UNIVERSITY OF LONDON

GARDEN HALLS, UNIVERSITY OF LONDON

AIR QUALITY ASSESSMENT

March 2013

Document Control

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Job Number	J1592

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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
1592/1/F2	8 March 2013	Final Report	Prof. Duncan Laxen

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Contents

1 Introduction

1.1 This Report has been prepared to describe the air quality impacts associated with the redevelopment of the Garden Halls, Cartwright Gardens by the University of London. This report has been commissioned by the applicant's development manager, University Partnership Programme, to support the planning and conservation area consent applications.

1.2 Redevelopment of the existing student accommodation will comprise the demolition of Canterbury (including York) and Commonwealth Halls, partial-demolition and refurbishment of Hughes Parry Hall and provision of new student accommodation (Sui Generis) to provide a net increase of 187 units (from 1,013 to 1,200 student bed-spaces); associated ancillary uses (including communal areas); two external courtyards; together with public realm improvements to Cartwright Gardens and the surrounding area.

1.3 The Site lies within an Air Quality Management Area (AQMA) declared by Camden Council for exceedences of the annual mean nitrogen dioxide and PM_{10} objectives. The Site may therefore be exposed to poor air quality and the local area is sensitive to any additional emissions, which the Proposed Development may generate. The potential air quality impacts have been assessed, focussing upon nitrogen dioxide and PM_{10}, which are the pollutants of concern. The potential impacts of dust and PM_{10} from construction and demolition have also been assessed, and the assessment includes a mitigation strategy for both construction and operational air quality impacts.

1.4 The Proposed Development plans to employ gas-fired CHP units and gas boilers to satisfy the Proposed Development's heat and power demand. Emissions of oxides of nitrogen (NOx) from the CHP units and boilers may impact upon local air quality. The potential impacts of these NOx emissions have been included in this air quality assessment.

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

2 Policy Context and Assessment Criteria

Air Quality Strategy

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

Planning Policy

National Policy

2.2 The National Planning Policy Framework (NPPF) (National Planning Policy Framework, 2012) introduced in March 2012 now sets out planning policy for the UK in one place. It replaces previous Planning Policy Statements, including PPS23 on Planning and Pollution Control. The NPPF contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account, as well as the EU limit values or national objectives for pollutants, the presence of any AQMAs and the appropriateness of both the development for the site, and the site for the development.

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

2.4 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

The London Plan

2.5 The London Plan 2011 (GLA, 2011) sets out the spatial development strategy for London. It brings together all relevant strategies, including those relating to air quality.

2.6 Policy 7.14, 'Improving Air Quality', addresses the spatial implications of the Mayor's Air Quality Strategy and how development and land use can help achieve its objectives. It recognises that Boroughs should have policies in place to reduce pollutant concentrations, having regard to the Mayor's Air Quality Strategy. Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

The Mayor's Air Quality Strategy

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

Local Policies

2.8 The Local Development Framework (LDF), which replaced the Unitary Development Plan (UDP) in November 2010, is a collection of planning documents that (in conjunction with national planning policy and the Mayor's London Plan) sets out the strategy for managing growth and development in the borough, including where new homes, jobs and infrastructure will be located. Policy DP32 Air quality and Camden's Clear Zone, in the Camden Development Policies Local Development Framework document sets out how Camden will expect developments to reduce their impact on air quality. It states:

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

2.9 It also states:

> *'Our growth areas of Euston, Kings Cross, Holborn, Tottenham Court Road and West Hampstead are located along busy roads and currently experience poor levels of air quality and disturbance from noise. Developments in these areas will need to be well protected against air and noise pollution to ensure they are suitable for occupation.'*

2.10 Camden Council has also prepared a supplementary planning document - Camden Planning Guidance 6 Amenity, which provides further guidance on air quality. It includes information on

when an air quality assessment will be required, what an air quality assessment should cover and what measures can reduce air quality emissions and protect public exposure.

Air Quality Action Plan

2.11 Camden Council has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough. The Council has since developed an Air Quality Action Plan 2009 - 2012 (Camden Council, 2011). This identifies actions and mitigating measures necessary to improve air quality in the Borough.

Assessment Criteria

Health Criteria

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

2.13 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2009). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.

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

2.15 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. Achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). The limit values for nitrogen dioxide are the same levels as the UK objectives, but applied from 2010 (The Air Quality Standards Regulations 2010 (No. 1001), 2010). The limit values for PM_{10} and $PM_{2.5}$ are also the same level as the UK statutory objectives, but applied from 2005 for PM_{10} and will apply from 2015 for $PM_{2.5}$. As the latter is more stringent than the UK objective (as it applies from 2015 rather than 2020) it is used as the relevant assessment criterion in this assessment.

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

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

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

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it. The EU limit value is the same, but is to be met by 2015.

Construction Dust Criteria

2.17 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management[1] (Institute of Air Quality Management, 2009) has therefore been used. Full details of this approach are provided in Appendix A2.

Environment Agency Assessment Criteria

2.18 The Environment Agency has considered potential impacts from industrial and boiler emission in its H1 guidance (Environment Agency, 2010). This explains that regardless of what the baseline environmental conditions are, a process can be considered as insignificant if:

- The long-term (annual mean) process contribution is <1% of the long-environmental standard; and;
- The short-term (24-hour mean or shorter) process contribution is <10% of the short-term environmental standard.

[1] The Institute of Air Quality Management (IAQM) is the professional body for air quality practitioners in the UK.

2.19 It should be recognised that these criteria determine when an impact can be screened out as insignificant. They do not imply that impacts will necessarily be significant above these levels merely that above these levels there is a potential for significant impacts that should be assessed using a detailed assessment methodology such as detailed dispersion modelling (as has been carried out for this project in any event).

2.20 In addition, Environment Agency H1 guidance explains that *"As a guide, detailed dispersion modelling of long term emissions maybe useful where:*

- *local receptors maybe sensitive to long term emissions;*
- *released substances fall under an Air Quality Management Plan;*
- *the sum of the background concentration and process contribution exceed 70% of the appropriate long term standard";*

and that: "*As a guide, detailed dispersion modelling of short-term emissions maybe useful where:*

- *local receptors maybe sensitive to short emissions;*
- *the short-term process contribution is more than 20% of the relevant short-term environmental standard minus twice the long term background concentration."*

2.21 The approach taken in this assessment is to use detailed dispersion modelling in the first instance, and to apply the Environment Agency screening criteria to the model outputs. Where impacts are shown to be below these screening criteria, they are judged to be insignificant. Where this initial screening shows the potential for significant impacts, then an assessment of the predicted total concentrations needs to be carried out following the IAQM guidance described below.

Descriptors for Air Quality Impacts and Assessment of Significance

2.22 There is no official guidance in the UK on how to describe air quality impacts nor to assess their significance. The approach developed by the IAQM (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's (EPUK) guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. This approach includes elements of professional judgement. Full details of this approach are provided in Appendix A3, with the professional experience of the consultants preparing the report set out in Appendix A4.

3 Assessment Approach

Consultation

3.1 The assessment follows a methodology agreed with LB Camden via an email discussion between Poppy Lyle (Air Quality officer at LB Camden) and Laurence Caird (Air Quality Consultants) held in October 2012.

Existing Conditions

3.2 Existing air quality conditions at The Site have been identified using a number of approaches. A site visit has been carried out to identify existing emissions sources from a visual inspection of the area. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2012c).

3.3 Information on background air quality has been obtained by collating the results of monitoring carried out by LB Camden and using the national pollution maps published by Defra (2012a). These cover the whole country on a 1x1 km grid.

CHP and Boiler Plant Impacts

Modelling Methodology

3.4 The impacts of emissions from the proposed CHP units and gas boilers have been modelled using the ADMS-4 dispersion model. ADMS-4 is a new generation model that incorporates a state-of-the art understanding of the dispersion processes within the atmospheric boundary layer. Entrainment of the plume into the wake of the Proposed Development has been simulated within the model. The emission rate, exhaust temperature, and exhaust flow rate have been provided by Cundall Johnston and Partners LLP. The model input parameters are set out in Appendix A5.

3.5 ADMS-4 was run to predict the contribution of the proposed gas boiler and CHP emissions to annual mean concentrations of nitrogen oxides, as well as to the 99.8th percentile of 1-hour mean nitrogen oxides concentrations.

3.6 The model was run using five consecutive years (2007 - 2011) of hourly sequential meteorological data obtained from the monitoring station located at Heathrow Airport, which is considered suitable for this site. The assessment is based on the modelling results using the worst-case meteorological year, as a precaution.

Sensitive Locations

3.7 Process concentrations of NOx from the CHP and boiler plant have been modelled at a number of receptor locations representing both existing residential properties in the vicinity of The Site, as

well as the Proposed Development itself. Concentrations at each receptor location have been modelled at various heights between ground level and the top floor of each building, to account for the fact that the worst-case impacts may not occur at ground-floor level. The receptor locations included in the assessment are described in Table 2 and shown in Figure 1.

Table 2: Description of Receptor Locations

Receptor	Description
Existing properties [a]	
Receptor 1	Property at Hastings Street/Mabledon Place
Receptor 2	Property at Hastings Street
Receptor 3	Property at Hastings Street/Sandwich Street
Receptor 4	Property at Sandwich Street
Receptor 5	Property at Sandwich Street
Receptor 6	Property at Sandwich Street
Receptor 7	Property at Sandwich Street
Receptor 8	Property at Sandwich Street/Leigh Street
Receptor 9	Property at Cartwright Gardens/Marchmont Street
Receptor 10	Property at Cartwright Gardens/Burton Place
Receptor 11	Property at Cartwright Gardens
Receptor 12	Property at Cartwright Gardens/Mabledon Place
New properties [b]	
Receptor A	Hughes Parry Tower
Receptor B	Hughes Parry Tower
Receptor C	Hughes Parry Tower
Receptor D	Hughes Parry Tower
Receptor E	Hughes Parry Tower
Receptor F	Hughes Parry Hall
Receptor G	Hughes Parry Hall/Canterbury (including York)
Receptor H	Hughes Parry Hall/Canterbury (including York)
Receptor I	Canterbury (including York)/Commonwealth Halls
Receptor J	Canterbury (including York)/Commonwealth Halls
Receptor K	Commonwealth Halls
Receptor L	Commonwealth Halls

[a] Receptors modelled at a height of 1.5 m and 12 m to represent ground-floor and top-floor levels.

[b] Receptors modelled at varying heights from 1.5 m (ground-floor level) to 50 m (Hughes Parry Tower), depending on scheme height of each block.

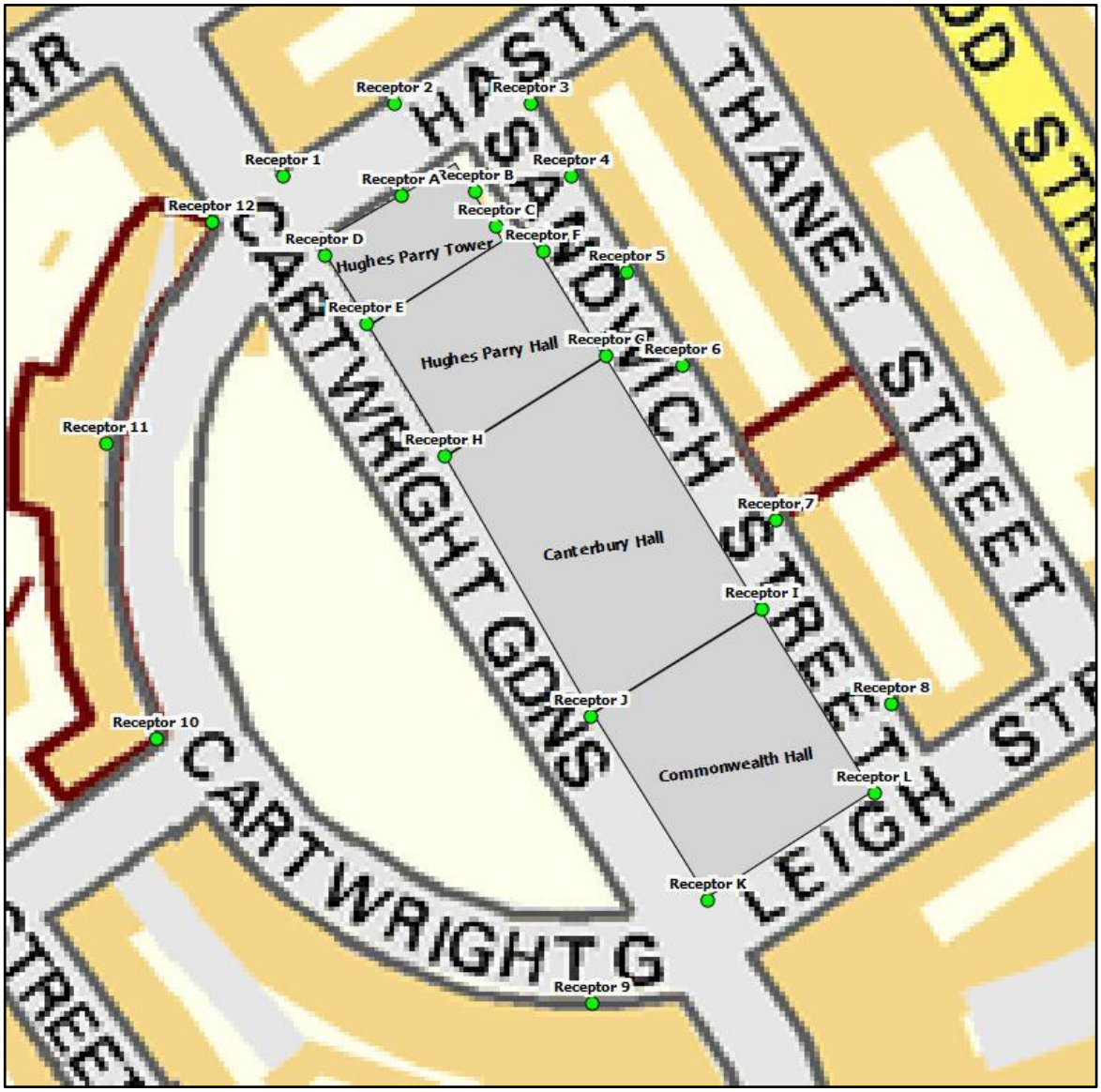

Figure 1: Receptor Locations

Construction Impacts

3.8 Locations sensitive to dust emitted during construction will be places where members of the public are regularly present. Residential properties and commercial operations close to the site will be most sensitive to construction dust. Any areas of sensitive vegetation or ecology that are very close to dust sources may also be susceptible to some negative effects.

3.9 It is very difficult to quantify emissions of dust from construction activities. It is thus common practice to provide a qualitative assessment of potential impacts, making reference to the assessment criteria set out Appendix A2.

Mitigation Strategy

3.10 Mitigation measures to minimise the impact of air quality on future residents of the Proposed Development have been proposed and appraised.

4 Existing Conditions

4.1 The Site is located adjacent to Cartwright Gardens, 100 m south east of Euston Road in the London Borough of Camden. It currently consists of 1,013-bed student accommodation halls for students at the University of London. The Proposed Development comprises partial demolition of the existing halls, and partial reconstruction and partial renovation to create new student accommodation halls with 1,200 rooms.

4.2 A search of the UK Pollutant Release and Transfer Register website (Defra, 2012c) did not identify any industrial or waste management sources within 1 km of the Proposed Development. Other than road traffic, no other sources were identified during the site visit.

4.3 LB Camden has investigated air quality within its area as part of its responsibilities under the LAQM regime. LB Camden has declared a borough wide AQMA for exceedences of the nitrogen dioxide objective (Camden Council, 2011a).

4.4 In terms of PM_{10}, LB Camden concluded that there have been no exceedences of the objectives recently. It is therefore unlikely that existing PM_{10} levels will exceed the objectives within the study area.

Local Air Quality Monitoring

4.5 LB Camden operates three long-term automatic monitoring stations within its area. None of these are in close proximity to The Site. The Council also operates a number of nitrogen dioxide diffusion tubes, prepared and analysed by Gradko Environmental (using the 50% TEA in acetone method), which include tubes installed at Argyle School, Euston Road, Wakefield Gardens, Tavistock Gardens, and the British Library, all of which are within 300 m of the Site. To provide context for this assessment, results for the three automatic monitoring sites, and five diffusion tube sites mentioned above, are presented in Table 3.

Table 3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2006-2011) [a]

Site No.	Site Type	2006	2007	2008	2009	2010	2011
Automatic Monitors - Annual Mean (µg/m^3) [b]							
Camden – Bloomsbury	Background	**56.6**	**61.0**	**55.2**	**54.2**	**55.2**	**49.9**
Camden Shaftesbury Avenue	Roadside	**72.0**	**76.8**	**79.8**	**87.8**	**88.7**	**75.6**
Camden – Swiss Cottage	Roadside	**71.4**	**77.2**	**75.5**	**84.5**	**81.8**	**71.6**
Objective		**40**					
Automatic Monitors - No. of Hours > 200 µg/m^3							
Camden – Bloomsbury	Background	0	6	0	2	1	0
Camden Shaftesbury Avenue	Roadside	4	**22**	9	13	**21**	15
Camden – Swiss Cottage	Roadside	**39**	**113**	**70**	**217**	**128**	**77**
Objective		**18**					
Diffusion Tubes - Annual Mean (µg/m^3) [c]							
CA1 – Argyle School	Roadside	**-**	**50.2**	**51.9**	**49.9**	**50.0**	-
CA4 – Euston Road	Roadside	**90.6**	**91.2**	**93.3**	**87.1**	**82.0**	**87.6**
CA6 – Wakefield Gardens	Background	**48.5**	**49.6**	37.8	39.4	34.0	**42.9**
CA10 – Tavistock Gardens	Background	**-**	**46.3**	**46.8**	**50.1**	**52.0**	**44.7**
CA13 – British Library	Background	**-**	**54.5**	**48.7**	**54.1**	**47.0**	-
Objective		**40**					

[a] Exceedences of the objectives are shown in bold

[b] Data downloaded from the London Air Quality Data Archive (LAQN, 2012).

[c] 2011 data provided by Camden Council, 2007-2010 data have been taken from the 2010 Annual Progress Report (Camden Council, 2011a), and 2006 data have been obtained from the 2009 Updating and Screening Assessment (Camden Council, 2009). All data have been bias adjusted by the Council.

4.6 The annual mean objective is exceeded at all the monitoring sites between 2006 and 2011, except for the years 2007-2010 at the Wakefield Gardens background site (CA6), located 300 m southeast of The Site. The short-term objective is also exceeded at the Shaftesbury Avenue and Swiss Cottage monitoring sites.

4.7 There are no clear trends in monitoring results for the past six years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards. The implications of this are discussed later in Section 5 of this report.

4.8 The automatic monitoring stations also measure PM_{10} concentrations and two of the automatic monitors measure $PM_{2.5}$ concentrations. Data are presented in Table 4. There are no exceedences of the annual mean PM_{10} or $PM_{2.5}$ objectives at any these sites. The 24-hour mean PM_{10} objective was exceeded at the Swiss Cottage monitoring site in 2006 and 2007, but this objective has been met at all three sites since 2007.

Table 4: Summary of PM_{10} and $PM_{2.5}$ Automatic Monitoring (2006-2011) [a] [b]

Site No.	Site Type	2006	2007	2008	2009	2010	2011
PM_{10} Annual Mean (µg/m^3)							
Camden – Bloomsbury	Background	26.0	25.9	23.1	22.8	17.8	22.6
Camden Shaftesbury Avenue	Roadside	31.4	33.2	29.9	30.4	29.5	31.6
Camden – Swiss Cottage	Roadside	31.9	30.2	27.5	25.4	26.1	26.8
Objective		**40**					
PM_{10} No. Days >50 µg/m^3							
Camden – Bloomsbury	Background	18	22	13	15	2	18
Camden Shaftesbury Avenue	Roadside	29	33	20	16	5	31
Camden – Swiss Cottage	Roadside	**37**	**37**	19	11	11	27
Objective		**35**					
$PM_{2.5}$ Annual Mean (µg/m^3)							
Camden – Bloomsbury	Background	13.8	14.0	13.3	16.3	16.1	17.5
Camden – Swiss Cottage	Roadside	-	-	-	17.4	16.5	16.1
Objective		**25** [c]					

[a] Exceedences of the objectives are shown in bold

[b] Reference equivalent. Data downloaded from the London Air Quality Data Archive (LAQN, 2012).

[c] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 µg/m^3 is to be met by 2015.

Background Pollutant Concentrations

4.9 In addition to these locally measured concentrations, estimated background concentrations in the study area have been obtained from the national maps for 2012 (Table 5). The background concentration of nitrogen dioxide is above the annual mean objective. Background concentrations of PM_{10} and $PM_{2.5}$ are all below the objectives.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2012 (µg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2012	94.7	**48.6**	23.3	16.5
Objectives	-	**40**	**40**	**25** [a]

[a] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 µg/m^3 is to be met by 2015.

Road Traffic Emissions

4.10 The Site has the potential to be affected by road traffic emissions from Cartwright Gardens and Euston Road. Although Euston Road is a busily trafficked route through central London, it is over 100 m from the Proposed Development site and is unlikely to contribute a significant portion of pollutant concentrations at the Proposed Development at such a distance.

4.11 The London Atmospheric Emissions Inventory (LAEI) holds Annual Average Daily Traffic (AADT) flows for the vast majority of roads in central London, excluding very minor roads. The LAEI does not contain traffic information for Cartwright Gardens which demonstrates that the road does not carry a large volume of traffic. This is supported by observations made during a site visit where no vehicles were seen to use Cartwright Gardens either for access, or as a through road.

4.12 The LAEI does, however, hold data for Marbledon Place which links Cartwright Gardens to Euston Road, north of the development site. The total AADT flow for Marbledon Place in 2011 was 2,110 vehicles according to the LAEI. It is unlikely that this volume of traffic would be using Cartwright Gardens, but even if it were, this volume of vehicles is unlikely to contribute a significant portion of pollutant concentrations at the façades of the Proposed Development.

Summary of Existing Conditions

4.13 The existing air quality conditions in the study area are generally poor. The annual mean background nitrogen dioxide concentrations, as displayed in Table 3 and Table 5, exceed the objective in the area around The Site.

4.14 Roadside and background PM_{10} and $PM_{2.5}$ concentrations are below the objectives in Camden.

5 Impact Assessment

CHP and Boiler Plant Impacts

5.1 The contributions of nitrogen dioxide at receptor locations due to the operation of the gas-fired CHP and boiler plant at the Proposed Development are shown in Table 6. Maximum process contributions at each receptor location (as listed in Table 2) are set out. A full table of model results is presented in Appendix A6.

5.2 The proposed CHP and boiler plant are predicted to add a maximum of 0.32 $\mu g/m^3$ to annual mean nitrogen dioxide concentrations. This is less than 1% of the 40 $\mu g/m^3$ standard and therefore, in accordance with the Environment Agency screening criteria, these impacts can be discounted as insignificant.

5.3 In terms of the 99.8th percentile of 1-hour mean nitrogen dioxide concentrations, the proposed CHP and boiler plant is predicted to add a maximum of 1.49 $\mu g/m^3$ to existing concentrations. This is less than 10% of the 200 $\mu g/m^3$ standard. According to the Environment Agency screening criteria, these impacts can therefore also be discounted as insignificant.

5.4 In terms of the impact magnitude and impact descriptors for annual mean nitrogen dioxide presented in Table A3.1 and Table A3.2 respectively (see Appendix A3), the maximum process contributions presented in Table 6 are all imperceptible in magnitude and would lead to negligible air quality impacts. These criteria are not applicable to the short-term nitrogen dioxide concentrations, but it is judged that they would also represent negligible air quality impacts.

Table 6: Maximum Predicted Process Contributions of Nitrogen Dioxide from CHP and Boiler Plant

Receptor Number	Height (m)	Nitrogen Dioxide Concentrations (μg/m^3)			
		Annual Mean	Above 1% Screening Criteria? [a]	99.8th Percentile of 1-Hour Mean Concentrations	Above 10% Screening Criteria? [a]
Receptor 1	12	0.03	No	0.88	No
Receptor 2	12	0.09	No	1.15	No
Receptor 3	12	0.11	No	0.88	No
Receptor 4	12	0.10	No	0.95	No
Receptor 5	12	0.07	No	0.88	No
Receptor 6	12	0.05	No	0.75	No
Receptor 7	12	0.02	No	0.59	No
Receptor 8	12	0.02	No	0.43	No
Receptor 9	12	0.02	No	0.35	No
Receptor 10	12	0.03	No	0.45	No
Receptor 11	12	0.01	No	0.57	No
Receptor 12	12	0.03	No	0.86	No
Receptor A	50	0.32	No	1.18	No
Receptor B	50	0.28	No	1.16	No
Receptor C	50	0.29	No	1.49	No
Receptor D	50	0.23	No	1.49	No
Receptor E	50	0.17	No	1.49	No
Receptor F	26	0.10	No	0.95	No
Receptor G	26	0.06	No	0.77	No
Receptor H	26	0.07	No	1.49	No
Receptor I	36	0.05	No	0.74	No
Receptor J	36	0.05	No	0.70	No
Receptor K	36	0.05	No	0.72	No
Receptor L	36	0.05	No	0.73	No

[a] Comparison against Environment Agency screening criteria described in paragraph 2.18.

Impacts of Other Local Emission Sources

5.5 It has already been identified in this report that air quality at the development site is poor, and that road traffic and on-site CHP and boiler emissions are unlikely to constitute a major source of pollutant concentrations at the Proposed Development. It is, however, also important to assess other potential pollutant sources in the area (particularly any proposed sources), and the impacts these may have on air quality at The Site.

5.6 The following two sources have been identified during discussions with Camden Council[2]:

- Proposed CHP boiler at Phoenix Court, NW1 1EL; and
- Proposed CHP boiler at the Francis Crick Institute, Euston.

5.7 There is no detailed data of the specifications of these boilers against which to conduct a detailed assessment, and therefore the potential impacts have been discussed qualitatively.

5.8 The Phoenix Court site lies 525 m from The Site, and the Francis Crick Institute site is slightly closer, at around 440 m from The Site. Both sites are located to the north of The Site, beyond Euston Road and the British Library.

5.9 It is very unlikely that there would be any significant air quality impacts at The Site from either of these proposed installations, given the distances involved. It should also be noted that prevailing winds in central London are from the south west, and therefore both sites are downwind of The Site in relation to the prevailing winds, which will limit the passage of emissions from the CHP boilers towards The Site.

5.10 The Site is currently used as residential student accommodation. Boiler emissions should therefore be considered in any detailed air dispersion modelling undertaken by the applicants at Phoenix Court and the Francis Crick Institute. These assessments would identify any impacts at the Proposed Development. If impacts are identified, then it should be the responsibility of the applicants at Phoenix Court and Francis Crick Institute respectively to mitigate this, as residential exposure exists at The Site regardless of whether or not this application for the Proposed Development is approved.

5.11 It is therefore concluded that the proposed CHP boilers at Phoenix Court and Francis Crick Institute do not provide a constraint to the Proposed Development.

Construction Impacts

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

[2] Discussions held between Laurence Caird (AQC) and Katie Watson (Camden Council) in November 2011.

are various sensitive receptors that may be affected by dust, including residential properties, and less sensitive commercial premises. There are no sensitive ecological receptors that might be affected. There will be receptors within 20 m of the site boundary, in the form of offices on Hastings Street to the north, commercial and residential properties on Sandwich Street to the east and Leigh Street to the south, and further dwellings between 20 and 100 m from the Proposed Development to the west. Cartwright Gardens, which is included within The Site, but which will not be use for any construction, is vegetated with trees and bushes which will act as a dust buffer between the site and the residential properties to the west, which will reduce the risk of dust at these properties. The background PM_{10} concentration at the site is 22.3 µg/m^3.

Demolition

5.13 There will be a requirement to demolish the 5 story section of Hughes Parry Hall as well as the entire Commonwealth Halls, and Canterbury (including York). The method of demolition has not yet been decided. A mobile crusher may be used on site before removal of the material, but this has not yet been decided.

Earthworks

5.14 The Site covers some 6,064 m^2, approximately 2,200 m^2 of which will be subject to earthworks, involving removal of the foundations of the demolished buildings and breaking up of a paved area. This activity will be centred on the areas currently occupied by Commonwealth Halls and Canterbury (including York), and the lower section of Hughes Parry Hall. Dust during earthworks will arise mainly from the handling of dusty materials. Most of the earthworks will involve the removal of subsoil, which will largely be damp and not prone to creating dust.

Construction

5.15 The construction will involve rebuilding of Commonwealth Halls, Canterbury (including York) and the lower section of Hughes Parry Hall. The project will also involve renovation of the existing Hughes Parry Tower. Dust will arise from the handling and storage of dusty materials, and from the cutting of concrete.

Trackout

5.16 The number of vehicles accessing The Site, which may track out dust and dirt is currently unknown, but given the small size of The Site it is likely that there will only be a small number of vehicle movements per day (<10). There are a number of properties lying within 20 m of the public highway within 50 m of the site entrance/exit, which may be affected by dust.

5.17 Using the criteria in Appendix 1 the risk categories for the four construction activities are judged to be as set out in Table 7.

Table 7: Summary of Risk of Effects Without Mitigation

Source	Dust Soiling and PM_{10} effects	Ecological effects
Demolition	High Risk Site	None
Earthworks	Medium Risk Site	None
Construction	High Risk Site	None
Trackout	Medium Risk Site	None

5.18 The sensitivity of the areas around the site to dust soiling from the four sources is judged to be high, using the criteria set out in Table A2.4. The sensitivity to PM_{10} impacts are judged to be low as background annual mean PM_{10} concentrations are less than 30 µg/m^3.

5.19 On this basis the significance of dust effects without mitigation would be as set out in Table 8, using the criteria in Table A2.5.

Table 8: Summary Significance Table Without Mitigation

Source	Dust soiling effects	Ecological effects	PM_{10} effects
Demolition	Moderate adverse	None	Negligible
Earthworks	Moderate adverse	None	Negligible
Construction	Moderate adverse	None	Negligible
Trackout	Moderate adverse	None	Negligible
Overall significance	**Moderate adverse**		

6 Mitigation Strategy

Operational Impacts

6.1 The assessment of baseline air quality conditions has identified that the annual mean nitrogen dioxide objective is likely to be exceeded at The Site. In order to help minimise exposure of future residents of the Proposed Development to poor air quality, a number of mitigation measures have been proposed:

- The Proposed Development will not generate any additional road traffic during operation than the existing use at the site;
- Common areas of the Proposed Development (kitchens and lounge rooms) will be supplied with filtered air via a ventilation system; and
- Emissions from the proposed boiler and CHP plant at the development will be extracted through a flue that terminates 3 m above the highest point on the development roof. This has been shown to guarantee negligible impacts on air quality.

6.2 Although the Proposed Development may generate a large number of vehicle movements during the days at the beginning and end of each university term, with students moving in and out of the accommodation, the Proposed Development will not generate any day-to-day traffic movements, other than a small number of service vehicles, most of which are already routine at the site, such as bin collections and maintenance visits. The impact of term start/end traffic of the additional rooms at the Proposed Development will be negligible as an annual average. The Proposed Development will therefore not cause any air quality impacts due to local road traffic emissions.

6.3 In order to mitigate the impact of exceedences of the annual mean nitrogen dioxide objective at the Proposed Development, the common areas (e.g. kitchens and lounge rooms) will be supplied with clean air via a filtered ventilation system. Filters will comply with EN779 standards and routine maintenance will ensure good working of the system. Due to ceiling height constraints, the bedrooms must remain naturally ventilated.

6.4 Existing boilers at The Site are old and inefficient. These will be replaced with new, low-emission boilers and CHP plant. As the demand of the Proposed Development for heat and hot water will not increase substantially from the current development, the low-emission boilers will ensure that NOx emissions from the Proposed Development are considerably reduced relative to the current plant, and therefore air quality impacts in the local area will also be reduced. The proposed boiler and CHP plant have been shown to have negligible impacts on local air quality.

Construction Impacts

6.5 Measures to mitigate dust emissions would be required during the construction phase of the Proposed Development in order to reduce impacts upon nearby residential properties.

6.6 The Site has been identified as a 'Medium' site based on the criteria set out in the GLA Best Practice Guidance (GLA, 2006). The guidance describes the following best practice measures that should be employed, as appropriate, to reduce the impacts of the site to those of a low risk site:

Site Planning

- Erect solid barriers to site boundary;
- No bonfires;
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors;
- Identify responsible person in charge;

Construction Traffic

- All vehicles to switch off engines – no idling vehicles;
- All loads entering and leaving the site to be covered;
- No site runoff of water or mud;
- All non road mobile machinery (NRMM) to use ultra low sulphur tax-exempt diesel (ULSD) where available;
- On-road vehicles to comply with the requirements the Low Emission Zone (LEZ) as a minimum;

Demolition Works

- Use water as dust suppressant;
- Cutting equipment to use water as suppressant or suitable local exhaust ventilation system;
- Securely cover skips and minimise drop heights;
- Wrap buildings to be demolished.

Site Activities

- Minimise dust generating activities;
- Use water as dust suppressant where applicable;
- Enclose stockpiles or keep them securely sheeted;

- If applicable, ensure concrete crusher or concrete batcher has a permit to operate.

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

7 Residual Impacts

Operational Impacts

7.1 The mitigation measures outlined in Section 6 of this report will ensure that the impacts of poor local air quality on the Proposed Development will be minimised. It is judged that the filtered ventilation system and low-NOx boiler and CHP plant will ensure that the Proposed Development will lead to improved air quality for occupiers of the site compared to the current levels.

7.2 The impacts of emissions from the Proposed Development on the local area will be negligible.

Construction Impacts

7.3 Table 9 provides an overall summary table of the residual effects of dust and PM_{10} during construction with mitigation in place.

Table 9: Summary Significance Table With Mitigation

Source	Dust soiling effects	Ecological effects	PM_{10} effects
Demolition	Slight adverse	None	Negligible
Earthworks	Negligible	None	Negligible
Construction	Slight adverse	None	Negligible
Trackout	Negligible	None	Negligible
Overall significance	**Minor adverse**		

Significance of Air Quality Impacts

7.4 There is still a risk of slight adverse dust effects during demolition and construction, even with mitigation in place but any effects will be temporary and relatively short lived, and will only arise during dry weather with the wind blowing towards a receptor, at a time when dust is being generated and mitigation measures are not being fully effective.

7.5 Overall there is judged to be a minor adverse risk of dust effects during the construction period.

7.6 The operational air quality impacts are judged to be *insignificant.* This professional judgement is made in accordance with the methodology set out in Appendix A3 and taking account of the factors set out in Table 10. In particular this judgement takes account of the assessment that the operation of the boiler and CHP plant will lead to negligible impacts at all receptor locations, both at existing nearby residential properties, and at the Proposed Development itself.

Table 10: Factors Taken Into Account in Determining the Overall Significance of the Scheme on Local Air Quality With Mitigation

Factors	Outcome of Assessment
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.	Future residents of the Proposed Development will not be exposed to worsened air quality when compared to existing residents of the site. The use of a filtered ventilation system will result in an improvement in air quality at The Site. No other existing properties will suffer worsened air quality as a result of the Proposed Development.
The magnitude of the changes and the descriptions of the impacts at the receptors.	The impacts will be negligible at all existing properties. There may be slight beneficial impacts at the Proposed Development, due to installation of filtered ventilation; however, this has not been quantified.
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.	The Proposed Development will increase the residential capacity of The Site, and therefore will introduce new exposure in a location where annual mean nitrogen dioxide concentrations will be above the objective.
Uncertainty, including the extent to which worst-case assumptions have been made	The assessment includes some uncertainty. No nitrogen dioxide measurements have been made at The Site, so the assumption that background nitrogen dioxide concentrations will exceed the annual mean objective at The Site is a conservative one. In addition, it has not been possible to quantitatively assess the impacts of emissions from existing boiler plant at The Site, to demonstrate the relative level of improvement to local air quality that would be brought by the new low-NOx boiler and CHP plant.
The extent to which an objective or limit value is exceeded	The annual mean nitrogen dioxide objective is exceeded at present. The filtered ventilation system will reduce these levels at The Site. Residents may, however, be exposed to annual mean nitrogen dioxide concentrations which exceed the objective.

8 Summary and Conclusions

8.1 The air quality impacts associated with the construction and operation of the Proposed Development have been assessed. Existing conditions within the study area show poor air quality, with exceedences of the annual mean nitrogen dioxide objective at The Site. Concentrations of PM_{10} and $PM_{2.5}$ are currently expected to meet the objectives at The Site.

8.2 The Proposed Development will not generate additional traffic flows on local roads and therefore the impact of road traffic emissions from the Proposed Development is negligible.

8.3 The Proposed Development will incorporate gas-fired CHP and centralised boiler plant. The air quality impacts of NOx emissions from the proposed plant have been assessed, using the ADMS-4 dispersion model. Modelling demonstrates that the process contributions of emissions from the CHP and boiler plant on annual mean and 99.8th percentile of hourly mean concentrations of nitrogen dioxide would be negligible at all receptor locations assessed. This includes existing residential properties, and a number of locations at the Proposed Development itself.

8.4 LB Camden has identified two proposed CHP boilers to consider in the assessment, for their potential impact on the Proposed Development. These are at Phoenix Court and the Francis Crick Institute north of the British Library. Both boilers are a substantial distance from The Site and impacts are anticipated to be negligible.

8.5 A number of mitigation measures to reduce the impact of poor air quality at the Proposed Development have been proposed. These include filtered ventilation to common areas, and installation of low-NOx boilers and CHP plant to replace the existing boiler system at The Site. These measures should yield a slight beneficial impact to air quality for future residents of the Proposed Development, although this impact has not been quantified.

8.6 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. Even with these measures in place, there remains a risk that a number of existing off-site properties might be affected by occasional dust-soiling impacts. Any effects will be temporary and relatively short lived, and will only arise during dry weather with the wind blowing towards a receptor, at a time when dust is being generated and mitigation measures are not being fully effective. The overall impacts during construction are judged to be minor adverse with mitigation.

8.7 Overall, the Proposed Development is judged to have an *insignificant* impact on local air quality. Redevelopment of The Site should lead to slight beneficial impacts to the air quality at the site itself. Air quality does not provide a constraint to the scheme, provided the mitigation measures outlined in Section 6 of this report are incorporated into the development.

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10 Glossary

AADT Annual Average Daily Traffic

ADMS-Roads Atmospheric Dispersion Modelling System

AQMA Air Quality Management Area

AURN Automatic Urban and Rural Network

Defra Department for Environment, Food and Rural Affairs

DfT Department for Transport

EFT Emissions Factor Toolkit

Exceedence A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure

HDV Heavy Duty Vehicles (> 3.5 tonnes)

LDV Light Duty Vehicles (<3.5 tonnes)

LEZ Low Emission Zone

µg/m^3 Microgrammes per cubic metre

NO Nitric oxide

NO_2 Nitrogen dioxide

NOx Nitrogen oxides (taken to be NO_2 + NO)

Objectives A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides

PM_{10} Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter

$PM_{2.5}$ Small airborne particles less than 2.5 micrometres in aerodynamic diameter

Standards A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

TEA Triethanolamine – used to absorb nitrogen dioxide

11 Appendices

A1 Extracts from the London Plan, Mayor's Air Quality Strategy and the Low Emission Zone (LEZ)

London Plan

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

"Development proposals should:

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

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

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

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

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

The Mayor's Air Quality Strategy

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

Policy 1 – Encouraging smarter choices and sustainable travel;

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

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

Supporting car free developments.

Policy 2 – Promoting technological change and cleaner vehicles:

Supporting the uptake of cleaner vehicles.

Policy 4 – Reducing emissions from public transport:

Introducing age limits for taxis and PHVs.

Policy 5 – Schemes that control emissions to air:

Implementing Phases 3 and 4 of the LEZ from January 2012

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

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

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

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

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

Applying emissions limits for biomass boilers across London;

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

Low Emission Zone (LEZ)

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

A2 Construction Dust Assessment Criteria

Assessment Procedure

A2.1 The criteria developed by IAQM divides the activities on construction sites into four types to reflect their different potential impacts. These are:

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

A2.2 The assessment procedure is split into four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there are sensitive receptors within 350 m of the boundary of the site and/or within 100 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is “negligible”.

STEP 2: Assess the Risk of Dust Effects Arising

A2.5 The risk of dust effects is determined by:

- the scale and nature of the works, which determines the risk of dust arising; and
- the proximity of sensitive receptors.

A2.6 The risk categories assigned to the site are different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Demolition

A2.7 The potential dust emission classes for demolition are as follows:

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

Medium: Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level; and

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

A2.8 The potential dust emission class determined above should be used in the matrix in Table A2.1 to determine the **demolition risk category** with no mitigation applied based on the distance to the nearest receptors.

Table A2.1: Risk Category from Demolition Activities

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

a These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

Earthworks and Construction

A2.9 The potential dust emission classes for earthworks are as follows:

Large: Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000tonne;

Medium: Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000tonne – 100,000tonne; and

Small: Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000tonne, earthworks during wetter months.

A2.10 The potential dust emission classes for construction are as follows:

Large: Total building volume >100,000m^3, piling, on site concrete batching; sandblasting

Medium: Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and

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

A2.11 These potential dust emission classes should then be used in the matrix in Table A2.2 to determine the **earthworks risk category and the construction risk category** with no mitigation applied.

Table A2.2: Risk Category from Earthworks and Construction Activities

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

a These distances are from the dust emission source. Where this is not known then the distance should be from the site boundary. The risk is based on the distance to the nearest receptor.

Trackout

A2.12 The potential dust emission classes for trackout are as follows:

Large: >100 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;

Medium: 25-100 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and

Small / Medium: <25 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

A2.13 These potential dust emission classes should be used in Table A2.3 to determine the **risk category for trackout** with no mitigation applied.

Table A2.3: Risk Category from Trackout

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

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

STEP 3: Identify the Need for Site-specific Mitigation

A2.14 Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is a low, medium or high risk site.

STEP 4: Define Effects and their Significance

A2.15 The significance is determined using professional judgement, taking account of the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks set out within the risk effects summary table. The sensitivity of the area is defined as very high, high, medium and low based on the criteria in Table A2.4.

Table A2.4: Examples of Factors Defining Sensitivity of an Area

Sensitivity of area	Examples	
	Human receptors	Ecological receptors[a]
Very high	• Very densely populated area. • More than 100 dwellings within 20m. • Local PM_{10} concentrations exceed the objective. • Contaminated buildings present. • Very sensitive receptors (e.g. oncology units). • Works continuing in one area of the site for more than one year.	European Designated site.
High	• Densely populated area. • 10-100 dwellings within 20m of site. • Local PM_{10} concentrations close to the objective (e.g. annual mean 36-40 µg/m^3). • Commercially sensitive horticultural land within 20m.	Nationally Designated site.
Medium	• Suburban or edge of town area. • Less than 10 receptors within 20m. • Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 µg/m^3).	Locally designated site.
Low	• Rural area; industrial area • No receptors within 20m • Local PM_{10} concentrations well below the objectives (less than 75%) • Wooded area between site and receptors	No designations.

[a] Only if there are habitats that might be sensitive to dust

A2.16 The sensitivity of the area surrounding the construction / demolition site is combined with the risk of the site giving rise to dust effects to define the significance of the effects for each of the four activities (demolition, earthworks, construction and trackout) using Table A2.5 for the baseline without mitigation and Table A2.6 when mitigation is applied.

Table A2.5: Significance of Effects for Each Activity Without Mitigation.

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

Table A2.6: Significance of Effects for Each Activity With Mitigation.

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

A2.17 The final step is to determine the overall significance of the effects arising from the construction phase of a proposed development. This is based on professional judgement but takes into account of the significance of the effects for each of the four activities.

A3 Impact Descriptors and Assessment of Significance

A3.1 There is no official guidance in the UK on how to describe the nature of air quality impacts nor to assess their significance. The approach developed by the Institute of Air Quality Management[3] (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. This involves three distinct stages: the application of descriptors for magnitude of change; the description of the impact at each sensitive receptor; and then the assessment of overall significance of the scheme.

Impact Descriptors

A3.2 The definition of ***impact magnitude*** is solely related to the degree of change in pollutant concentrations, expressed in microgrammes per cubic metre, but originally determined as a percentage of the air quality objective. ***Impact description*** takes account of the impact magnitude and of the absolute concentrations and how they relate to the air quality objectives or other relevant standards. The descriptors for the magnitude of change due to the scheme are set out Table A3.1 while Table A3.2 sets out the impact descriptors. These tables have been designed to assist with describing air quality impacts at each specific receptor. They apply to the pollutants relevant to this scheme and the objectives against which they are being assessed.

Table A3.1: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. days with PM_{10} concentration greater than 50 µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase/decrease ≥4 µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5 µg/m^3
Medium	Increase/decrease 2 - <4 µg/m^3	Increase/decrease 3 or 4 days	Increase/decrease 1.25 - <2.5 µg/m^3
Small	Increase/decrease 0.4 - <2 µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase/decrease <0.4 µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25 µg/m^3

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

Table A3.2: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide, PM_{10} and $PM_{2.5}$ Concentrations and Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor [a]

Absolute Concentration [b] in Relation to Objective/Limit Value	Change in Concentration/day [c]		
	Small	Medium	Large
Above Objective/Limit Value [d]	Slight	Moderate	Substantial
Just Below Objective/Limit Value [e]	Slight	Moderate	Moderate
Below Objective/Limit Value [f]	Negligible	Slight	Slight
Well Below Objective/Limit Value [g]	Negligible	Negligible	Slight

[a] Criteria have been adapted from the published criteria to remove overlaps at transitions.

[b] The 'Absolute Concentration' relates to the 'With-Scheme' air quality where there is an increase in concentrations and to the 'Without-Scheme' air quality where there is a decrease in concentrations.

[c] Where the Impact Magnitude is *Imperceptible*, then the Impact Description is *Negligible*.

[d] Where the Impact Magnitude is *Imperceptible*, then the Impact Description is *Negligible*.

[d] 'Above': >40 µg/m^3 annual mean NO_2 or PM_{10}, >25 µg/m^3 annual mean $PM_{2.5}$, or >35 days with PM_{10} > 50 µg/m^3.

[e] 'Just below': >36 – ≤40 µg/m^3 of annual mean NO_2 or PM_{10}, >22.5 - ≤25 µg/m^3 annual mean $PM_{2.5,}$ or >32 – ≤35 days with PM_{10} >50 µg/m^3.

[f] 'Below': >30 – ≤36 µg/m^3 of annual mean NO_2 or PM_{10}, >18.75 - ≤22.5 µg/m^3 annual mean $PM_{2.5,}$ or >26 – ≤32 days with PM_{10} >50 µg/m^3.

[g] 'Well below': ≤30 µg/m^3 annual mean NO_2 or PM_{10}, ≤18.75 µg/m^3 annual mean $PM_{2.5,}$ or ≤26 days with PM_{10} >50 µg/m^3.

Assessment of Significance

A3.3 The IAQM (Institute of Air Quality Management, 2009) guidance is that the ***assessment of significance*** should be based on professional judgement, with the overall air quality impact of the scheme described as either, *insignificant*, *minor*, *moderate* or *major*. In drawing these conclusions, the factors set out in Table A3.3 should be taken into account. A summary of the professional experience of staff contributing to this assessment is provided in Appendix A4.

Table A3.3: Factors Taken into Account in Determining Air Quality Significance

Factors
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.
The magnitude of the changes and the descriptions of the impacts at the receptors using the criteria set out in Table A3.1 and Table A3.2
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.

Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made
The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$

A4 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc MIAQM

Prof Laxen is the Managing Director of Air Quality Consultants, a company which he founded in 1993. He has over forty years' experience in environmental sciences and is a member of Defra's Air Quality Expert Group and the Department of Health's Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM_{10}, $PM_{2.5}$ and ozone and was responsible for setting up UK's urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries and published over 70 scientific papers and given numerous presentations at conferences.

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is a Principal Consultant with AQC, with seven years' experience in the field of air quality including the completion of air quality assessments for local authorities, new commercial and residential developments, road schemes, airports and industrial processes in the UK. He has experience in ambient air quality monitoring for numerous pollutants using a wide range of techniques and is also competent in the monitoring and assessment of nuisance odours and construction dust. Mr Caird has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators.

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

A5 Modelling Methodology

Model Inputs

A5.1 The impacts of emissions from the proposed CHP and boiler plant have been predicted using the ADMS-4 dispersion model. The model was run to predict the contribution of the proposed CHP and boiler plant emissions to annual mean concentrations of nitrogen oxides and the 99.8th percentile of 1-hour mean nitrogen oxides concentrations.

A5.2 The model input parameters were taken from technical data sheets for the Internal ENER-G 70 CHP units and Broag-Remeha 610 ECO PRO gas boilers specified for the Cartwright Gardens development. The technical data sheets and CHP and boiler system specifications, including flue heights and dimensions, were provided by Cundall Johnson and Partners LLP.

A5.3 Entrainment of the plume into the wake of the Hughes Parry Tower (the so-called building downwash effect) has been taken into account in the model. The location of the CHP and boiler flues, and the buildings included in the model are shown in Figure A5.1. The flues have been modelled at a height of 54 m (3 m above the roof level).

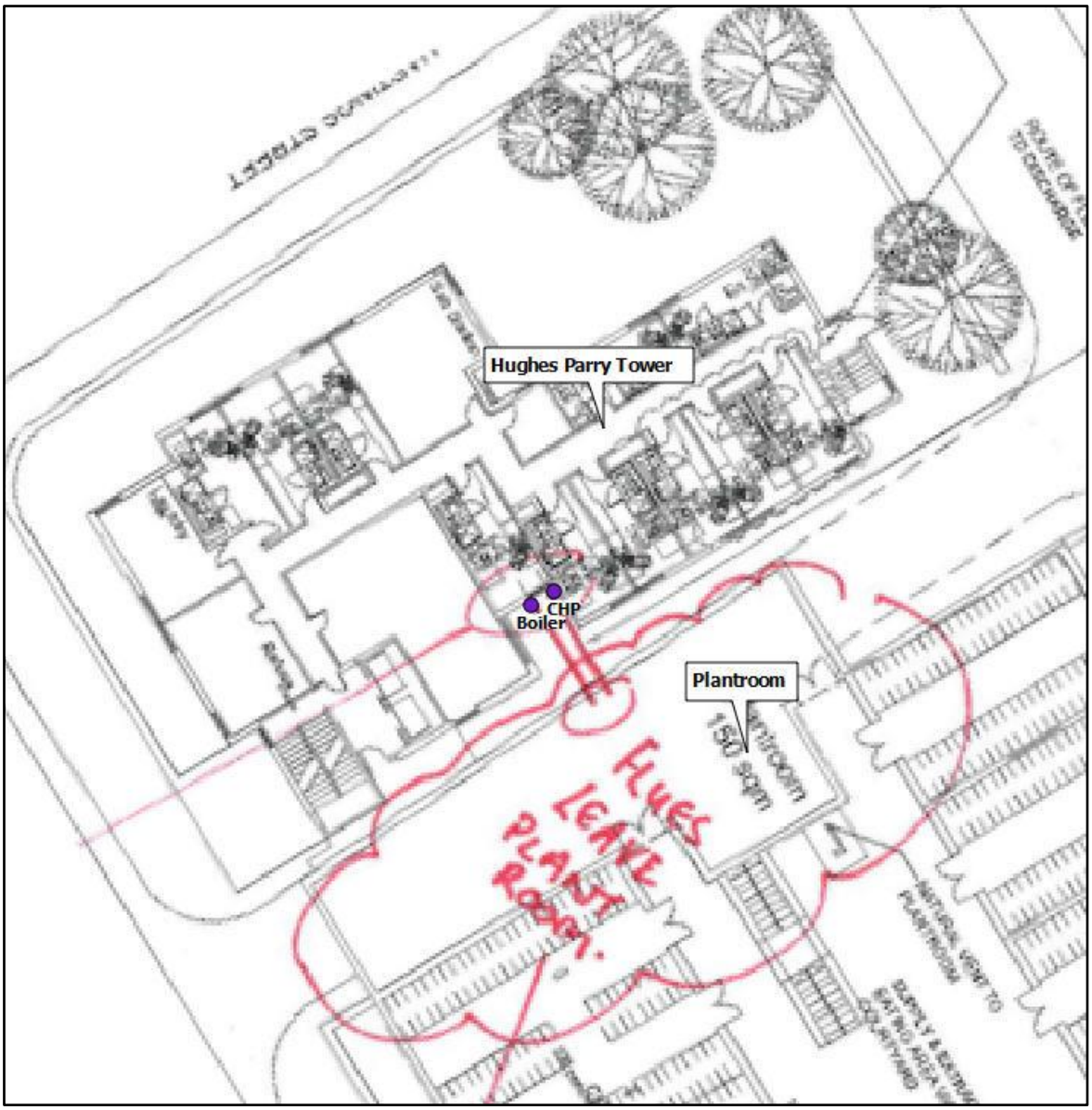

Figure A5.1: Flue Locations

Assumptions

A5.4 The following assumptions have been made:

- The CHP units will operate at 100% for 3650 hours per year; and
- The boilers will operate at 50% average load for 8760 hours per year.

A5.5 The operational load of the gas boilers will vary considerably dependent on heating demand, with highest demand (and therefore loading) in the morning, and lower demand late at night and during the day. There will also be seasonal variations in operating loads, with much lower heating

demands in the summer compared to winter months. The assumption that all four boilers operate continuously (8760 hour per year) at 50% load is a conservative assumption for the entire year. Although during peak periods all four boilers could operate at close to 100% load, for long periods in the summer, operation of all four boilers will not be required, and net average boiler loading would be <50%.

A5.6 The parameters entered into the model are shown in Table A5.1.

Table A5.1: Proposed CHP and Boiler Plant Model Input Parameters

Parameter	CHP (3x units)[a]	Boiler (x4 units)[b]
NOx emission rate (g/s)[c]	0.009	0.024
Boiler capacity (kW)	330 kW	2500 kW
Temperature (deg C)	120	80
Flue height above ground (m)	53	53
Flue diameter (m)	0.173	0.700
Volumetric flow rate (m^3/s)	0.252	1.245
Anticipated average load	100%	50%
Utlisation over year (hrs)	3650	8760

[a] Parameters are combined totals for all three CHP units.

[b] Parameters are combined totals for all four boilers.

[c] Based on 100% loading for worst-case assessment of 1-hour nitrogen dioxide concentrations.

Post-Processing

A5.7 Emissions from the CHP and boiler plant will be predominantly in the form of nitrogen oxides (NO_x). The approach recommended in the Technical Guidance LAQM TG(09) (Defra, 2009) was used to predict annual mean nitrogen dioxide concentrations and the 99.8th percentile of 1-hour mean nitrogen dioxide concentrations from the model predictions of nitrogen oxides. This assumes that:

annual mean nitrogen dioxide concentrations = annual mean nitrogen oxides x 0.7; and

99.8th percentiles of 1-hour mean nitrogen dioxide concentrations = 99.8th percentiles of 1-hour mean nitrogen oxides x 0.35

A5.8 The model was run assuming 100% operation at 100% load, in order that the assessment of 99.8th percentile of 1-hour nitrogen dioxide concentrations be worst-case. In order to assess the annual mean nitrogen dioxide concentrations in accordance with the operating assumptions set out in paragraph A5.4, the predicted annual mean process contributions of NOx have been appropriately adjusted for the assumed operating hours and loads, before the annual mean nitrogen dioxide concentrations have been calculated using the equation above.

A6 Model Results

A6.1 The annual mean and 99.8th percentile of 1-hour mean process contributions of nitrogen dioxide from the proposed CHP and boiler plant at the Proposed Development are presented in Table A6.1. All of the process contributions fall below the relevant screening criteria, and are thus considered to be insignificant.

Table A6.1: Predicted Process Contributions of Nitrogen Dioxide from CHP and Boiler Plant at All Modelled Receptor Locations

Receptor Number	Height (m)	Nitrogen Dioxide Concentrations (µg/m^3)			
		Annual Mean	Above 1% Screening Criteria? [a]	99.8th Percentile of 1-Hour Mean Concentrations	Above 10% Screening Criteria? [a]
Receptor 1	1.5	0.03	No	0.88	No
Receptor 1	12	0.03	No	0.88	No
Receptor 2	1.5	0.09	No	1.15	No
Receptor 2	12	0.09	No	1.15	No
Receptor 3	1.5	0.11	No	0.88	No
Receptor 3	12	0.11	No	0.88	No
Receptor 4	1.5	0.10	No	0.95	No
Receptor 4	12	0.10	No	0.95	No
Receptor 5	1.5	0.07	No	0.88	No
Receptor 5	12	0.07	No	0.88	No
Receptor 6	1.5	0.05	No	0.75	No
Receptor 6	12	0.05	No	0.75	No
Receptor 7	1.5	0.02	No	0.59	No
Receptor 7	12	0.02	No	0.59	No
Receptor 8	1.5	0.02	No	0.43	No
Receptor 8	12	0.02	No	0.43	No
Receptor 9	1.5	0.02	No	0.35	No
Receptor 9	12	0.02	No	0.35	No
Receptor 10	1.5	0.02	No	0.43	No
Receptor 10	12	0.03	No	0.45	No
Receptor 11	1.5	0.01	No	0.55	No
Receptor 11	12	0.01	No	0.57	No

Receptor Number	Height (m)	Nitrogen Dioxide Concentrations (μg/m^3)			
		Annual Mean	Above 1% Screening Criteria? [a]	99.8th Percentile of 1-Hour Mean Concentrations	Above 10% Screening Criteria? [a]
Receptor 12	1.5	0.03	No	0.86	No
Receptor 12	12	0.03	No	0.86	No
Receptor A	1.5	0.32	No	1.18	No
Receptor A	18	0.32	No	1.18	No
Receptor A	50	0.32	No	1.18	No
Receptor B	1.5	0.28	No	1.16	No
Receptor B	18	0.28	No	1.16	No
Receptor B	50	0.28	No	1.16	No
Receptor C	1.5	0.29	No	1.49	No
Receptor C	18	0.29	No	1.49	No
Receptor C	50	0.29	No	1.49	No
Receptor D	1.5	0.23	No	1.49	No
Receptor D	18	0.23	No	1.49	No
Receptor D	50	0.23	No	1.49	No
Receptor E	1.5	0.17	No	1.49	No
Receptor E	18	0.17	No	1.49	No
Receptor E	50	0.17	No	1.49	No
Receptor F	1.5	0.10	No	0.95	No
Receptor F	18	0.10	No	0.95	No
Receptor F	26	0.10	No	0.95	No
Receptor G	1.5	0.05	No	0.77	No
Receptor G	18	0.05	No	0.77	No
Receptor G	26	0.06	No	0.77	No
Receptor H	1.5	0.07	No	1.49	No
Receptor H	18	0.07	No	1.49	No
Receptor H	26	0.07	No	1.49	No
Receptor I	1.5	0.02	No	0.57	No
Receptor I	26	0.03	No	0.59	No
Receptor I	36	0.05	No	0.74	No

Receptor Number	Height (m)	Nitrogen Dioxide Concentrations (μg/m^3)			
		Annual Mean	Above 1% Screening Criteria? [a]	99.8th Percentile of 1-Hour Mean Concentrations	Above 10% Screening Criteria? [a]
Receptor J	1.5	0.01	No	0.59	No
Receptor J	26	0.03	No	0.61	No
Receptor J	36	0.05	No	0.70	No
Receptor K	1.5	0.02	No	0.38	No
Receptor K	36	0.05	No	0.72	No
Receptor L	1.5	0.02	No	0.41	No
Receptor L	36	0.05	No	0.73	No

[a] Comparison against Environment Agency screening criteria described in paragraph 2.18.