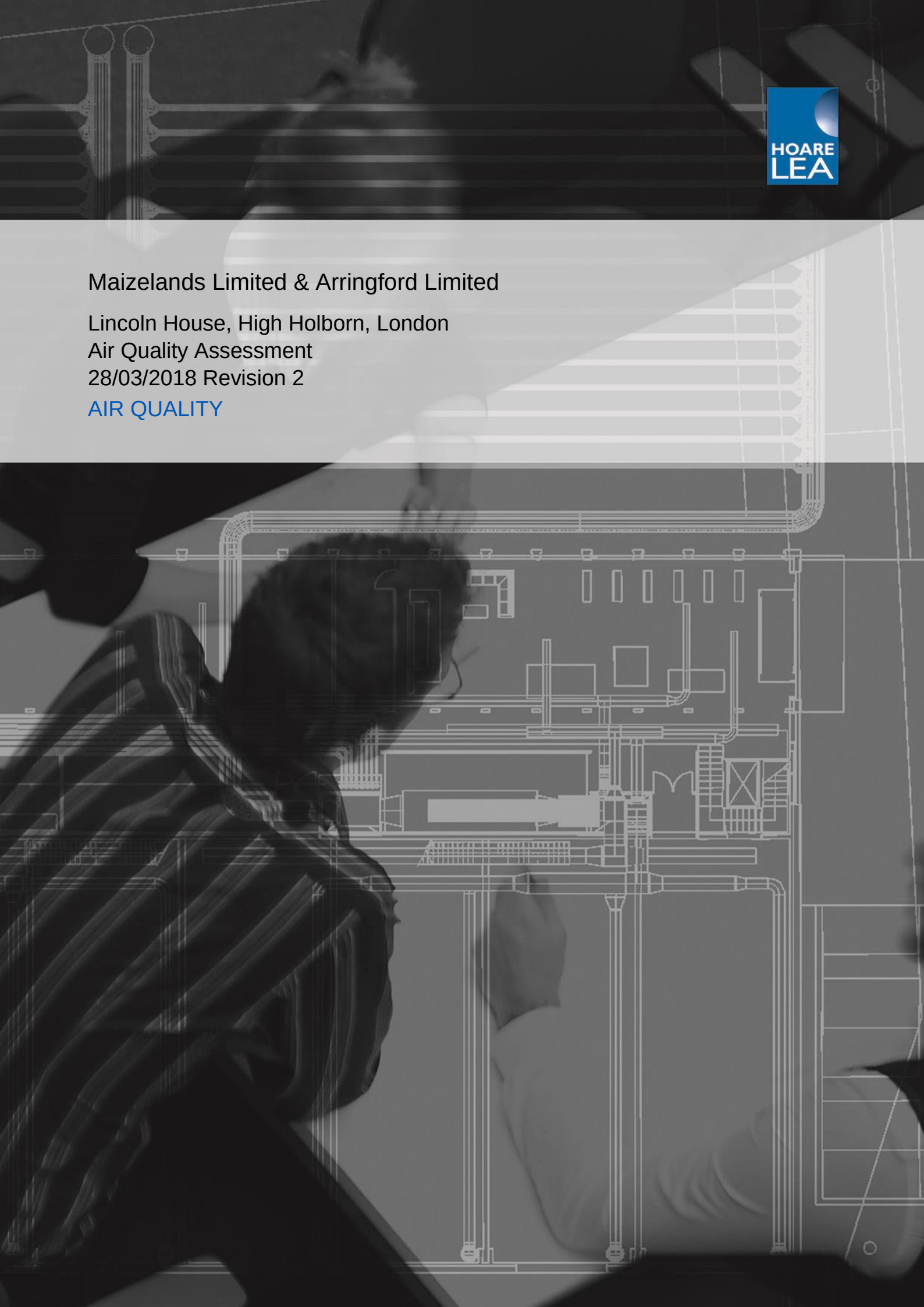
May 2018

Hoare Lea

Air Quality Assessment



Maizelands Limited & Arringford Limited

Lincoln House, High Holborn, London
Air Quality Assessment
28/03/2018 Revision 2

AIR QUALITY

Audit sheet

Rev.	Date	Description	Prepared	Verified
1	13/11/2017	First draft	ES/GG	CR
2	28/03/2018	Second draft – updated client name and areas	RD	CR

Contents

Executive summary

This report describes the potential air quality impacts associated the proposed refurbishment and extension of an existing retail and office building called Lincoln House, located at 296-302 High Holborn, in the London Borough of Camden (LBC).

The site lies within an Air Quality Management Area (AQMA) where annual mean nitrogen dioxide (NO_2) concentrations exceed the national air quality objective. The proposed extension is for offices and therefore the short-term objectives for NO_2 and PM_{10} have been used as a conservative measure given that no objectives apply for the uses proposed.

A risk assessment of the potential impacts of the construction of the development has been undertaken to identify appropriate measures. Provided these are implemented, for example through a planning condition, the residual impacts are considered to not be significant.

The air inlet for the mechanical ventilation system will be located on the roof and rear façade of the extension, where concentrations will be lower than at street level, with ventilation risers to distribute air down the building, providing further confidence that users will not be exposed to unacceptable air quality. At these locations the short term objectives are likely achieved.

The need to undertake a detailed assessment of the impact of road traffic emissions associated with the Proposed Development has been scoped out. This is because there are no car parking spaces proposed and road traffic generated is below the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) planning guidance criteria for when a detailed assessment may be required.

A qualitative assessment was undertaken of the impact of the existing air quality on the Proposed Development. Air quality is not predicted to exceed the relevant objective for places of work at the façade of the building at the time of occupation at the air intake locations.

The impacts of the energy combustion plant emissions on the existing receptors and future users of the development have been assessed. The energy combustion plant consists of two Wessex Modumax mk3 boilers (WM 254/762V), which are not intended to be used simultaneously. There is no relevant exposure where the energy centre emissions give rise to a potentially impact, and therefore the impact is considered to be not significant.

Concentrations of PM_{10} and $PM_{2.5}$ will remain below the objective at existing receptors in 2020.

The development is air quality neutral according to the Greater London Authority's (GLA) benchmarking assessment methodology.

The overall operational air quality impacts of the development are judged to be not significant.

1. Introduction

1.1 Proposed Development

Hoare Lea has been commissioned by Maizelands Limited & Arringford Limited to undertake an assessment of the potential air quality impacts arising from a proposed refurbishment and extension, hereafter referred to as the 'Proposed Development'.

The Proposed Development is located at 296-301 High Holborn, Camden, London (post code WC1V 7JH) and the location is shown in Figure 1.

The site is bound to the north by High Holborn (A40), to the east and west by existing commercial buildings, and to the south by Lincolns Inn Fields. The area surrounding the site consists of hotels, offices and retail developments. The extension will be to the south of the current building, approximately 30 m from High Holborn with the existing building being retained (see Annex 1 – Proposed Development Plans for the latest plans).

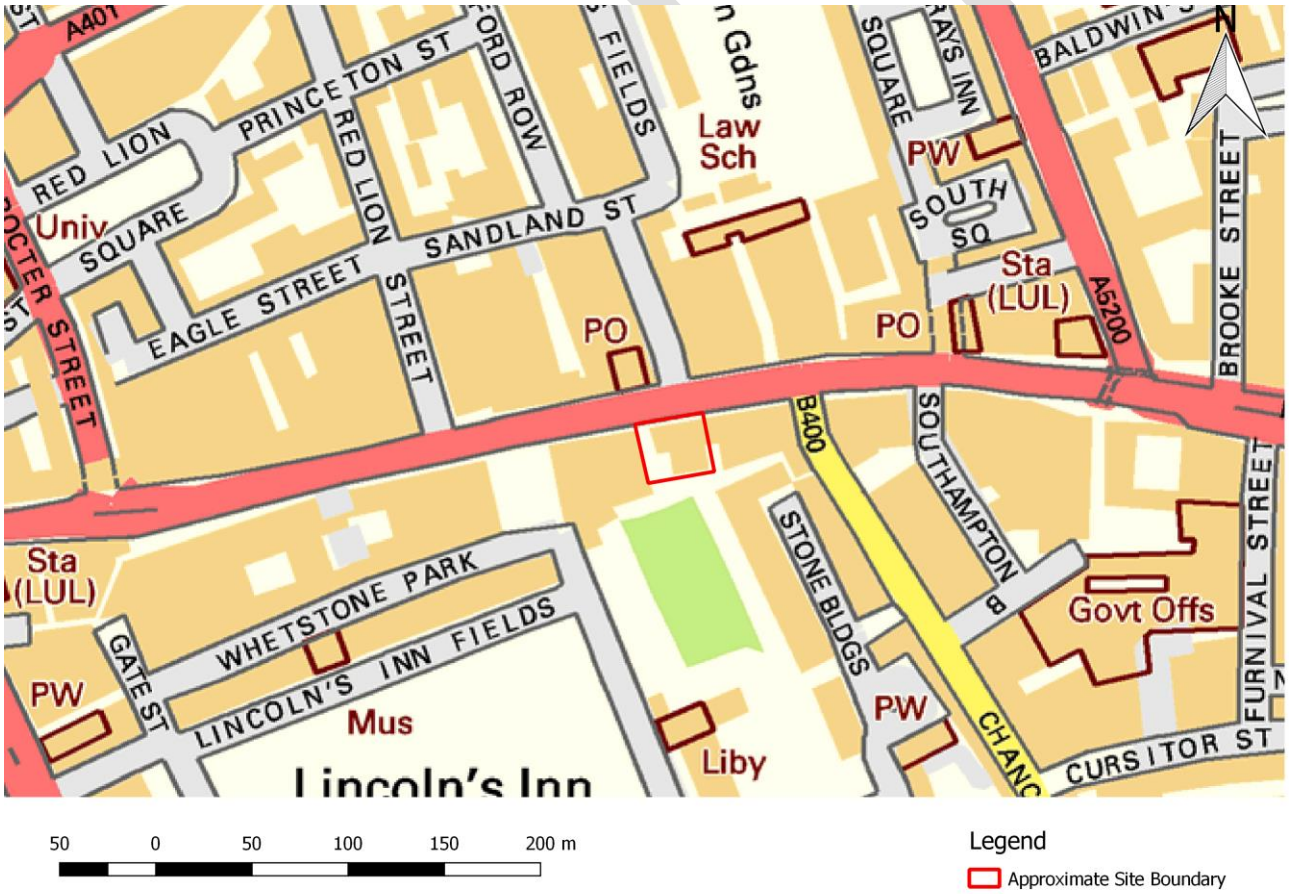


Figure 1 Location of the Proposed Development in LBC. Contains OS Data © Crown Copyright and Database rights 2017

Lincoln House currently comprises approximately 5,660m^2 of office and retail space across lower ground, ground and eight floors. The Proposed Development will include a new extension above and to the rear façade of the existing building, with internal refurbishment of its existing uses of retail and office activities, providing an extra 1,945 m^2 of office floor space and provision of a green wall.

This report assesses the potential impacts associated with the construction and operational phases of the Proposed Development with respect to air quality.

A glossary of terms provided in section 8

1.2 Scope of Assessment

The scope of the assessment was agreed with Adam Webber, Environmental Health Practitioner at the LBC by telephone and email on the 27th October 2017 as follows:

- It is anticipated that the road traffic associated with the Proposed Development will be less than the current use and so the change is less than 100 annual average daily traffic (AADT), the threshold in Table 6.2 of the Environmental Protection United Kingdom (EPUK) & Institute of Air Quality Management (IAQM) guidance 'Land-Use Planning & Development Control: Planning for Air Quality'. Therefore the impact of emissions generated from road traffic associated with the development will not be assessed.

- The Proposed Development may be subject to the impacts of road traffic emissions from the existing road network. The impacts from existing road traffic emissions at relevant locations across the Proposed Development has therefore been assessed with respect to the relevant air quality objectives.

- The air quality impact from the operation of the energy centre (maximum NOx emission rate approximately 7.8mg/s) on nearby existing receptors has been assessed following the latest Environmental protection UK (EPUK) and Institute of Air Quality Management (IAQM) planning guidance[10].

- The air quality assessment will include an assessment of construction impacts on Air Quality and Dust using the IAQM methodology, in compliance with London's SPG on 'The Control of Dust and Emissions During Construction and Demolition (2014)'. This will include assessment of the demolition of the existing buildings on the site.

- The main air pollutants of concern from road traffic are NO_2 and particulate matter (PM_{10} and $PM_{2.5}$). Gas-fired energy systems produce insignificant quantities of PM_{10} and $PM_{2.5}$ and therefore only the energy centre's impact on NO_2 has been considered

- An air quality neutral assessment will also be carried out as part of the air quality assessment for the Proposed Development.

2. Legislation, Policy and Guidance Documents

2.1 Air Quality Strategy and Local Air Quality Management

The Environment Act 1995 (Part IV) requires the Secretary of State to publish an air quality strategy and local authorities to review and assess the quality of air within their boundaries. The latter has become known as Local Air Quality Management (LAQM).

The Air Quality Strategy[1] provides the policy framework for air quality management in the UK. It sets out air quality standards and objectives for key air pollutants. These standards and objectives are designed to protect human health and the environment. The Strategy also sets out how the different sectors of industry, transport and local government, can contribute to achieving these air quality objectives.

Air quality in London is devolved to the Mayor of London, who has powers Under Part IV of the Environment Act 1995 to intervene and direct local authorities in Greater London. In support of these devolved powers, the Mayor established a London specific LAQM system (LLAQM)[2] in 2016 for the coordinated discharge of Mayor's and Boroughs' responsibilities.

Local authorities are required to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If the objectives are not achieved, the authority must declare an AQMA and should prepare an action plan within 12 months. An action plan must identify appropriate measures and policies that can be introduced in order to work towards achieving the objective(s).

The air quality objectives set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations 2000[3], and the Air Quality (England) (Amendment) Regulations 2002[4].

The objectives for NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) are set out in Table 1. The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. It should be noted that local authorities in England have a flexible role in working towards reducing emissions and concentrations of $PM_{2.5}$.

Table 1: Air Quality Criteria for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO_2)	1-hour Mean	200 µg/m^3 Not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 Not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
Fine Particles ($PM_{2.5}$)*	Annual Mean	25 µg/m^3

* The $PM_{2.5}$ objective, which is to be met by 2020, is not in (Air Quality England) Regulations and there is no requirement for local authorities to assess it, although they are encouraged to do so.

The objectives apply at locations where members of the public are likely to be regularly present and exposed over the averaging period of the objective. Examples of where the annual mean objectives should apply are provided in LAQM.TG16, and include: building facades of residential properties, schools, hospitals. The

annual mean objectives are not relevant for the building facades of offices or other places of work where members of the public do not have regular access, kerbsides or gardens.

The 24-hour objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels.

The 1-hour objective for NO_2 also applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations, pavements of busy shopping streets, carparks and bus stations which are not fully enclosed. The 1-hour objective does not apply at kerbside sites where the public do not have regular access.

2.2 EU limit values

The European Union has also set limit values for NO_2, PM_{10} and $PM_{2.5}$; these are legally binding and have been implemented into English legislation by The Air Quality Standards Regulations 2010[5].

The limit values for NO_2, PM_{10} and $PM_{2.5}$ are the same as the English objectives (Table 1), but applied from 2010 for NO_2, 2005 for PM_{10} and 2015 for $PM_{2.5}$. The limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway).

2.3 The Mayor's Air Quality Strategy

The most recent Mayor's Air Quality Strategy (MAQS)[6] for London was published in December 2010. The overarching aim of the Strategy is to reduce pollution concentrations in London to achieve compliance with the EU limit values as soon as possible. The Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures. A total of 15 policies are outlined.

Policy 7 specifically relates to using the planning process to improve air quality. The Mayor will ensure 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.

The output from this policy is to ensure that measures to improve air quality are embedded in the planning process and incorporated into the London Plan (see section 3.2.2Lb).

In July 2015 the GLA released a Progress Report on the delivery of the Mayor's Air Quality Strategy. The report confirms that an Ultra-Low Emission Zone (ULEZ) will be introduced in the capital by 2020 and includes new emissions requirements for buses and taxis. It also provides an update on the implementation of the 15 MAQS policies along with the next steps that are being taken by the London's Mayor to improve the air quality in London.

The current Mayor of London is introducing a programme of measures to improve air quality and is planning on publishing a new air quality strategy, as part of a broader environmental strategy, later this year. The main aim in regards to air quality is outlined below:

> "*London will have the best air quality of any major world city by 2050, going beyond the legal requirements to protect human health and minimise inequalities*."

To achieve this, the early introduction of the ULEZ within London's Congestion Charge Zone in 2020 will be implemented and its possible extension to cover the area within the north and south circular roads for light duty vehicles and the replacement of the Low Emission Zone by an ULEZ for all light and heavy duty vehicles in 2021. The long term plan is to phase out the use of fossil fuels that are used to heat and cool buildings and to provide hot water.

The MAQS will be replaced with London Environment Strategy which is currently in draft for public consultation. The following proposed policies relate to the planning process in regards to improving air quality:

Policy 4.2.2 – *"Reduce emissions from non-road transport sources, including by phasing out fossil fuels;"*

Policy 4.2.3 – *"Reduce emissions from non-transport sources, including by phasing out fossil fuels;"*

Policy 4.3.3 – *"Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces and reduce the impact of building emissions on air quality;"*

Policy 4.3.4 – *"Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces."*

The Strategy also includes the focus on the 187 Air Quality Focus Areas (AQFA) declared by the GLA. Focus Areas are defined to address concerns raised by boroughs within the LAQM review process and forecasted air pollution trends. These are locations that not only exceed the EU annual mean limit value for NO_2, but are also locations with high human exposure. This is not an exhaustive list of London's hotspot locations, but where the GLA believe the problem to be most acute.

2.4 Local Air Quality Management in Camden

The Proposed Development is situated within an Air Quality Management Area (AQMA), declared by LBC for exceedances of the nitrogen dioxide (NO_2) and fine particulate matter (PM_{10}) objectives.

An Air Quality Action Plan 2016 – 2018 was published in January 2013, which sets out the air quality issues and opportunities in Camden, and includes a range of actions grouped under the following themes:

- Reducing transport emissions
- Reducing emissions associated with new development
- Reducing emissions from gas boilers and industrial processes
- Air quality awareness-raising initiatives
- Lobbying and partnership working

2.5 Planning Policy

2.5.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) 2012[7] sets out planning policy for England. It includes advice on when air quality should be a material consideration in development control decisions. Relevant sections are set out below:

Paragraph 109: "The planning system should contribute to and enhance the national and local environment by … preventing both new and existing development from contributing to or being put to an unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability..."

Paragraph 120: "To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."

Paragraph 124: " Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

Paragraph 203: "Local Planning Authorities should consider where otherwise unacceptable development could be made acceptable through the use of condition or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

The NPPF is supported by Planning Practice Guidance (PPG)[8].

The PPG states that:

Paragraph 001 (Reference ID: 32-001-20140306): "Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit."

The PPG also states that:

Paragraph 005 (Reference ID: 32-005-20140306): "Whether or not air quality is relevant to a planning decision will depend on the Proposed Development and its location. Concerns could arise if the development is likely to generate an air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)."

The PPG also sets out the information that may be required in an air quality assessment, stating that:

Paragraph 007 (Reference ID: 32-007-20140306): "Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific"

It also provides guidance on options for mitigating air quality impacts, and makes clear that:
Paragraph 008 (Reference ID: 32-008-20140306): "Mitigation options where necessary will be locationally specific, will depend on the Proposed Development and should be proportionate to the likely impact."

2.6 London Planning Policy

The London Plan Consolidated with Alterations since 2011 sets out the spatial development strategy for London. It brings together all relevant strategies, including the MAQS.

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

Supplementary Planning Guidance (SPG) on 'The Control of Dust and Emissions During Construction and Demolition' requires an assessment of the impacts of construction works on air quality, using the IAQM methodology. An Air Quality and Dust Management Plan (AQDMP), should be submitted with the planning application, together with confirmation that an Air Quality and Dust Management Plan (AQDMP) will be provided to the local authority prior to the commencement of works. Within this report these documents are referred to as the Air Quality Assessment and the Dust Management Plan respectively.

The Sustainable Design and Construction SPG makes reference to the Mayor's 'air quality neutral' policy and provides minimum requirements for emissions from boilers. All major developments in London needs to be assessed against emissions benchmarks for buildings and transport. Developments with emissions of NOX and PM_{10} below these benchmarks are considered to be 'air quality neutral'.

2.7 Camden Council Local Plan

The Camden Local Plan sets out the Council's planning policies and replaces the Core Strategy and Development Policies planning documents (adopted in 2010). The Local Plan will cover the period from 2016-2031. The following CC4 policy relates to Air Quality, it states:

- "*The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.*
- *The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.*
- *Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.*

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

2.8 Guidance Documents

2.8.1 Guidance on the Assessment of Dust from Demolition and Construction

The Institute of Air Quality Management (IAQM) produced guidance on the assessment of dust from demolition and construction[9]. This document provides a risk-based methodology for assessing construction impacts, including demolition and earthworks where appropriate.

2.8.2 Guidance on the Assessment of Operational Impact of New Developments

Guidance produced by Environmental Protection UK (EPUK), and IAQM in January 2017 entitled 'Land-Use Planning & Development Control: Planning for Air Quality[10] aims to ensure that air quality is properly accounted for in the development control process. The main foci of the guidance are the assessment of the impact of emissions and advice on how to describe air quality impacts and their significance.

2.8.3 Air Quality Neutral Planning Support Update: GLA 80371

Air Quality Consultants Ltd and ENVIRON UK Ltd produced guidance on behalf of the Greater London Authority on how to assess whether a development is air quality neutral. It provides benchmarks for assessing that development is consistent with the Mayor's policy.[11]

3. Methodology of Assessment

3.1 Consultation

The approach to the assessment was agreed with the Environmental Health Practitioner at LBC as described in section 1.2.

3.2 Existing Air Quality in the Study Area

A baseline air quality review was undertaken to determine the existing air quality in the vicinity of the site.

This desk-top study was undertaken using the following sources:

- Air quality data for Camden, including a review of the LBC air quality reports and local monitoring data;
- The UK Pollutant Release and Transfer Register[12];
- Background pollution maps from Defra's Local Air Quality Management (LAQM) website[13];
- The UK Ambient Air Quality Interactive Map[14];
- Defra's Nitrogen Dioxide Fall Off With Distance[15]
- Greater London Authority LAEI Air Quality Focus Areas [16]
- Greater London Authority (GLA) modelling[17]; and
- Aerial photography from Google Maps.

3.3 Construction Phase Impacts

Fugitive dust emissions during the construction may give rise to increased PM_{10} concentrations and dust deposition, albeit this is a temporary impact. These impacts have been assessed using the IAQM methodology (see Annex 2 – IAQM Construction Methodology) to identify appropriate mitigation measures commensurate with the risk.

Activities on the proposed construction site have been divided into four types to reflect their different potential impacts. These are:

- Demolition
- Earthworks
- Construction and
- Trackout

No significant demolition is anticipated as the development is an extension to the existing building. Demolition has therefore been scoped out from the assessment.

The risk of dust emissions was assessed for each activity with respect to:

- Potential loss of amenity due to dust soiling;
- The risk of health effects due to a significant increase in exposure to PM_{10}

A desk based review using online resources of habitats and ecologically designated sites has been undertaken. There are considered no relevant ecological receptors within 50m of the Proposed Development.

First the potential dust emission magnitude was defined based on the scale of the anticipated works and is classified as Small, Medium or Large. Then the sensitivity of the area was defined based on the receptor sensitivity, number of receptors, and the distance from the source.

Receptors were identified within distance bands from the site boundary using aerial imagery and maps of the surrounding area (see Figure 6). The PM_{10} background concentration was also taken into account. The area was then defined as High, Medium or Low sensitivity.

The potential dust emission magnitude and the sensitivity of the area were combined to define the risk of impacts.

3.4 Operational Phase Impacts

3.4.1 Introduction of Impacts

The operational impacts that are to be assessed include the energy systems emission impacts and impacts from road traffic with respect to the exposure of the Proposed Development to existing air quality via a qualitative review.

3.4.2 Energy Centre Impacts

The Proposed Development will include two gas-fired boilers to provide heat and power albeit these are not to be used simultaneously. The technical details of the boilers proposed are provided in Annex 3 – Model Input Data.

The impacts of emissions from the proposed energy centre have been modelled using the ADMS 5 (v5.2.1.0) dispersion model. ADMS 5 is an extensively validated new generation Gaussian plume air dispersion model, and is used by regulators, government departments, consultancies and industry. The model is able to simulate the entrainment of the plume in the wake of the building. Full details of the modelling methodology and the model input parameters are provided in Annex 3 – Model Input Data.

Concentrations have been predicted across a 500 m x 500 m grid to determine the maximum off-site impact of the operation of the combined heat and power (CHP) and gas boilers on the annual mean concentrations of NO_2 and the 99.8th percentile of 1-hour mean NO_2 concentrations. Concentrations have been modelled at two different height levels, from 1.5 m and 33.43 m.

3.4.3 Air Quality Neutral Assessment

To enable the implementation of the air quality neutral policy of the London Plan, emission benchmarks have been developed for buildings and transport, the latter of which are dependent on the zone in London where the development is located. Developers are required to calculate emissions due to building operations and transport, and to compare these emissions with the benchmarks, which are set out in Annex 3.

Where the development's emissions exceed the benchmarks, on-site mitigation is required. Where emissions continue to exceed the benchmarks after appropriate on-site mitigation, the excess emissions need to be off-set off-site through agreement with the local planning authority.

Full details of the modelling methodology are provided in Annex 3 – Model Input Data.

3.5 Assessment of Significance

3.5.1 Construction Dust

The IAQM guidance on the assessment of dust from demolition and construction states that the primary aim of the risk assessment is to identify site specific mitigation that, once implemented, should ensure that there will be no significant effect. Therefore, the assessment has been used to determine an appropriate level of mitigation for the construction phase.

3.5.2 Operational Impacts

There is no official guidance in the UK on how to assess the significance of the effects of air quality on new developments.

The approach suggested by EPUK and the IAQM in guidance on Land-Use Planning & Development Control: Planning for Air Quality has been used for existing receptors. This guidance recommends the use of the annual mean objectives. It also recommended that the $PM_{2.5}$ objective is used to assess the impact due to particulate matter as it is more conservative than the objectives for PM_{10}, and most of the emissions from combustion sources, occur in the $PM_{2.5}$ fraction.

The air quality impacts at individual receptors have been described by determining the percentage change in concentrations relative to the air quality assessment level (AQAL) and comparing this with the total long-term average concentration (boiler + background + road traffic), as set out in Table 2.

Table 2 EPUK / IAQM 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% of more of AQAL	Moderate	Substantial	Substantial	Substantial

For the proposed receptors the predicted concentrations have been assessed against the NO_2 objectives shown in Table 1. Where an exceedance of an objective is predicted, mitigation measures are recommended to reduce exposure to below the objective value.

The determination of the significance of the effects includes elements of professional judgement and the professional experience of the consultant preparing the report is set out in Annex 5 – Professional Experience.

There is no statutory guidance in the UK on how to describe air quality impacts, or how to assess their significance. Professional judgement has been used to identify the need for mitigation measures to ensure that future users of the Proposed Development are not exposed to unacceptable air quality.

The overall significance of the air quality effects are judged as either significant or not significant taking account of:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

3.6 Baseline Air Quality

This section sets out the available information on air quality in the vicinity of the Proposed Development.

3.6.1 LAQM Review and Assessment

The Proposed Development is located within Camden's AQMA declared by LBC for exceedances of the annual mean and short term objectives for NO_2 and PM_{10}.

3.6.2 Local Air Quality Monitoring

There are four automatic monitoring stations in operation in the London Borough of Camden with two automatic monitors within close proximity to the Proposed Development: Shaftesbury Avenue (x 530060 y 181290), a roadside site, and Bloomsbury (x 530120 y 182034), an urban background site, see Table 3.

Additionally, on the London Air website there is an automatic site called Camden – Holborn (IM1), a kerbside site measuring NO_2 concentrations, operated by "inmidtown BID", and not a local authority. The data for this site are available on the LAQN[18]. Also detailed in Table 3.

Table 3 Automatic monitoring data for Holborn, Bloomsbury and Shaftesbury Avenue sites. Concentration in µg/m^3, 1- hour and 24-hour measurements show number of exceedances of the concentration i.e. 200 µg/m^3 for NO_2 and 50 µg/m^3 for PM_{10}.

Monitoring site and distance (m) from site boundary (approx.)	Objective	2012	2013	2014	2015	2016
NO_2						
Holborn 350 m	Annual mean (µg/m^3)	-	-	-	83	84
	Number of exceedances of the 1-hour mean NO_2 concentrations	-	-	202	75	46

Monitoring site and distance (m) from site boundary (approx.)	Objective	2012	2013	2014	2015	2016
Bloomsbury, 860 m	Annual mean (µg/m^3)	55	44	45	48	42
	Number of exceedances of the 1-hour mean NO_2 concentrations	1	0	0	0	0
Shaftesbury Avenue, 850 m	Annual mean (µg/m^3)	71	74	69	-	-
	Number of exceedances of the 1-hour mean NO_2 concentrations	12	10	1	-	-
PM_{10}						
Bloomsbury, 860 m	Annual mean (µg/m^3)	19	18	20	19	20
	Number of exceedance of the 24-hour mean PM_{10} concentrations	10	4	11	6	9
Shaftesbury Avenue, 850 m	Annual mean (µg/m^3)	29	29	25	22	-
	Number of exceedance of the 24-hour mean PM_{10} concentrations	23	15	15	4	-

The annual mean NO_2 concentrations are above the objective at all automatic monitoring sites over the past five years.

The Shaftesbury Avenue and Holborn monitoring sites being roadside and kerbside locations are likely similar to the conditions for the Proposed Development on High Holborn in Camden. The monitoring results at these sites indicate that air quality is generally poor for NO_2 with the annual objective being met for the previous five years.

The short term objective for NO_2, i.e. the 1-hour mean has been exceeded once in 2014 at Holborn, above the permitted 18 times above 200 µg/m^3. The short-term objective for NO_2 was not exceeded for Shaftesbury Avenue or Bloomsbury over the previous five years.

The PM_{10} annual mean concentrations have remained fairly consistent across the previous five years for which ratified data is available, and there have been no exceedances of the objectives. The short term objective for PM_{10}, i.e. the 24-hour mean, has not been exceeded for the previous five years, below the permitted 35 days.

In addition to automatic monitoring stations, there are also a number of diffusion tube sites located throughout the Borough monitoring NO_2 concentrations. The closest diffusion tubes to the Proposed Development are: Bloomsbury Street, a roadside site, approximately 920 m from the Proposed Development, Wakefield Gardens and Tavistock Gardens, both urban background sites, approximately 940 and 1,200 m from the Proposed Development as shown in Figure 2 and Table 4.

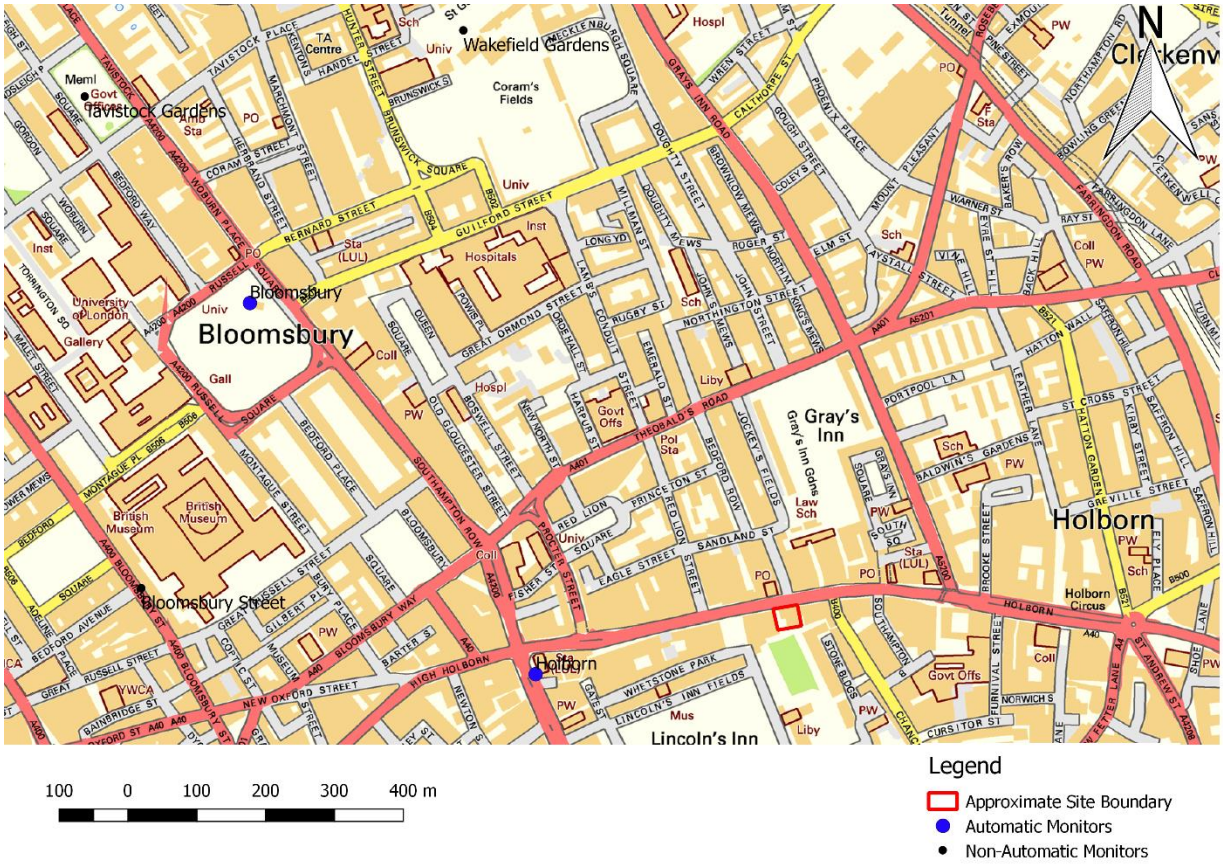


Figure 2 Local authority automatic and non-automatic monitoring locations in vicinity of the Proposed Development. Contains OS Data © Crown Copyright and Database rights 2017

Table 4 Diffusion tube data (annual mean NO_2 concentrations µg/m^3) for the diffusion tubes located within approximately 1km from the development site*

Site	Grid Reference		2012	2013	2014	2015*	2016*
	x	y					
Bloomsbury Street	529962	181620	72	76	81	75	72
Wakefield Gardens	530430	182430	39	40	36	-	-
Tavistock Gardens	529880	182334	40	49	47	38	39

*The annual mean was taken from https://opendata.camden.gov.uk

The NO_2 data measured in the vicinity of the Proposed Development over the previous five years shows the annual mean objective has been exceeded at the roadside site Bloomsbury Street which is likely to be similar to the air quality at the Proposed Development.

An annual mean concentration of 60μg/m^3 or above is often used to indicate a possible exceedance of the hourly mean NO_2 objective. It is considered likely, based on the above data, that the one-hour objective will be exceeded at the Proposed Development based on the monitoring data provided.

3.6.3 Industrial Pollution

A desk based review of potential industrial sources using the UK Pollutant Release and Transfer Register, and the Environment Agency's 'what's in your backyard' websites[19] did not identify any significant industrial or waste management sources of air pollution that are likely to affect the Proposed Development with regard to air quality.

3.6.4 Defra Predicted Concentrations

Defra have produced projections of future concentrations of NO_2 and NOx across the UK up to 2030 for the development of the 2017 Air Quality Plan[20]. The annual average background concentrations used to predict the roadside concentrations at High Holborn (census ID 75102) are shown in Table 5 for 2015 (baseline year), 2017 (current year) and 2020 (opening year of the Proposed Development).

The background concentrations have been obtained from the national maps published by Defra[21]. These estimated concentrations are produced on a 1km by 1km grid basis for the whole of the UK. The development site falls into grid square x 530500 y 181500 and the predicted concentrations for this grid square for PM_{10} and $PM_{2.5}$ are provided in Table 5

Table 5 Estimated annual mean background concentrations in 2015, 2017 and 2020 in μg/m^3

Year	NO_2*	PM_{10}	$PM_{2.5}$
2015	67	22.9	16.5
2017	59	22.3	16.0
2020	40	21.5	15.2

*Data collected from Census ID: 75102

It can be seen that these modelled background concentrations for PM_{10} and $PM_{2.5}$ are all well below the annual mean objective levels but exceed for NO_2. The modelled NO_2 in 2015 were lower than those measured at Holborn and Bloomsbury automatic monitoring sites but were higher for PM_{10}.

Data are available for the road link High Holborn (A40) immediately adjacent to the development site. The modelled concentrations for NO_2, PM_{10} and $PM_{2.5}$ are 78.4 μg/m^3, 27.7 μg/m^3 and 19.5 μg/m^3 respectively for 2013. These data are well below the annual mean objective for PM_{10} and $PM_{2.5}$, but exceed the annual mean objective for NO_2. The annual mean NO_2 concentration at High Holborn is predicted to be above 60 μg/m^3, the threshold at which the hourly objective is likely to be exceeded.

3.6.4.1 Defra's Nitrogen Dioxide Fall Off With Distance

An estimated value for the roadside air quality can be calculated for High Holborn (A40). With the façade of the Proposed Development being approximately 7 m from the roadside the estimated annual NO_2 concentration at the High Holborn façade of the proposed building can be calculated as to be 82.8 µg/m^3 using Defra's calculator[22]. The annual mean NO_2 concentration at High Holborn is predicted to be above 60 µg/m^3, the threshold at which the hourly objective is likely to be exceeded.

The figures were calculated using 2013 data which represents a worse case data set compared with the more recent and most available data set of 2015. The roadside NO_2 concentration on High Holborn is likely to be similar to that around the Proposed Development, when coupled with the use of 2013 data which assumes no improvement in air quality since 2013, this calculated figure is likely to be less in reality.

3.6.5 Greater London Authority

3.6.5.1 Air Quality Focus Areas

There are a number of Air Quality Focus Area's (AQFA's) identified in London with five AQFA's in Camden. These are locations that not only exceed the EU annual mean limit value for NO_2, but are also locations with high human exposure. The Proposed Development is within one of these AQFA's as illustrated in Figure 3.

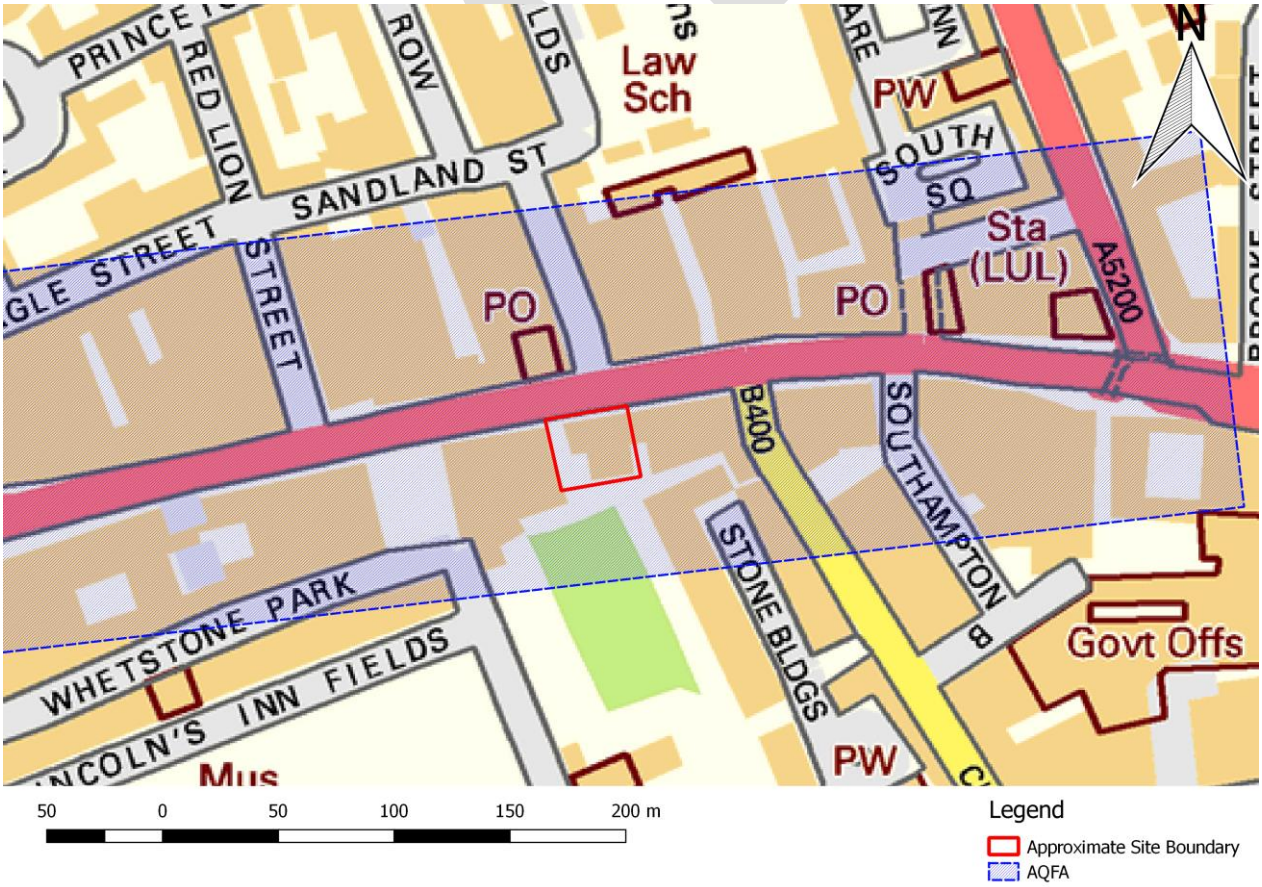


Figure 3 Focus area and location of Proposed Development in Camden. OS Data © Crown Copyright and Database rights 2017

The Proposed Development is located within the boundary of a declared AQFA. It is therefore likely that there will be high human exposure around the Proposed Development with air quality exceeding the annual mean limit value for NO_2 as a result of the AQFA.

3.6.5.2 Pollution Maps

The GLA produce annual mean concentration maps for the whole of London on a 20m by 20m grid for a historic year (2013) and future years (2020, 2025 and 2030). Figure 4 and Figure 5 illustrate the annual mean NO_2 and PM_{10} concentrations in the immediate area of the Proposed Development for 2013.

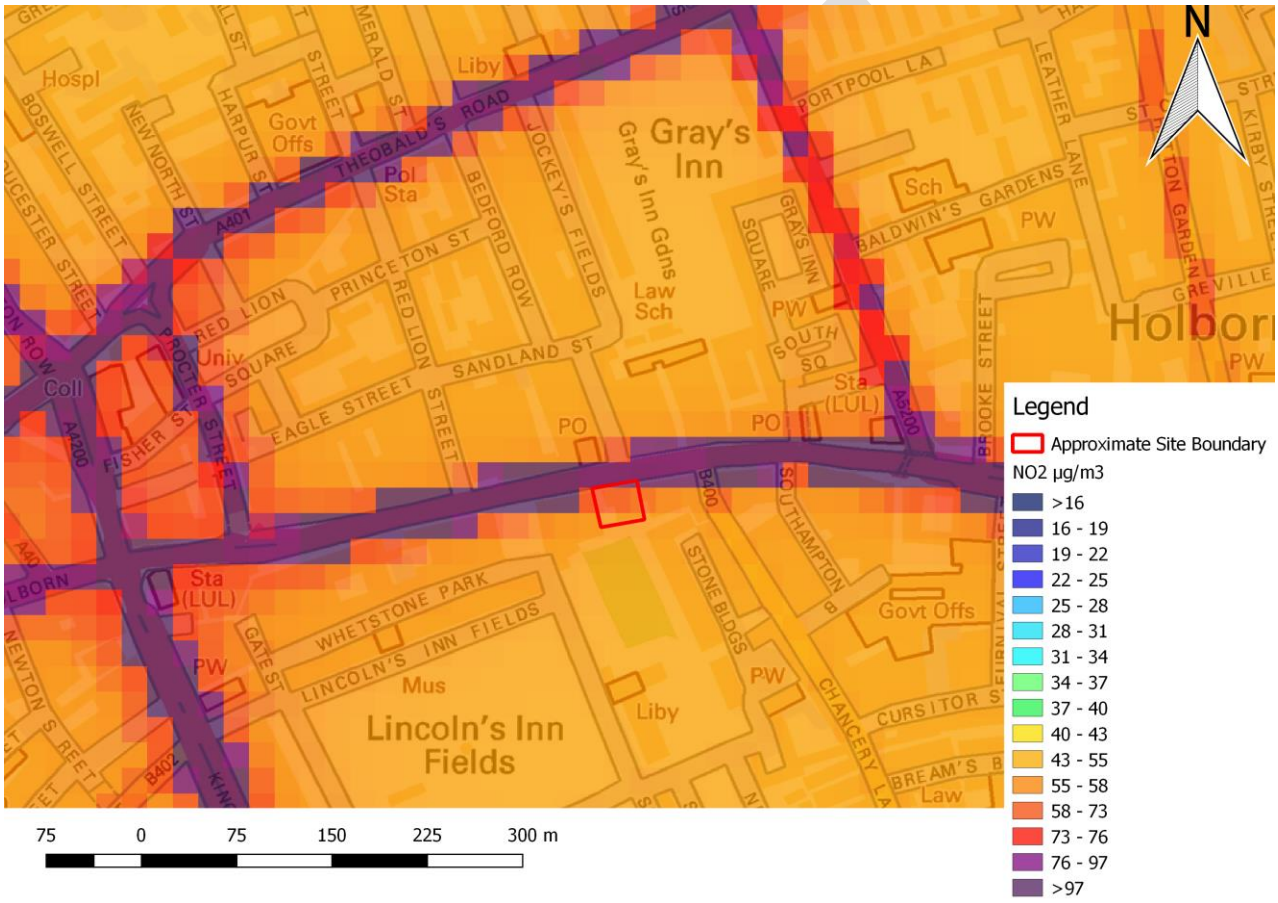


Figure 4 Modelled 2013 annual mean NO_2 concentrations (GLA, 2017), with red outline indicating approximate Proposed Development location OS Data © Crown Copyright and Database rights 2017

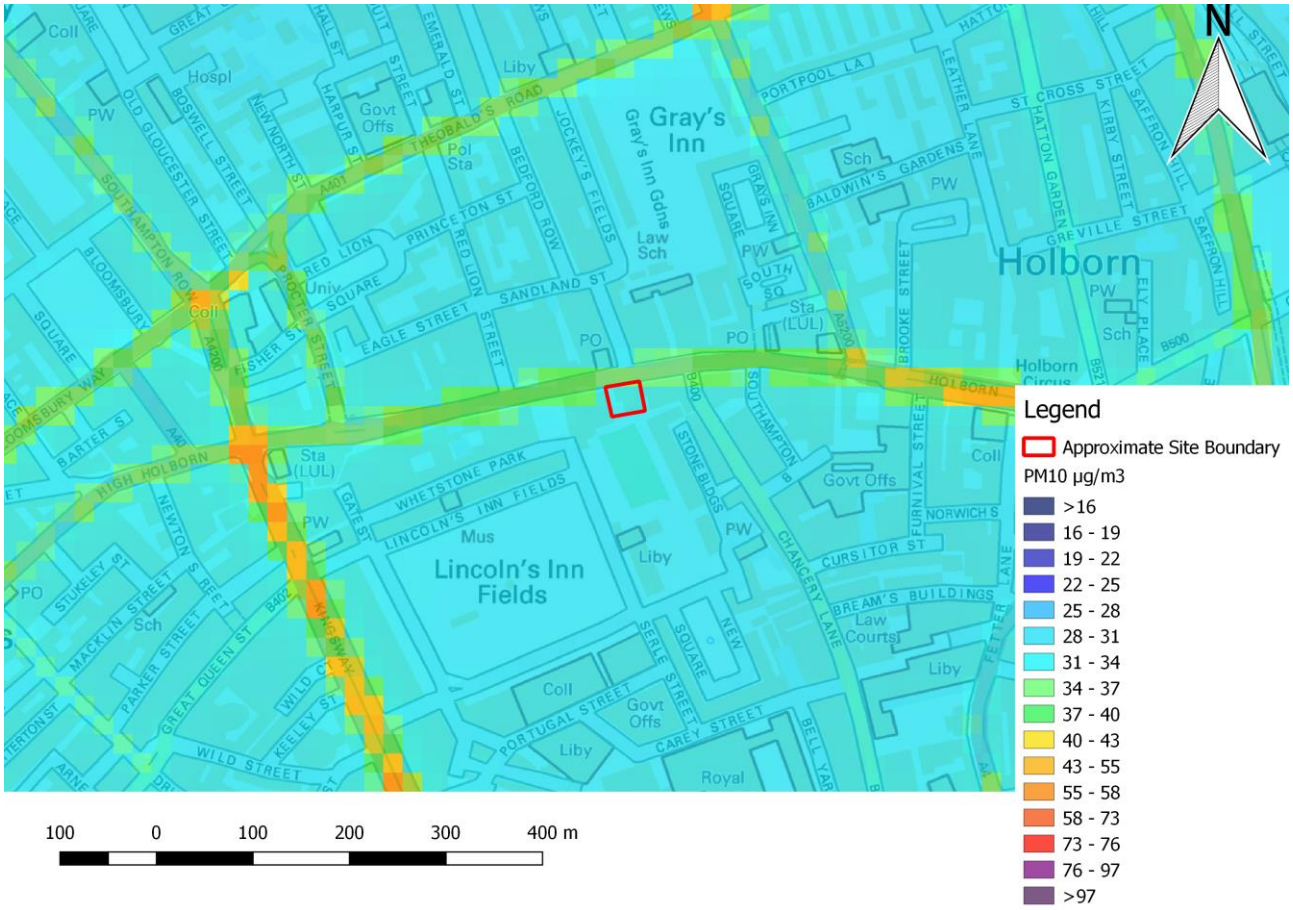


Figure 5 Modelled 2013 annual mean PM_{10} concentrations (GLA, 2017), with red outline indicating approximate Proposed Development location OS Data © Crown Copyright and Database rights 2017

The concentration of key pollutants in 2013 are shown on Table 6 for the coordinates of the Proposed Development. The annual mean NO_2 objective is predicted to be exceeded in 2013, but not in 2020, when it is predicted to be well below the objective.

Table 6 Annual mean concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ (grid reference x 530900 y 181580) (GLA, 2017)

Year	Pollutant Concentration - (µg/m³)			
	NOx	NO_2	PM_{10}	$PM_{2.5}$
2013	119	59.4	29.5	18.8
2020	51.0	34.9	27.2	16.7

3.7 Summary of background data

In summary, the assessment of the baseline data has shown that the air quality in parts of Camden is poor. The annual mean NO_2 objective is widely exceeded, particularly at roadside and kerbside locations. However the annual mean objective does not apply to places of work (i.e. offices in this instance) and so the annual mean objective is not relevant to this assessment.

There is little data on the short-term concentrations as neither diffusion tubes nor modelling provides this information. However, this can be inferred from the annual measurements. The closest monitoring station, at Holborn, shows the annual mean NO_2 concentration at High Holborn is predicted to be above 60 $\mu g/m^3$, the threshold at which the hourly objective is likely to be exceeded. However, it is reasonable to assume that pollutant concentrations recorded at Holborn will be higher than those at the Proposed Development. This is because there is more road traffic on Kingsway than High Holborn, where the monitoring site is located close to a major road junction. The proposed ventilation strategy is to obtain air from the façade facing Lincoln Inn Fields and at roof level. At these locations, given the distance from the road and the intervening buildings the concentrations are likely to be significantly lower than on the High Holborn façade.

The risk of future users of Lincoln House being exposed to NO_2 concentrations exceeding the hourly objective value is unlikely with the proposed ventilation strategy, however it is acknowledged that the hourly objective isn't applicable for the uses proposed.

Both the air quality objectives for PM_{10} and $PM_{2.5}$ are achieved across the city.

4. Impact Assessment

The potential for air quality impacts during construction and operation of the Proposed Development are discussed in this section.

4.1 Construction phase

This sub section provides the results for demolition, earthworks, construction and trackout activities associated with the Proposed Development. Based on the impact assessment appropriate mitigation has been identified.

The risk of dust impacts is based on the potential dust emissions magnitude and the sensitivity of the area as described in Section 4.1.3. The two factors are then combined to determine the risk of dust impacts with no mitigation applied. In the absence of any site specific information a highest risk category has been applied to represent the worst case scenario.

4.1.1 Potential Dust Emission Magnitude

Earthworks
Even though the site proposes a heavy refurbishment including new foundations and buried drainage in potentially dust type soil (clay), it is unlikely that substantial earthworks will be required. This is due to the site being relatively small, approximately 801 m^2, and based on the limited earthworks proposed, the potential dust emissions magnitude is considered to be small.

Construction
The total building volume for the Proposed Development is likely to be between 25,000 m^3 – 50,000 m^3. In accordance with the IAQM criteria, the potential dust emission magnitude from construction based on this detail would be medium.

Trackout
Initial information on the number of outward Heavy Duty Vehicle (HDV) trips to be generated during the construction phase per day was not available at the time of writing of this report. There may be short distances of unpaved road / tracks proposed as part of the development. However, given the dimension of the site are they are likely to be less than 50m in length. The potential dust emissions magnitude from trackout is considered to be small.

4.1.2 Summary of Potential Dust Emission Magnitude

As outlined in the IAQM guidance, the scale and nature of the works has been assessed to determine the potential dust emissions magnitude for the Proposed Development site. Table 7 shows a summary of the classifications for the Proposed Development for each of the activities.

Table 7 Dust Emission Magnitude for the Proposed Development

Activity	Dust Emission Magnitude
Earthworks	Small
Construction	Medium
Trackout	Small

4.1.3 Sensitivity of the Study Area

The area surrounding the site consists primarily of commercial premises. Figure 6 shows the Proposed Development location (red line) and a series of distance bands from the boundary of the site. Note that receptors identified at a greater distance than 350 m have not been included as the IAQM Guidance[9] does not consider that there will be a material impact beyond this distance (see Annex 2 – IAQM Construction Methodology).

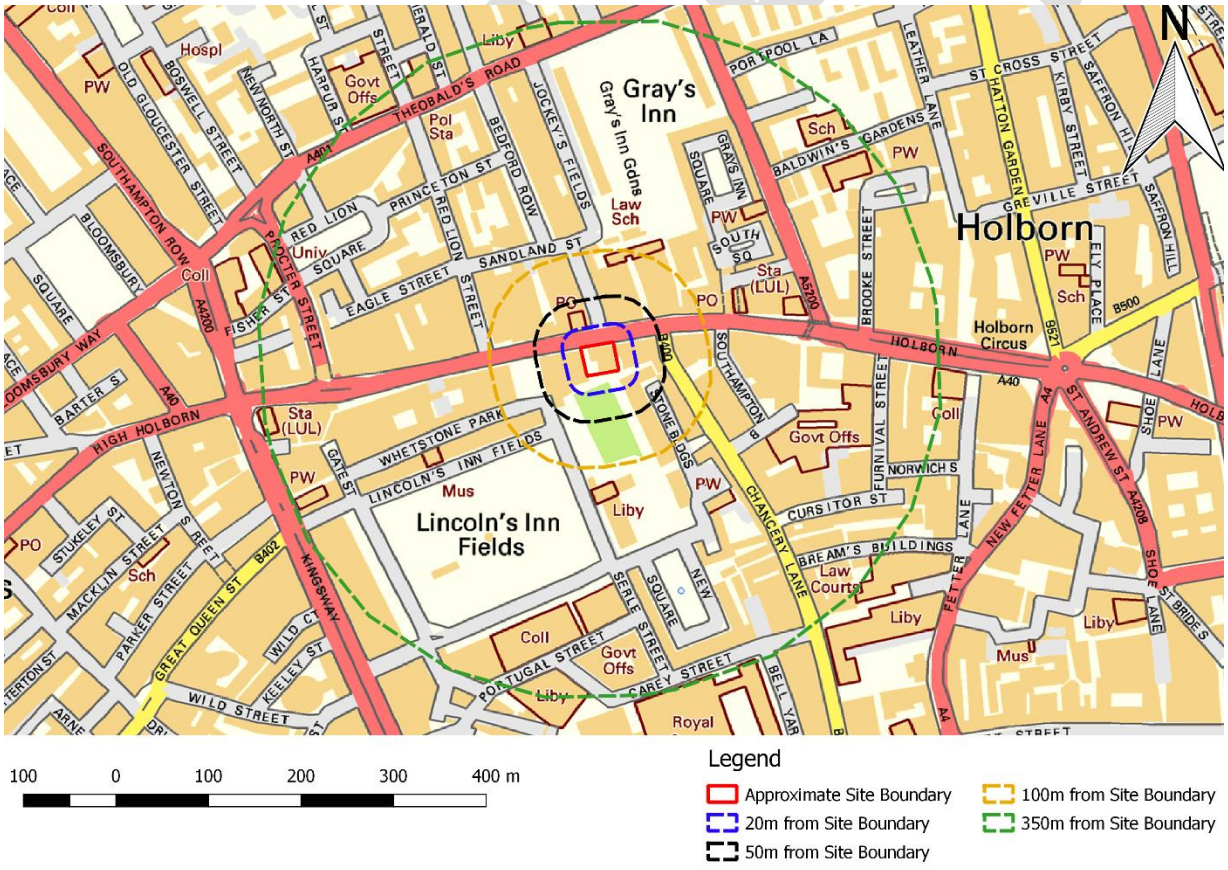


Figure 6 IAQM demolition and construction distance band criteria from site boundary. Contains Ordnance Survey Data © Crown Copyright 2017

4.1.4 Sensitivity of the Study Area to Dust Soiling

Residential areas are considered to be highly sensitive to dust soiling. There are between 10-100 residential receptors within 50 m of the Proposed Development. The area surrounding the site is considered to be medium sensitivity to dust soiling for the activities of construction and earthworks.

For trackout, the distances are measured from the side of the roads used by construction traffic. Without site specific mitigation, trackout may occur from roads up to 50 m from small development sites, as measured from the site exit, and up to 50 m from the edge of the road. The sensitivity of the area to dust soiling effects associated with trackout from the Proposed Development site has been classified as medium.

4.1.5 Sensitivity of the Study Area to the Health Effects of PM_{10}

Defra's modelled background PM_{10} concentrations for 2016 is 22.7 µg/m^3. As the local PM_{10} concentration is under 24 µg/m^3 the area is considered to be of low sensitivity to the health effects of PM_{10} for earthworks, construction and trackout.

4.1.6 Summary of Sensitivity

The sensitivity of the area is summarised for each activity in Table 8.

Table 8 Sensitivity of the Surrounding Area

Potential Impact	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium
Human Health	Low	Low	Low

4.1.7 Risk of Dust Effects

The dust emissions magnitude (section 4.1.1) is combined with the sensitivity of the area (section 4.1.3) to determine the risk of impacts with no mitigation applied. A summary of the unmitigated risk during each activity is provided in Table 9.

It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on the worst-case assumption that all works will be undertaken at the site boundary closest to each receptor area. Therefore, the actual risk is likely to be lower than that predicted during the majority of the construction phase.

Table 9 Summary of Potential Unmitigated Dust Risks

Potential Impact	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Medium Risk	Negligible
Human Health	Negligible	Low Risk	Negligible

4.2 Operational Phase

The potential for air quality impacts on existing receptors and on the Proposed Development during the operation of the Proposed Development are discussed in this section.

4.2.1 Existing Receptors – Energy Centre

The maximum ground level concentrations of both the annual mean NO2 and 99.79th percentile of 1-hour NO2 concentration from the boiler are shown in Table 10 and Table 11 respectively.

An area around the development is predicated to experience an increase in annual mean NO_2 concentrations of 1 µg/m^3 and 0.7 µg/m^3 at ground level and roof level respectively. The impact from the Proposed Development at ground level is negligible and the impact at roof level is slight when assessed against the EPUK/IAQM guidance. Additionally, the 1-hour NO_2 99.79th percentile from the boilers emissions are predicted to be below the screening criterion suggested in the EPUK/IAQM guidance of 10% of the short term objective.

Consequently, there is considered to be no significant effect of the NOx emissions from the developments energy plant on existing receptors and local air quality where there is relevant exposure.

Table 10 Contribution to annual mean and 1-hour 99.79th percentile dispersion modelling results from the energy centre predicted at ground level (1.5m) using the meteorological year 2016.

	Annual mean (µg/m^3)	99.79th Percentile (µg/m^3)
Maximum NO_2 (µg/m^3)	0.1	1.8
AQAL (µg/m^3)	40	200
AQAL (%)	0.25	0.9

Table 11 Contribution to annual mean and 1-hour 99.79th percentile dispersion modelling results from the energy centre predicted at roof level (33.4m) using the meteorological year 2016.

	Annual mean (µg/m^3)	99.79th Percentile (µg/m^3)
Maximum NO_2 (µg/m^3)	0.7	18
AQAL (µg/m^3)	40	200
AQAL (%)	1.75	9

4.2.1.1 Impact on the Proposed Development

This section provides the qualitative assessment of the impacts of emissions from road traffic and existing background air quality on future users of the Proposed Development.

When coupled with baseline data from section 3.6, it's likely that the annual NO_2 concentration is going to be exceeded and also the short term NO_2 objective at ground floor is also likely to be exceeded. This is due to the high traffic flow on High Holborn and the distance the closest façade is from the road combined with data from the Holborn automatic monitoring site which measured NO_2 to be 84 µg/m^3 at the latest year available, 2016. This is above the threshold of 60 µg/m^3 indicating a possible exceedance of the hourly mean NO_2 objective. However, the short-term objective does not apply as the Proposed Development is for an office extension.

Furthermore, the nitrogen drop-off distance estimated value of 82.8 µg/m^3 value was calculated using the baseline year as 2013, regarded the "worst case scenario year." It is therefore likely that this will decrease when the building is occupied as concentrations from road transport sources typically decline with height to reach the background concentrations of between 35-40 µg/m^3 in 2020 as seen in Table 5 and Table 6 and measured NO_2 concentration of 42 µg/m^3 from Bloomsbury automatic monitoring station.

To ensure the impact of the road traffic emission on the development is reduced, all levels are proposed to be mechanically ventilated with the air intakes being located on the Lincoln Inns Field façade with the basements ventilation also located on the same façade. As the air intakes for the ventilation are facing Lincoln Inn Fields, concentrations are expected to be lower than that at the High Holborn Façade. The windows in the building are openable but it is intended for purge ventilation and is not intended for the primary ventilation of the building.

With the ventilation strategy in place, the short term NO_2 objective is anticipated to be achieved at the facade of the Proposed Development where the air intake are proposed.

The PM_{10} and $PM_{2.5}$ objectives are anticipated to be achieved at the development site.

4.3 Air Quality Neutral Assessment

4.3.1 Building Emissions

The calculation of the total building emissions (TBE) for the development for comparison with the building emissions benchmark (BEB) is shown in Table 12. The TBE of 122.2 kg NOx/yr is less than the BEB of 227.5 kg NOx/yr; therefore, the Proposed Development is air quality neutral with regard to building emissions.

Table 12: Calculation of TBE and BEB

Description		Value	Unit
A	Annual NOx Emissions Boilers	122.2	kg/yr
B	**TBE NOx**	**122.2**	**kg/yr**
C	Gross Internal Floor Area Class A1 (Retail)	193	m^2
D	NOx BEB for Class A1 (Retail)	4294	g/m^2/yr
E	Gross Internal Floor Area Class B1 (Business)	7,245	m^2
F	NOx BEB for Class B1 (Business)	234326.4	g/m^2/yr
G = (F x E) + (C x D)	**BEB NOx**	**238.6**	**kg/yr**

4.3.2 Transport Emissions

The transport assessment shows that there are is no car parking proposed as part of the development; therefore, the emissions from transport can be considered air quality neutral.

5. Mitigation

5.1 Construction Phase

To mitigate the potential impacts during the construction phase it is recommended that mitigation measures consistent with the GLA's SPG and IAQM guidance are implemented. The following mitigation measures in Table 13 have been selected for the development site at Lincoln House based upon the dust risk categories outlined in 4.1.3 of this report.

The table below details the measures that should be incorporated in the Dust Management Plan.

Table 13 Fugitive dust mitigation measures that are applicable to the Proposed Development

Issue	Mitigation Measure
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
Dust Management Plan	Develop and implement a Dust Management Plan (DMP), which may include measures to control emissions, approved by the Local Authority. 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
	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	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling check of surfaces such as street furniture, cars, window sills within 100m of the site boundary, with cleaning to be provided if necessary
	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
	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 is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Issue	Mitigation Measure
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 that are at least as high as any stockpiles on site
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period
	Avoid site runoff of water or mud
	Keep site fencing, barriers and scaffolding clean using wet methods
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used cover as described below
	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 London Non Road Mobile Machinery (NRMM) standards
	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
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where applicable)
	Produce a construction logistics plan to manage the sustainable delivery of goods and materials
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing)
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate
	Use enclosed chutes and conveyors and covered skips
	Minimize drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
	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	Avoid bonfires and burning of waste materials
Construction	Avoid scrabbling (roughening of concrete surfaces) if possible

Issue	Mitigation Measure
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
	For smaller supplies of fine powder material ensure bags are sealed after use and stored appropriately to prevent dust
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being in continuous use
	Avoid dry sweeping of large areas
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport
	Record all inspections of haul routes and any subsequent action in a site log book
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)

5.2 Operational Phase

The operation of the Proposed Development's energy centre will not have a material impact on the existing receptors in the local community where there is relevant exposure and therefore no mitigation measures are required.

The Proposed Development ventilation strategy is for intakes to be located at roof and faced level on the Lincoln Inn Fields side of the development. As the objective is likely not exceed for office and retail use at these locations there is no requirement for mitigation relating to air quality.

It is understood for the ventilation strategy is that the mechanical ventilation runs as the primary source of fresh air to the offices. The windows on the High Holborn Façade, can be opened if the users wish to, but will be restricted and used only for short term purge ventilation, as defined by Part F of the building regulations[23]. As such is it's recommended that provision should be made in the buildings management to advise users of the building, particularly those on the lower floors of the implications of air quality and the current ventilation strategy. For example, if the users wish to open the windows they can, but they will need to contact the building management to turn on the underfloor ventilation system. It is not anticipated that this will be done for usual operation, but may be utilised if the tenant wishes to turn off the mechanical system during midyear operation.

5.3 Air Quality Neutral

The air quality neutral benchmark has been met and further mitigation measures are **not required.**

6. Residual Impacts

6.1 Construction Phase

Assuming the relevant mitigation measures outlined in the mitigation section are implemented through, for example, a planning condition, the residual effect from dust generating activities associated with this phase of the development is considered to be **not significant.**

6.2 Operational Phase

The residual impact of the operational phase of the Proposed Development is **not significant.**

7. Summary and Conclusions

This report describes the potential air quality impacts associated with the proposed refurbishment and extension to Lincoln House, located on High Holborn, in the LBC. The Proposed Development will include a new extension above and to the rear façade of the existing building, with internal refurbishment of its existing use of retail and office activities.

The site lies within an AQMA where annual mean NO_2concentrations exceed the national air quality objective. The proposed extension is for offices and therefore only the short-term objectives for NO_2 and PM_{10} applies.

The need to undertake a detailed assessment of road traffic emissions associated with the Proposed Development have been scoped out. This is because there are no parking spaces proposed and traffic generated is below the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) planning guidance criteria for when a detailed assessment may be required.

A risk assessment of the potential impacts of the construction of the development has been undertaken to identify appropriate measures. Provided these are implemented, for example trough a planning condition, the residual impacts are considered to not be significant.

The annual mean NO_2 concentrations may exceed the objective on the development site, but there will be no relevant exposure over this averaging period. It is considered unlikely that the one-hour NO_2 objective will be exceeded on the site of the Proposed Development at the intake locations of the proposed ventilation systems based on the facade of the development at Lincoln Inn Fields. The air inlet for the mechanical ventilation system will be located on the roof and rear façade of the extension, where concentrations will be lower than at street level, with ventilation risers to distribute air down the building.

The impacts of the energy combustion plant emissions on the air quality for existing receptors and future users of the development have been assessed. The energy combustion plant consists of two boilers which are not intended to be used simultaneously. There is no relevant exposure where the energy centre emissions give rise to a potentially significant impact, and therefore the impact is considered to be not significant.

The development is considered to be air quality neutral with respect building related emissions according to the GLA's benchmarking assessment methodology.

The overall operational air quality impacts of the development are judged to be not significant.

8. Glossary of terms

AADT	Annual Average Daily Traffic
AQMA	Air Quality Management Area
CEMP	Construction Environmental Management Plan
CHP	Combined Heat and Power
Defra	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
EHO	Environmental Health Officer
EPUK	Environmental Protection UK
GIFA	Gross Internal Floor Area
HDV	Heavy Duty Vehicles (> 3.5 tonnes gross vehicle weight)
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LBC	London Borough of Camden
LLAQM	London Local Air Quality Management
LLAQM.TG	London Local Air Quality Management – Technical Guidance
LDV	Light Duty Vehicles ($\leq$3.5 tonnes gross vehicle weight)
MAQS	Mayor's Air Quality Strategy
µg/m^3	Micrograms per cubic metre
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
NRMM	Non-Road Mobile Machinery
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 micrometres
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than 2.5 micrometres
PPG	Planning Practice Guidance
SPG	Supplementary Planning Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
Trackout	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
ULEZ	Ultra Low Emission Zone

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10. Annexes

10.1 Annex 1 – Proposed Development Plans

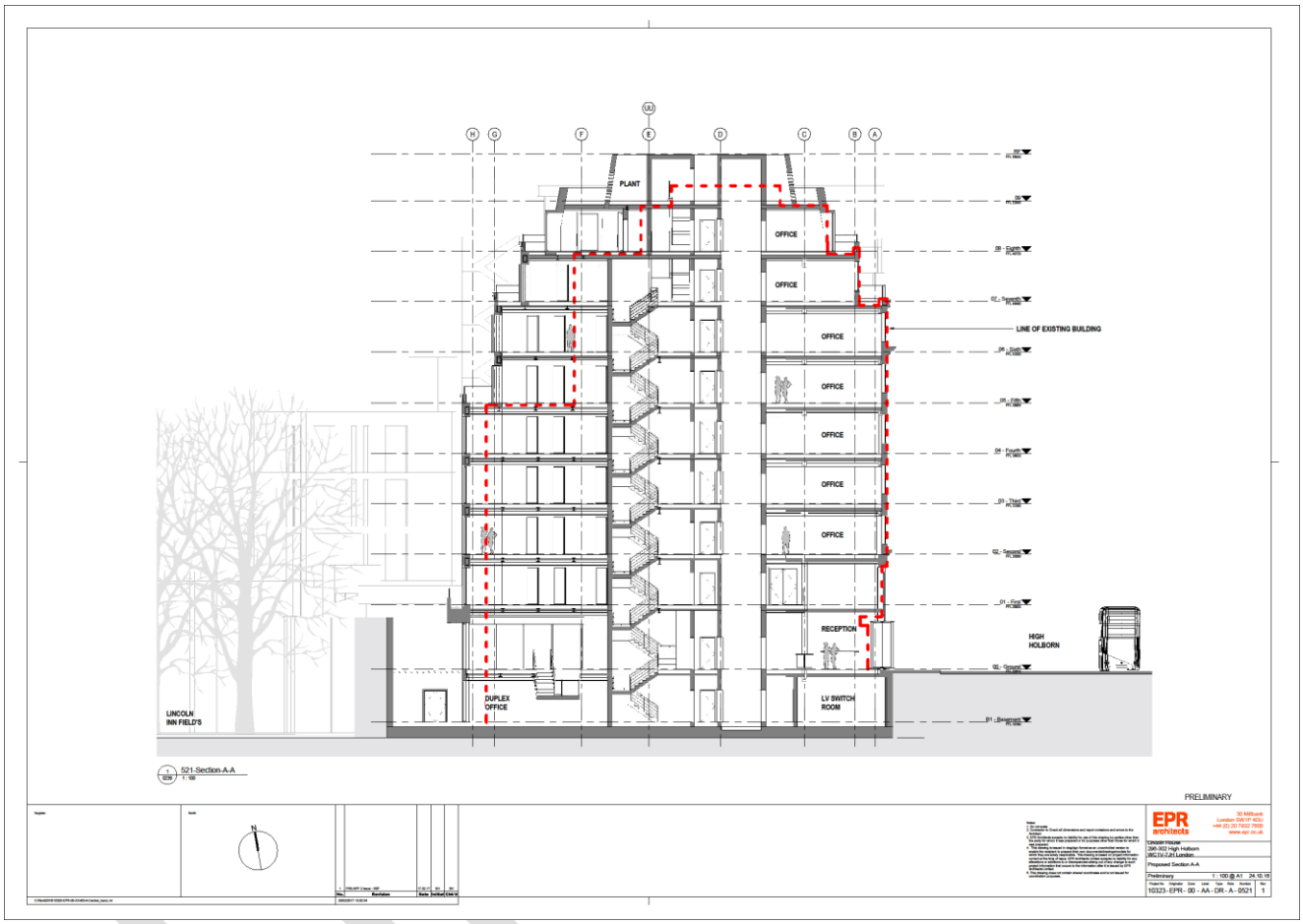

Figure 7 *Proposed side elevation (indicative only) – Source: EPR Architects 10323-EPR-00-AA-DR-A-0521*

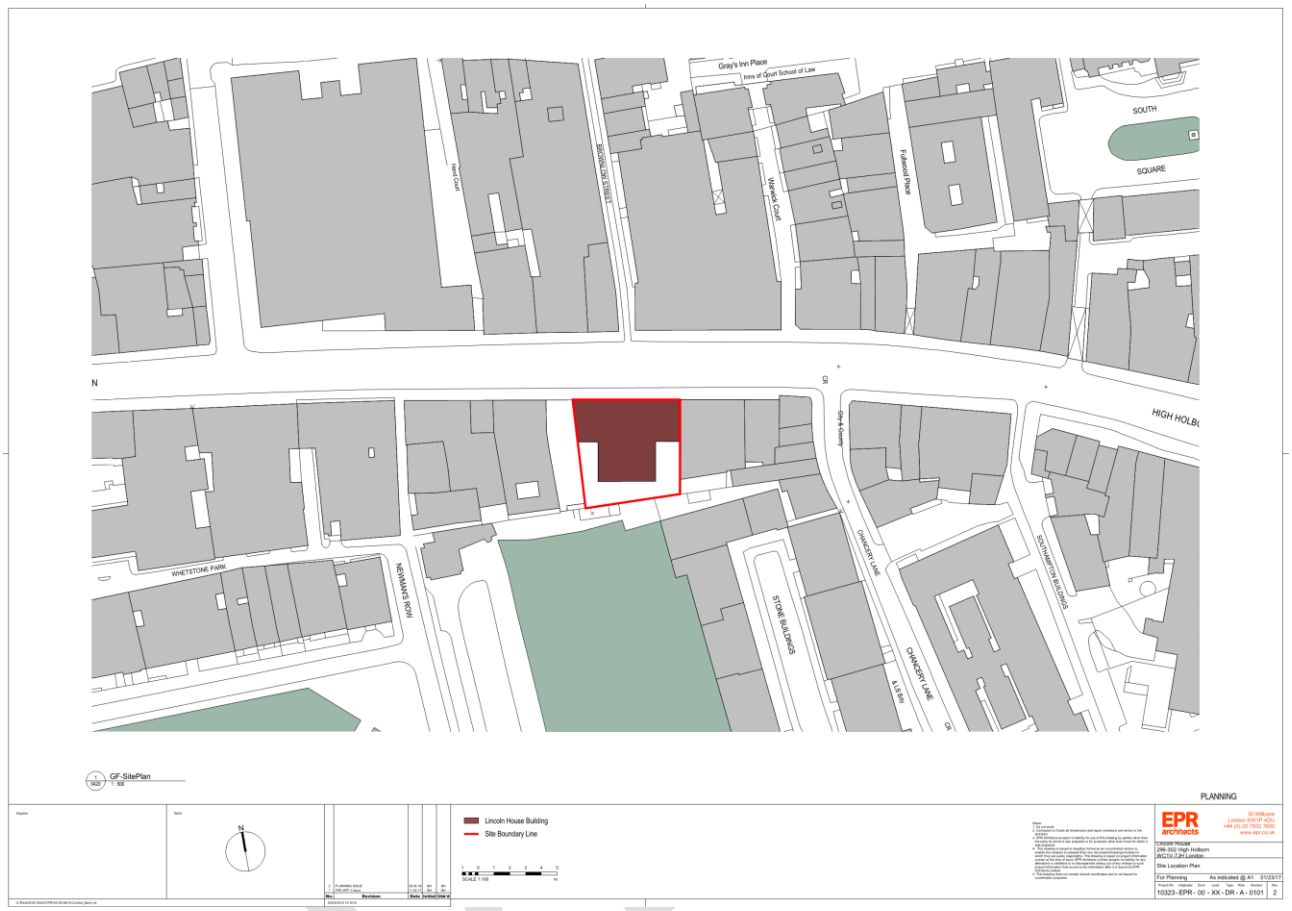

Figure 8 *Site Location Plan – Source: EPR Architects 10323-EPR-00-XX-DR-A-0101*

Figure 9 *Perspective view of Lincoln House with proposed extension – Source: EPR Architects – Lincoln House Feasibility Study, November 2015*

10.2 Annex 2 – IAQM Construction Methodology

Table 14 IAQM guidance[9] on the sensitivity of the area to dust soiling effects on people and property [ab]

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<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

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 6** and **Box 9.**

[b] Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. The sensitivity of the area in this case would be high.

[c] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 15 IAQM guidance[9] on sensitivity of the area to human health impacts [ab]

Receptor Sensitivity	Annual Mean PM_{10} concentration[c]	Number of Receptors[d]	Distance from the Source (m)[e]				
			<20	<50	<100	<200	<350
High	>32 µg/m³ (>18 µg/m³ 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/m³ (16-18 µg/m³ 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/m³ (14-16 µg/m³ in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³ (<14 µg/m³ in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³ (>18 µg/m³ in Scotland)	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³ (16-18 µg/m³ in Scotland)	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³ (14-16 µg/m³ in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³ (<14 µg/m³ in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 7** and **Box 9**.

[b] Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the **highest level** of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. If the annual mean PM_{10} concentration is 29 µg/m³, the sensitivity of the area would be high.

[c] Most straightforwardly taken from the national background maps, but should also take account of local sources. The values are based on 32 µg/m³ being the annual mean concentration at which an exceedence of the 24-hour objective is likely in England, Walesand Northern Ireland. In Scotland there is an annual mean objective of 18µg/m³.

[d] In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

[e] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

10.3 Annex 3 – Model Input Data

10.3.1 Energy Centre

The ADMS-5 model has been run to predict the contribution of energy centre plant emissions to annual mean nitrogen oxides and the 99.79th percentile of 1-hour mean nitrogen oxides concentrations. The approach recommended by Defra/Environment Agency online guidance has been used to estimate annual mean NO_2 concentrations and 99.79th percentiles of 1-hour mean NO_2 concentrations from the modelled NOx output assuming (Environment Agency and Defra, 2016):

- Annual mean NO_2 concentrations = annual mean NOx concentrations; and
- 99.79th percentiles of 1-hour mean NO_2 concentrations = 99.79th percentiles of 1-hour mean NOx x 0.5.

10.3.1.1 Model Input Parameters

The exact flue locations are currently unknown; therefore, the flues have been located in the centre of the roof top plant area as shown on the most recent plans. The energy centre plant has yet to be specified; therefore, a likely plant specification has been provided by Hoare Lea, with additional information taken from technical specifications for the likely plant (SAV (UK) Limited, 2015; Hamworthy Heating, 2017). The data input to the model are shown in Table 16. The flue locations are shown in Figure .

Entrainment of the plume into the wake of the building (the building downwash effect) has been simulated within the model. The Proposed Development building on which the plant sits has been included as the main building, with a height of 21.75 m, as shown in Figure . Other development and local buildings adjacent to the main building have also been included in the model.

It has been assumed that the two boiler plant exhausts will combine to a single flue and that the two CHP exhausts will combine to a single flue, as shown in Figure .

A factor of 0.5 has been applied to the boiler plant emissions to account for limited use during the summer months. This is a conservative assumption as the plant will operate depending on the demand for heat and power.

10.3.1.2 Meteorological Data

The meteorological data has been taken from the monitoring station located at Heathrow Airport, which is considered suitable for the area. Table 17 shows the values for surface roughness and the Monin-Obukhov length inputs used in the model.

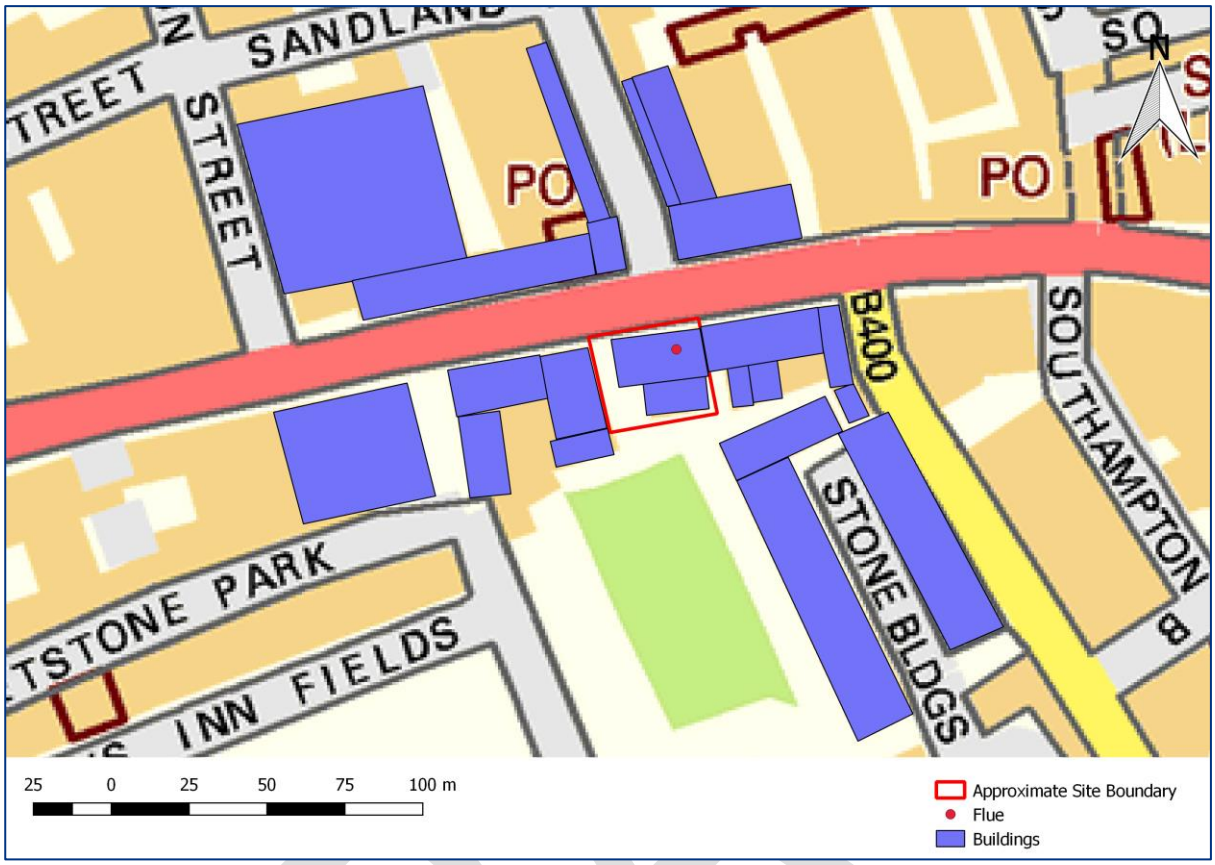

Figure 10 Flue Location and Buildings Included in the Model Contains Ordnance Survey data © Crown copyright and database right 2017

Table 16 Model Input Parameters used in ADMS 5

Parameter		Energy Centre
Make and Model		Wessex Modumax mk3 (WM 254/752)
Fuel		Natural Gas
Thermal input (kWth)		719.4
Number in operation		2 a
Exhaust gas temperature (°C)		82
Exhaust gas volume flow rate (m^3/s)		0.02325
Flue height above ground (m)		37.43
Flue height above roof (m)		4
Flue diameter (m)		0.25
NOx emission rate	mg/kWh	7.7535
	g/s	0.00775

a Not proposed to be ran simultaneously

Table 17 Grid and Meteorological Data Settings used in ADMS 5

Meteorology		Value		
Monin-Obukhov Length (m)	Dispersion Site	100		
	Meteorological Measurement Site	30		
Surface Roughness (m)	Dispersion Site	1.5		
	Meteorological Measurement Site	0.3		
Grid		**Start**	**Finish**	**Number of Points**
x		530400	531400	50
y		181000	182000	50
z		1.5	33.43	9

10.4 Annex 4 – Air Quality Neutral

The methodology report that supports the GLA's SPG on Sustainable Design and Construction provides guidance on the application of the air quality neutral policy.

The developments emissions are compared with the relevant emissions benchmarks to determine whether the development is air quality neutral.

10.4.1 Building Emissions

The building emissions benchmarks (BEB) are shown in Table 18.

Table 18: Building Emissions Benchmarks (BEB)

Land Use Class	BEB (g/m^2/annum [a])	
	NOx	PM_{10}
Class A1 (Retail)	22.6	1.29
Class A3 to Class A5 (Restaurants, drinking establishments, hot food takeaway)	75.2	4.32
Class A2 and Class B1 (Financial/professional services/business)	30.8	1.77
Class B2 to Class B7 (General industrial)	36.6	2.95
Class B8 (Storage and distribution)	23.6	1.9
Class C1 (Hotels)	70.9	4.07
Class C2 (Residential institutions)	68.5	5.97
Class C3 (Residential dwellings)	26.2	2.28
Class D1 (a) (Medical and health services)	43	2.47
Class D1 (b) (Crèche, day centres etc.)	75	4.3
Class D1 (c-h) (Schools, libraries etc.)	31	1.78
Class D2 (a-d) (Cinemas, concert halls etc.)	90.3	5.18
Class D2 (e) (Swimming pools, gymnasium etc.)	284	16.3

a The area refers to the Gross Internal Floor Area (GIFA)

The BEB for the development is calculated by multiplying the gross internal floor area of each land use class by the relevant BEB from Table 18, and summing the results.

The building related emissions (BRE) for each land use category are calculated using the:

- Gross internal floor area of the development (m^2);
- On-site emissions of NOx associated with building use (kg/annum), calculated from energy use (kWh/annum) using default (see Table 19) or site specific emission factors (kg/kWh); and

- On-site emissions of PM_{10} associated with oil or solid fuel use (kg/annum) calculated from energy use (kWh/annum) using default (see Table 19) or site specific emission factors (kg/kWh).

Table 19: Default Emission Factors for Buildings

Development	Gas (kg/kWh)	Oil (kg/kWh)	
	NOx	NOx	PM_{10}
Domestic	0.0000785	0.0003690	0.0000800
Industrial/Commercial	0.0001940	0.0003690	0.0000800

The NOx and PM_{10} emissions for each land use class are summed to give the total building emissions (TBE) for the development. If the TBE for the development are less than the BEB for the development, then the development building emissions are deemed to be air quality neutral.

10.5 Annex 5 – Professional Experience

Chris Rush (Hoare Lea), BSc (Hons), MSc, PG Dip Acoustics, CEnv, MIOA, MIEMA, MIEnvSc, AMIAQM

Chris is an Associate Air Quality Consultant with Hoare Lea. He is a Chartered Environmentalist, a Member of the Institute of Acoustics, a Full Member of the Institute of Environmental Management and Assessment, a Member of the Institution of Environmental Sciences and an Associate Member of the Institute of Air Quality Management.

He has a diverse portfolio of experience and has worked on a range of projects from initial site feasibility, through planning and development to construction and operation. Chris's expertise covers planning, noise and air quality, specifically in relation to residential developments, industrial fixed installations such as waste management centres and transportation environmental impact on developments including air traffic.

Andy Day (Hoare Lea), BSc (Hons), MSc, AMIEnvSc, AMIAQM

Andy is a Graduate Air Quality Consultant with Hoare Lea. He is an Associate Member of the Institute of Environmental Sciences and an Associate Member of the Institute of Air Quality Management. He is a chemistry graduate with a Master's specialising in the catalysed removal of harmful volatile organic compounds (VOCs) often generated from the combustion of fuel in car engines.

Andy provided input to the research for a scientific paper involving the use of catalysts prepared by a low NOx method for the complete removal of propane and naphthalene in lab based experiments. He has contributed to research as part of his degree into the causes and effects of poor outdoor air quality as well as exposure to poor indoor air quality.

Gina Gissing (Hoare Lea), BSc (Hons), StudentIEMA

Gina is a Graduate Air Quality Consultant with Hoare Lea. She has recently successfully completed a BSc (Hons) in Environmental Management and Sustainability from Manchester Metropolitan University and is a Student Member of the Institute of Environmental Management and Assessment (IEMA).

As part of her academic work, Gina has been involved in the assessment process for various factors relating to human health, which has involved developing an understanding of the legislative framework in which these sit. She has also researched the nitrogen-fixing capabilities of mosses to assist the recovery of bogs and mires damaged through atmospheric deposition within her project.

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