	n/a	n/a	19.8	49.5	n/a	n/a
7	n/a	n/a	19.8	49.4	n/a	n/a
8	n/a	n/a	19.8	49.4	n/a	n/a

5.4.2 Energy plant emissions

Predicted concentrations of NO_2 at considered receptor locations are presented in Table 5-9 and Table 5-10. There is predicted to be a negligible change in pollutant concentrations as a result of energy plant emissions at all considered receptors. Therefore, with regards to EPUK/IAQM significance criteria it is considered that the impact from energy plant emissions will be negligible.

Table 5-9 Predicted long term concentrations

Receptor	Long term (annual mean)						
	NO_2 contribution (µg/m^3)	Background (µg/m^3)	Total annual mean NO_2 (µg/m^3)	AQAL (annual mean UK air quality objective (µg/m^3))	% of AQAL	% change relative to AQAL	Impact descriptor
1	0.0	23.8	23.8	40	59.6	0.1	Negligible
2	0.0	23.8	23.8	40	59.6	0.1	Negligible
3	0.1	23.8	23.9	40	59.7	0.2	Negligible
4	0.0	23.8	23.8	40	59.6	0.1	Negligible
5	0.1	23.8	23.9	40	59.7	0.2	Negligible
6	0.0	23.8	23.8	40	59.6	0.1	Negligible
7	0.0	23.8	23.8	40	59.6	0.1	Negligible
8	0.1	23.8	23.9	40	59.8	0.3	Negligible
9	0.2	23.8	24.0	40	59.9	0.4	Negligible
10	0.1	23.8	23.9	40	59.8	0.3	Negligible
11	0.1	23.8	23.9	40	59.7	0.2	Negligible
12	0.5	23.8	24.3	40	60.8	1.3	Negligible
13	0.4	23.8	24.2	40	60.4	0.9	Negligible
14	0.2	23.8	24.0	40	60.0	0.5	Negligible
15	0.1	23.8	23.9	40	59.8	0.3	Negligible

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Table 5-10 Predicted short term concentrations

Receptor	Short term hourly mean			
	NO_2 99.79th percentile contribution (µg/m^3)	AQAL (Hourly mean UK air quality objective (µg/m^3))	% change relative to AQAL	Impact descriptor
1	0.5	200	0.2	Negligible
2	0.6	200	0.3	Negligible
3	1.1	200	0.6	Negligible
4	0.6	200	0.3	Negligible
5	0.9	200	0.4	Negligible
6	0.6	200	0.3	Negligible
7	0.7	200	0.3	Negligible
8	1.7	200	0.9	Negligible
9	1.4	200	0.7	Negligible
10	1.2	200	0.6	Negligible
11	1.0	200	0.5	Negligible
12	1.9	200	0.9	Negligible
13	1.9	200	0.9	Negligible
14	1.8	200	0.9	Negligible
15	1.7	200	0.8	Negligible

5.5 Exposure of future receptors to ambient air quality

Although the proposed development is not located within an AQMA, it is located in close proximity to a busy road (Green Lane). Therefore it is necessary to consider the exposure of future residential properties to ambient air quality.

Air quality monitoring carried out (see section 3.2) measured concentrations of NO_2 at worst case roadside locations. The highest monitored concentration was at monitoring location 4, where an annual mean NO_2 concentration of 40.7 µg/m^3 has been measured. Although this is above the annual mean objective of 40 µg/m^3, the monitoring site is located approximately 1 m from the roadside, where pollutant concentrations will be high. The nearest proposed residential property will be located approximately 5 m from the roadside, and on the first floor of the development, where pollutant concentrations will be lower than those monitored, and therefore it is expected that future residential properties will not be exposed to pollutant levels that exceed objectives.

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6 Air Quality Neutral Assessment

6.1 Air quality neutral assessment

An air quality neutral assessment (AQNA) has been carried out in line with the GLA's Sustainable Design and Construction (SD&C) SPG[16]. The principle of 'air quality neutral' is to ensure that the cumulative impact from a large number of developments, which may individually have a small impact on air quality, does not lead to an incremental increase in background concentrations (or 'background creep'). This is proposed by the introduction of standards, or benchmarks, for building and transport emissions, for which all new major developments in London should adhere to. Developments which cannot meet these benchmarks should offset emissions in agreement with the local planning authority (LPA).

Both the London Plan and the MAQS include reference to new developments being air quality neutral. The London Plan states that development proposals should be at least air quality neutral and not lead to any further deterioration of existing poor air quality. The MAQS includes a policy which states that new developments in London shall, as a minimum, be 'air quality neutral' through the adoption of best practice in the management and mitigation of emissions.

Air Quality Neutral Planning Support[17] was published in order to accompany the SD&C SPG. This document provides a methodology for carrying out an air quality neutral assessment, calculating total building and transport emissions associated with the development, and gives benchmarks for transport and building emissions.

6.2 Operational road traffic emissions

Air quality neutral Traffic Emissions Benchmarks (TEBs) for various land uses are presented in Table 1.

Table 6-1 Air quality neutral Transport Emissions Benchmarks (TEBs)

Land use			
	CAZ (central activity zone)	**Inner London**	**Outer London**
NOx (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3)	40.7	100	267

[16] Mayor of London (2014), Sustainable Design and Construction – Supplementary Planning Guidance, Greater London Authority.
[17] Air Quality Consultants and Environ (2014), Air Quality Neutral Planning Support Update: GLA 80371

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Traffic emissions from the proposed development are calculated using the following information:

- Land use area/number of dwellings;
- Development trip rate;
- Average distance travelled per land use class; and
- Emissions of NOx and PM_{10} per kilometre.

In order to compare transport emissions from the development with air quality neutral TEBs, benchmarked emissions are calculated for the development for NOx and PM_{10} (see Table 6-2). Total Transport emissions are then calculated for the development (see Table 6-3 and Table 6-4). Benchmarked emissions are then subtracted from the total transport emissions for the development (Table 6-5). If the outcome is negative, transport emissions are within the benchmark. If positive, further mitigation will be required.

Annual trip generation rates are not available for the residential aspect of development, therefore only transport emissions from retail are considered.

Table 6-2 Total Transport Emissions Benchmarks for NOx and PM_{10}

Land use	Area (m^2)/No. dwellings	NOx Transport Emissions Benchmarks	Total NOx Benchmarked Emissions (kg/annum)	PM_{10} Transport Emissions Benchmarks	Total PM_{10} Benchmarked Emissions (kg/annum)
A1 – retail*	1,440m^2	249 g/m^2/annum	358.6	42.9 g/m^2/annum	61.8
		Total	**358.6**	**Total**	**61.8**

* Although the development proposal include A1 – A5 land uses, only A1 was considered because transport emissions benchmarks are only available for A1 land use

Table 6-3 Calculation of average distance travelled per year for land use categories

Land use	Area (m^2)/No. dwellings	Development trip rate (trips/m^2/year)	Number of trips per year	Average distance travelled per trip (km)	Distance travelled per year (km)
A1 (retail)	1,440m^2	123.6	177,982	5.4	961,102.8
				Total	**961,102.8**

Table 6-4 Calculation of Total Transport Emissions

Land use	Total average distance travelled per year (km)	NOx Transport Emission Factor (gNOx/vehicle-km)	Total NOx Transport emissions (kg/annum)	PM_{10} Transport Emission Factor (gPM_{10}/vehicle-km)	Total PM_{10} Transport emissions (kg/annum)
A1, C3	961,102.8	0.353	**339.3**	0.0606	**58.2**

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Table 6-5 Comparison between Total Transport Emissions and Total Transport Benchmarked Emissions

NOx	
Total Transport Emissions	339.3
Total Benchmarked Transport Emissions	358.6
Difference	**-19.3**
PM_{10}	
Total Transport Emissions	58.2
Total Benchmarked Transport Emissions	61.8
Difference	**-3.6**

As the Total Benchmarked Transport Emissions are higher than the Total Transport Emissions, the development transport emissions meet the air quality neutral benchmark, and therefore no further mitigation will be required.

6.3 Building emissions

Air quality neutral Building Emissions Benchmarks (BEBs) for various land uses are presented in Table 6-6. The proposed development includes the installation of three gas fired boilers and one gas fired CHP. As the boilers and CHP will be fuelled by natural gas, the main pollutant of concern will be nitrogen oxides (NOx).

Table 6-6 Air quality neutral Building Emissions Benchmarks (BEBs)

Land Use Class	NOx (g/m^2)
Class A1 (retail)	22.6
Class A3-A5 (restaurants, drinking establishments, hot food takeaway)	75.2
Class A2 and Class B1 (financial/professional services/businesses)	30.8
Class B2 - B7 (general industrial)	36.6
Class B8 (storage and distribution)	23.6
Class C1 (hotels)	70.9
Class C2 (residential institutions)	68.5
Class C3 (residential dwellings)	26.2
D1 (a) (medical and health services)	43.0
D1 (b) (crèche, day centres etc.)	75.0
Class D1 (c -h) (schools, libraries etc.)	31.0
Class D2 (a-d) (cinemas, concert halls etc.)	90.3
Class D2 (e) (Swimming pools, gymnasium etc.)	284

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Building emissions from the proposed development are calculated using the following information:

- land use area; and
- on site emissions of NOx associated with building use calculated from energy use and default or site specific emission factors.

In order to compare building emissions arising from the proposed development with air quality neutral BEBs, benchmarked emissions are calculated for the development for NOx (see Table 6-7). The total annual building NOx emissions from the development can be calculated from the energy centre data. Based upon assumptions made in the energy centre assessment and given annual average NOx emission rates (CHP = 0.0065g/s; Gas boilers = 0.0003g/s), this gives an equivalent Total Building NOx Emission of 214.4kg/annum.

Benchmark emissions are then subtracted from the total building emissions for the proposed development (Table 6-8). For the purpose of calculating a benchmark the London Underground Limited (LUL) station area (Sui Generis) has been added to the A1 retail area. It has been assumed that all retail will be A1 use class, this is a worst case assumption, as in reality there will be a mix of A1-A5, and benchmarks for A1 are most stringent. If the outcome is negative, building emissions are within the benchmark. If positive, further mitigation will be required.

Table 6-7 Total Building Emissions Benchmarks (BEBs)

Land use	**Area (m^2)**	**NOx Building Emissions Benchmarks ($gNOx/m^2/annum$)**	**Total NOx Benchmarked Emissions (kg/annum)**
A1-(retail) + LUL	1,624	22.6	36.7
C3 - residential	6,881	26.2	180.3
		Total	**217.0**

Table 6-8 Comparison between Total Building Emissions and Total Building Emissions Benchmarks

NOx (kg/annum)	
Total Building Emissions	214.4
Total Benchmarked Building Emissions	**217.0**
Difference	**-2.6**

As the Total Benchmarked Building Emissions are higher than the Total Building Emissions, the development building emissions meet the air quality neutral benchmark, and therefore no further mitigation will be required.

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7 Mitigation measures

7.1 Construction

Site-specific mitigation measures

Step 3 of the IAQM guidance sets out a framework for determining appropriate mitigation measures based on the predicted risk (step 2C), and also allowing for a level of professional judgment. The following mitigation measures can be incorporated into the development so as to ensure that the residual effects from construction are insignificant.

Mitigation measures will be agreed with LBH in the form of the Construction Management Plan. Mitigation measures could include:

Communications

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager;
- display the head or regional office contact information; and
- develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London, additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.

Site management

- record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked; and
- record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

Monitoring

- carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked;
- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and

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- agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and maintaining the site

- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary;
- fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable;
- ensure all vehicles switch off engines when stationary – no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable; and
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations

- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

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- no bonfires or burning of waste materials.

Measures specific to demolition

- ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
- avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- bag and remove any biological debris or damp down such material before demolition.

Measures specific to construction

- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

7.2 Operation

It is anticipated that improvements to junctions along Green Lane as a result of the development will ease congestion which would subsequently have a beneficial impact upon local air quality.

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8 Conclusions

The air quality monitoring survey, undertaken at four locations surrounding the site, indicates that air quality objectives for NO_2 will be meet at all sites except one location on Green Lane. This diffusion tube location is directly affected by emissions from traffic congestion at Green Lane. Although these results show a breach of the objective at one location, they are based on three months survey, monitoring will continue for three more months in order to provide a more robust data.

Modelling of traffic emissions for the future year of opening, with and without the proposed development, demonstrated that the impact on selected residential receptors will be negligible except at one receptor located on the corner of Green Lane and Station Approach. The impact on this receptor, according to the IAQM guidance, is predicted to be slight adverse. This is largely due to the change in road layout, with Station Approach moving closer to this receptor.

Modelling of energy plant emissions demonstrate that the impact on local air quality is negligible.

Air quality objectives are expected to be met at all existing residential receptors for future year of proposed development opening. Also, air quality objectives are expected to be met at all future residential properties.

Comparison of total building and transport emissions, associated with the proposed development, against relevant benchmarks demonstrated that the development is air quality neutral. Therefore no further mitigation measures are required.

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Appendix A

Assessing the risk of dust impacts

A) Defining the potential dust emission magnitude

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large.

Demolition: Example definitions for demolition are:

- **Large**: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- **Medium**: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; 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.

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

- **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 <20,000 tonnes, earthworks during wetter months.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s) / infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

- **Large**: Total building volume >100, 000 m^3, on site concrete batching, sandblasting;
- **Medium**: Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), 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).

Trackout: Factors which determine the dust emission magnitude 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 dust emission magnitude categories. Example definitions for trackout are:

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- **Large**: >50 HDV (>3.5t) outward movements[18] in any one day[19], potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;
- **Medium**: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and
- **Small**: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

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.

B) Defining the sensitivity of the area

The sensitivity of the area takes account of a number of factors:

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

Examples of sensitivities of various receptors to dust soiling, elevated PM_{10} and ecological effects are shown in Table 8-1.

For the sensitivity of people and their property to soiling, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the general principles in the table below.

For the sensitivity of people to the health effects of PM_{10}, the IAQM recommends that the air quality practitioner assumes that there are three sensitivities based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period, consistent with the Defra's advice for local air quality management.

With regards to ecological effects, it is advised to seek the advice of an ecologist to determine the need for an assessment of dust impacts on sensitive habitats and plants. Professional judgement is required to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the likely effect and the value of the ecological asset. A habitat may be highly valuable but not sensitive, alternatively it may be less valuable but more sensitive to dust deposition. Consequently, specialist ecological advice should also be sought to determine the sensitivity of the ecological receptors to dust impacts. In general most receptors will either be of high sensitivity or low sensitivity i.e. either sensitive or not to dust deposition.

[18] A vehicle movement is a one way journey. i.e. from A to B, and excludes the return journey.
[19] HDV movements during a construction project vary over its lifetime, and the number of movements is the maximum not the average.

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Table 8-1 Examples of receptor sensitivities for various construction effects

Receptor sensitivity	Effects		
	Dust soiling	**Elevated PM_{10}**	**Ecological**
High	• Users can reasonably expect a enjoyment of a high level of amenity • The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • Indicative examples include dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms.	• locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations with an international or national designation and the designated features may be affected by dust soiling; or • location where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain • an indicative example is a Special Area of Conservation (SAC) designated for acid heathlands adjacent to the demolition of a large site containing concrete (alkali) buildings or for the presence of lichen.
Medium	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • indicative examples include parks and places of work.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. • Indicative examples include a Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	• the enjoyment of amenity would not reasonably be expected; or • there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• locations where human exposure is transient. • indicative examples public footpaths, playing fields, parks and shopping streets.	• locations with a local designation where the features may be affected by dust deposition. • Indicative example is a local Nature Reserve with dust sensitive features.

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Additional factors to consider when determining the sensitivity of the area include the following

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which are considered go beyond the classifications given.

The following tables show how the sensitivity of an area can be determined for the various potential impacts. For each potential impact the highest level of sensitivity should be recorded.

Table 8-2 Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8-3 Sensitivity of the area to human health impacts

Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3 (>18 µg/m^3 in Scotland)	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

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Receptor sensitivity	Annual mean PM_{10} concentration	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 8-4 Sensitivity of the area to ecological impacts

Receptor sensitivity	Distance from the source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

C) Defining the risks of impacts

Dust emission magnitude determined at step A) should be combined with the sensitivity of the area determined at step B) in order to determine the risk of impacts with no mitigation applied. The following matrices provide a method of assigning the level of risk for each activity. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation will be required.

Table 8-5 Risk of dust impacts – demolition

Sensitivity of area	Dust emission magnitude		
	Large	**Medium**	**Small**
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible

Table 8-6 Risk of dust impacts – earthworks

Sensitivity of area	Dust emission magnitude		
	Large	**Medium**	**Small**
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

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Table 8-7 Risk of dust impacts – construction

Sensitivity of area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table 8-8 Risk of dust impacts – trackout

Sensitivity of area	Dust emission magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

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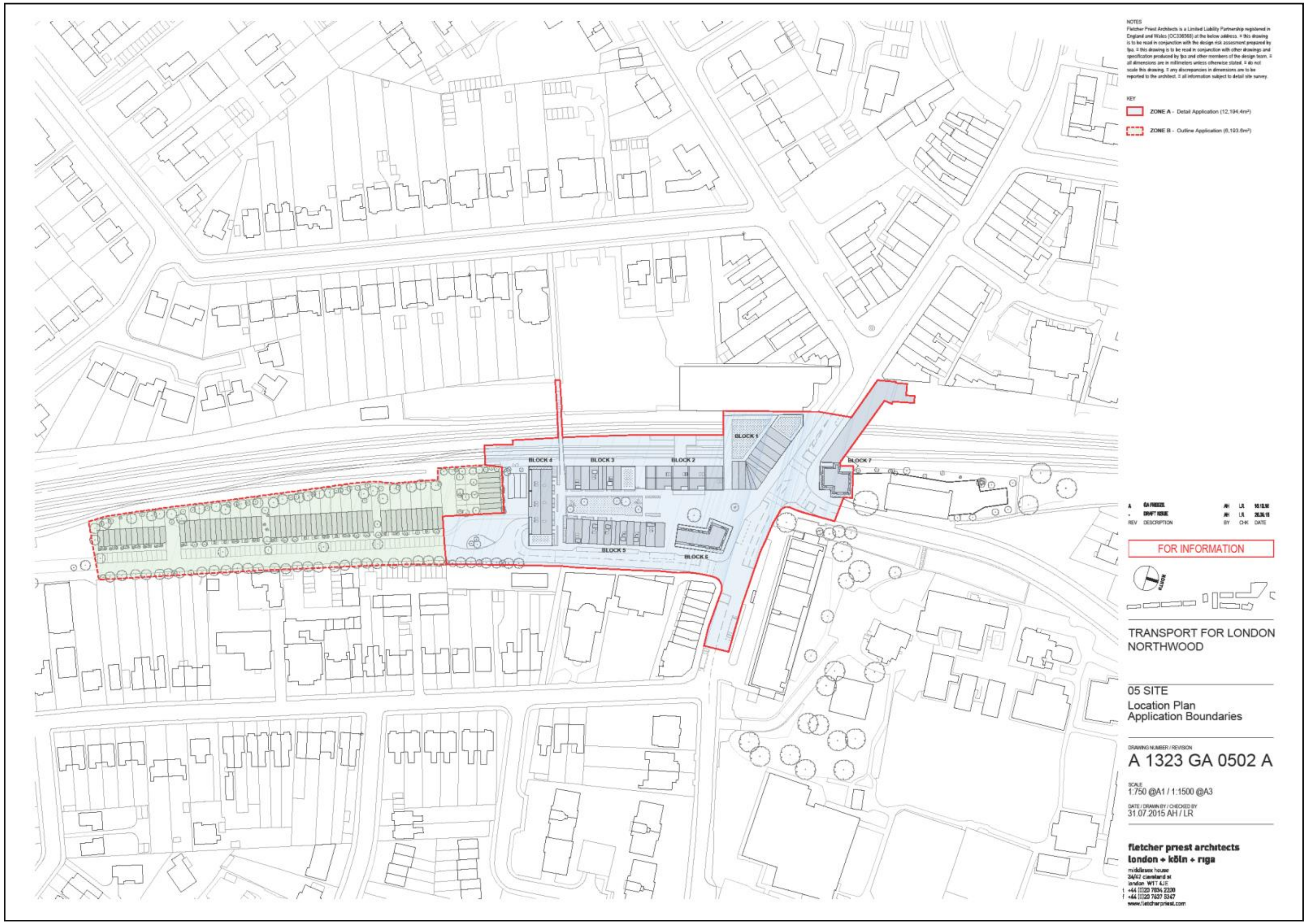
Appendix B



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