Kidderpore Avenue

Air Quality Assessment

On behalf of **Mount Anvil Ltd**

Project Ref: 32290/3001 | Rev: Issued| Date: July 2015

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1 Introduction

1.1 Proposed Development

1.1.1 Mount Anvil Ltd and King's College London have commissioned Peter Brett Associates LLP (PBA) to undertake an air quality assessment to support the planning application for the proposed development at Kidderpore Avenue, Hampstead. The proposed site is located within the boundary of the London Borough of Camden (the planning authority).

1.1.2 The proposed site is located to the west of Finchley Road A41 and directly adjacent to Kidderpore Avenue.

1.1.3 The proposed development involves the retention of the site's five Grade II statutorily listed buildings. Kidderpore Hall, the Maynard Wing, the Chapel and the old Skeel Library will all be sensitively converted to residential use, and the Summerhouse will be restored in a new location on the site close to the Chapel. Other non-listed buildings will also be retained and sensitively converted to residential use, namely Bay House, Dudin Brown, and Lady Chapman Hall.

1.1.4 Three existing buildings will be demolished and replaced with new residential buildings: Lord Cameron Hall, Rosalind Franklin Hall and the Queen Mother's Hall. Integrated in the Kidderpore Avenue elevation of the replacement for the Queen Mother's Hall will be an access to a basement area where car parking for residents and visitors will be provided. In total 97 spaces are proposed. The majority of cycle parking requirements will also be accommodated in the basement, amount to 312 spaces. Some cycle parking – in particular that intended to be used by visitors, amounting to 16 spaces – will be provided at ground floor level, carefully integrated into the hard and soft landscaping scheme.

1.1.5 New buildings are proposed in two locations on the site. The first is between the Chapel and Queen Mother's Hall where 'pavilion' houses are proposed. A terrace of 'townhouses' is proposed between the Chapel and the Maynard Wing on the site of the previously-consented student accommodation development, planning permission for which remains extant by virtue of the development having been commenced. The proposed development also includes residents' facilities and a concierge.

1.2 Scope

1.2.1 This report describes the existing air quality within the study area, considers the suitability of the site for residential development, and assesses the impact of the construction activities on air quality in the surrounding area. The site is not predicted to generate significant volume of traffic. Therefore the effect of development related traffic has been scoped out of the assessment. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic are nitrogen dioxide and fine particulate matter (PM_{10}).

1.2.2 There is no CHP system proposed for the development, only gas fired boilers with a NO_x emission less than 35mg/kWh. Modelling of energy centre emissions has therefore not been undertaken as the effects will likely be insignificant.

1.2.3 The assessment has been prepared taking into account relevant local and national planning policy, guidance and regulations.

2 Legislation and Policy

2.1 The Air Quality Strategy

2.1.1 The Air Quality Strategy (2007) establishes the policy framework for ambient air quality management and assessment in the UK. The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

2.1.2 Part IV of the Environment Act 1995 introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000 and the Air Quality (Amendment) (England) Regulations 2002.

2.1.3 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.

2.1.4 The Local Air Quality Management Technical Guidance 2009 (LAQM.TG (09); Defra, 2009) issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

2.2.1 The Air Quality Standards Regulations 2010 implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO_2. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

2.2.2 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

2.2.3 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

2.3 Planning Policy

National Policy

2.3.1 The National Planning Policy Framework was published in March 2012. This set out the Government's planning policies for England and how they are expected to be applied. In relation to conserving and enhancing the natural environment, paragraph 109 states that:

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

2.3.2 Paragraph 124, also states that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.3.3 Paragraph 203 goes on to say:

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

National Planning Practice Guidance (PPG)

2.3.4 National Planning Practice Guidance (PPG) was published in March 2014 to support the NPPF. Paragraph 001, Reference 32-001-20 of the PPG provides a summary as to why air quality is a consideration for planning:

"…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 local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date….If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan…..Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive…..Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

2.3.5 Paragraph 002, Reference 32-002-20140306, of the PPG concerns the role of Local Plans with regard to air quality:

"….Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider:

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution..; and*

- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

2.3.6 Paragraph 005, Reference 32-005-20140306, of the PPG identifies when air quality could be relevant for a planning decision:

"….When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*

- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affects biodiversity, particularly designated wildlife sites."*

2.3.7 Paragraph 007, Reference 32-007-20140306, of the PPG provides guidance on how detailed an assessment needs to be:

"Assessments should be proportionate 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."

2.3.8 Paragraph 008, Reference 32-008-20140306, of the PPG provides guidance on how an impact on air quality can be mitigated:

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact….Examples of mitigation include:

- *the design and layout of development to increase separation distances from sources of air pollution;*

- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*

- *means of ventilation;*
- *promoting infrastructure to promote modes of transport with low impact on air quality;*
- *controlling dust and emissions from construction, operation and demolition; and*
- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."*

2.3.9 Paragraph 009, Reference 32-009-20140306, of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment:

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."

The London Plan

2.3.10 The London Plan 2015[1] (adopted 10th March 2015) provides strategic planning guidance for Greater London. Each Borough's development plans must be in 'general conformity' with it.

2.3.11 The plan includes Policy 7.14 (Improving Air Quality) which states that development proposals should:

- 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;
- Where biomass boilers are included, set out a detailed air quality assessment that should forecast pollutant concentrations. Permission should only be granted if no adverse impacts from biomass are identified; and
- Aim to be 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as AQMAs).

2.3.12 Boroughs and others with relevant responsibilities should also have policies that:

- Seek reductions in levels of pollutants referred to in the Government's National Air Quality Strategy having regard to the Mayor's Air Quality Strategy; and
- Take account of the findings of the Air Quality Review and Assessments and Action Plans, in particular where AQMAs have been designated.

2.3.13 The Mayor will work with strategic partners to ensure the spatial, transport and design policies of the London Plan support his Air Quality Strategy.

2.3.14 The plan also includes Policy 8.2 (Planning Obligations) which states that the Mayor will provide guidance for boroughs and other partners on the preparation of frameworks for

[1] Available at: https://www.london.gov.uk/priorities/planning/london-plan/draft-further-alterations-to-the-london-plan

negotiations on planning obligations reflecting strategic priorities including the improvement of Air Quality.

2.3.15 Supplementary Planning Guidance (SPG) on Sustainable Design and Construction adopted in April 2014 forms part of the Implementation Framework for the London Plan[2]. For air pollution, the Mayor's Priorities are stated as:

- Developers are to design their schemes so that they are at least 'air quality neutral'.
- Developments should be designed to minimise the generation of air pollution.
- Developments should be designed to minimise and mitigate against increased exposure to poor air quality.
- Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7 (of the document).
- Developers and contractors should follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development.

2.3.16 The Sustainable Design and Construction SPG requires that air quality assessments are prepared for major developments where the development:

- is located within an AQMA:
- is likely to result in a new air pollution exceedance;
- is located within 150 metres of a sensitive receptor (schools, hospitals, care homes, nurseries, residential development);
- will bring sensitive receptors into an area of poor air quality;
- includes biomass boilers and/or combined heat and power; or
- involves waste management/treatment activities, mineral extraction or any other general industrial combustion process.

2.3.17 For major developments that meet the above criteria, an air quality assessment is required to be submitted with the planning application and include:

- a review of air quality around the development site using existing air quality monitoring and/or modelling data;
- air quality dispersion modelling data carried out in accordance with the London Councils Air Quality and Planning Guidance;
- an indication of the number of people (receptors) which will be exposed to poor air quality as a result of the development, and show their location on a map;
- an assessment of the impact on air quality during the construction phase and detailed mitigation methods for controlling dust and pollution emissions in line with the adopted SPG on The control of dust and emissions from construction and demolition; and

[2] Available at: www.london.gov.uk/priorities/planning/consultations/draft-sustainable-design-and-construction

- an outline and justification of mitigation measures associated with the design, location and operation of the development in order to reduce air pollution and exposure to poor air quality; and
- a maintenance regime for any combustion equipment or mitigation measures.

2.3.18 The Sustainable Design and Construction SPG provides guidance on:

- Minimising air quality emissions from location, transport, construction and demolition, and design and occupation;
- Protecting internal air quality;
- What is meant by 'air quality neutral';
- Emissions standards for combustion plant; and
- Offsetting provisions.

2.3.19 'Air quality neutral' applies across London as a whole and emission benchmarks have been proposed in terms of buildings' operation and transport emissions in order to meet this criteria. It is understood that the benchmark should be capable of being met without the need for significant additional mitigation. The emission benchmarks are summarised in **Appendix C.**

2.3.20 Where individual and/or communal gas fired boilers are installed in commercial and domestic buildings they should achieve a NO_x rating of less than 40mgNO_x/kWh. If the particular combustion equipment is not known at the time of the planning application, developers are required to provide a written statement of their commitment and ability to meet the emissions standards within their Air Quality Assessments. Emissions standards are provided for solid biomass boilers and CHP plants (see **Appendix D**).

2.3.21 Where developments do not meet the air quality neutral benchmarks, it is suggested that appropriate on-site mitigation measures will be required to off-set any excess in emissions. Measures could include:

- green planting/walls and screens;
- upgrade or abatement work to combustion plant;
- retro-fitting abatement technology for vehicles and flues; and
- exposure reduction.

2.3.22 In addition, as part of the Implementation Framework for the London Plan[3], a SPG on The Control of Dust and Emissions during Construction and Demolition was published in July 2014.

2.3.23 The SPG requires an Air Quality and Dust Risk Assessment to be submitted at the time of a planning application; with an Air Quality and Dust Management plan (AQDMP) submitted prior to the commencement of works.

2.3.24 The SPG provides guidance for:

[3] Available at: www.london.gov.uk/priorities/planning/consultations/draft-the-control-of-dust-and-emissions-during-construction-and-demolition

- the preparation of an Air Quality and Dust Risk Assessment for construction and demolition activities, including air quality (dust) risk assessments;
- the stages of development the Air Quality and Dust Risk Assessment is to cover, that is for demolition, earthwork, construction stages and trackout (vehicles leaving the site) stages of the works;
- the identification of the potential scale (large, medium, small) of dust emissions for each stage of work;
- the identification of the level of risk due to the scale of dust emissions on soiling (dirt), health and the natural environment, depending on the duration of the activities, their intensity, the prevailing meteorological conditions, the existing levels of background pollution and the sensitivity of receptors to dust;
- best practice methods for controlling dust and pollution control on-site and to prevent trackout;
- recommendations for monitoring low, medium and high risk sites; and
- early notification of new 2015 and 2020 standards for non-road mobile machinery.

Mayor's Air Quality Strategy

2.3.25 The Mayor's Air Quality Strategy[4] (2010) sets out policies to improve air quality in London and includes the following measures:

- Ensuring that public transport becomes cleaner;
- Reducing traffic growth by improving public transport and encouraging developers to make easy access to public transport in new developments;
- Introduction of Phase 3 of the Low Emission Zone (LEZ) in 2012 to cover PM_{10} emissions from minibuses and heavier Light Goods Vehicles (LGVs), and a LEZ nitrogen oxides (NO_x) standard from 2015.

2.3.26 Policy 7 on 'Using the planning process to improve air quality' aims to ensure that no new development has a negative impact on air quality in London. It states that the Mayor will use his planning powers to:

- Develop a check list to guide boroughs and developers in the assessment of potential emissions from new developments;
- Minimise increased exposure to existing poor air quality, particularly in AQMAs and where developments are to be used by large numbers of vulnerable people;
- Ensure air quality benefits are realised through planning conditions and Section 106 agreements; and
- A package of non-transport policy measures is also proposed to reduce localised pollution sources.

[4] Available at: www.london.gov.uk/sites/default/files/Air%20Quality%20Strategy%20v3.pdf

Local Policy

2.3.27 The London Borough of Camden Core Strategy (2010 – 2025) sets out the key elements of the planning framework in the Borough. A draft Local Plan is being produced which will replace the Core Strategy. A draft Local Plan is expected to be released in early 2015 for comments.

2.3.28 Policy CS13 of the Core Strategy, describes the measures new developments and/or redevelopments have to adopt during construction and occupation in order to achieve higher environmental standards. It states that:

"The Council will require all development to take measures to minimise the effects of, and to adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) …minimising carbon emissions from the redevelopment, construction and occupation of buildings…"

2.3.29 Policy CS16 consider the air quality within the borough. It states that:

"The Council will seek to improve health and well-being in Camden. We will:

e) … recognise the impact of poor air quality on health and implement Camden's Air Quality Action Plan which aims to reduce air pollution levels."

2.3.30 The Camden Development Policies adopted in 2010, forms part of the Council's Local Development Framework (LDF). It contributes towards delivering the Core Strategy by setting out detailed planning policies that the council will use when determining applications for planning permission in the borough. Policy DP32 on Air Quality and Camden's Clear Zone, states that:

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

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

Camden's Air Quality Action Plan

2.3.31 The Camden's Clean Air Action Plan (2013 – 2015) adopted in 2013, presents the actions the Borough will take in order to help reduce key pollutants in Camden - Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10}) - which mainly arise from traffic and boilers. Since 2000, the whole London Borough of Camden has been designated and Air Quality Management Area (AQMA) for exceedances of NO_2 and PM_{10} concentrations.

2.3.32 Some of actions presented in the Air Action plan are the following:

- *"Require developers to undertake and Air Quality Assessment (AQA) where a new development could have a negative impact on air quality, and provide and air quality mitigation plan where necessary.*

- *Require developers to submit Construction Management Plans in accordance with the London Best Practice Guidance to Control Dust and Emissions form Construction and Demolition.*

- *Promote the adoption of fuel saving measures to residents.*

- *Continue to monitor air pollution levels across the borough and review air quality monitoring network every year.*

- *Require development sites to meet the Mayor of London's energy hierarchy, with high standards of sustainable building design and construction, and consideration of CHP and renewables. Developers must ensure that best practice requirements for controlling NO_x and PM_{10} emissions from biomass boilers and CHP are met."*

2.3.33 As part of the Clean Air Act, a "Gas CHP Information Request Form" has to be supplied to the local authority prior to, or as part of, the planning application in order for the local authority to approve the CHP.

3 Methodology

3.1 Existing Conditions

3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by the London Borough of Camden (LBC). Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2014).

3.2 Construction Impacts

3.2.1 During demolition and construction the main potential effects are dust annoyance and locally elevated concentrations of PM_{10}. The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

3.2.2 Separation distance is also an important factor. Large dust particles (greater than 30µm), responsible for most dust annoyance, will largely deposit within 100m of sources. Intermediate particles (10-30µm) can travel 200-500m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10µm) are deposited slowly and may travel up to 1km; however, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

3.2.3 The Sustainable Design and Construction SPG (the SPG) outlines the risk evaluation to consider based on the site evaluation process set out in the Institute of Air Quality Management (IAQM) 2014 guidance on the assessment of dust from demolition and construction.

3.2.4 In accordance with the SPG, the dust emission magnitude is defined as either large, medium or small (**Table 3.1**) taking into account the general activity descriptors on site and professional judgement.

3.2.5 The sensitivity of the study area to construction dust impacts is defined as high, medium and low (**Table 3.2**), taking into account professional judgement.

Table 3.1: Risk Criteria for Dust Emission Magnitude

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000m^3 building volume, on site concrete batching, sandblasting
	Trackout

Dust Emission Magnitude	Activity
	>50 HDVs out / day, dusty soil type (e.g. clay), >100m unpaved roads
Medium	**Demolition** 20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks 2,500 - 10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4m - 8m high bunds, 20,000 - 100,000 tonnes material moved
	Construction 25,000 - 100,000m^3 building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 -100m unpaved roads
Small	**Demolition** <20,000m^3 building demolished, non-dusty material, <10m above ground level, work in winter
	Earthworks <2,500m^2 site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved
	Construction <25,000m^3, non-dusty material
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

Table 3.2: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50m 10 – 100 dwellings within 20m Museums, car parks, car showrooms within 50m PM_{10} concentrations approach or are above the daily mean objective.	National or Internationally designated site within 20m with dust sensitive features / species present
Medium	>100 dwellings, hospitals, schools, care homes within 100m 10 – 100 dwellings within 50m Less than 10 dwellings within 20m Offices/shops/parks within 20m PM_{10} concentrations below the daily mean	National or Internationally designated site within 50m with dust sensitive features / species present Nationally designated site or particularly important plant species within 20m

Area Sensitivity	People and Property Receptors	Ecological Receptors
	objective.	
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350m Less than 10 dwellings within 20 - 350m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 - 50m Locally designated site with dust sensitive features within 50m

3.2.6 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 3.3**), taking into account professional judgement.

Table 3.3: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

3.2.7 Based on the risk of dust impacts, appropriate mitigation is selected using professional judgement.

Significance Criteria

3.2.8 The construction impact significance criteria are based on the SPG. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

3.3 Road Traffic

Sensitive Locations

3.3.1 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, the proposed residential properties are considered to be sensitive receptors.

3.3.2 3 locations on the façade of the proposed buildings have been chosen as receptors (**Figure 2**). Receptors were modelled at a height of 1.5m representing residential exposure at ground floor level.

3.3.3 Concentrations have also been predicted at one automatic monitoring site located in close proximity to the site, in order to verify the modelled results (see **Appendix E** for further details on the verification method).

Model Predictions

3.3.4 Predictions have been carried out using the ADMS-Roads dispersion model (v3.2.4.0). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2014 meteorological data from the Heathrow Airport monitoring station, which is considered suitable for this area.

3.3.5 Annual Average Daily Traffic (AADT) flows and the proportions of HDVs, for roads within 250m of the proposed development site have been taken from the London Atmospheric Emissions Inventory (LAEI). Traffic data used in this assessment are summarised in **Appendix F**.

3.3.6 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v6.0.2, which utilises NO_x emission factors taken from the European Environment Agency COPERT 4 (v10) emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model. In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been carried out utilising 2014 emission factors and background concentrations, thus assuming no improvement in vehicle emissions or concentrations.

Assessment Criteria

3.3.7 The NAQOs for NO_2 and PM_{10} set out in the Air Quality Regulations (England) 2000 and the Air Quality (England) (Amendment) Regulations 2002 are shown in **Table 3.4**.

Table 3.4: Nitrogen Dioxide and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen dioxide (NO_2)	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40µg/m^3
Particulate matter (PM_{10})	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40µg/m^3

3.3.8 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. Analysis of long term monitoring data suggests that if the annual mean nitrogen dioxide concentration is less than 60µg/m^3 then the one-hour mean nitrogen dioxide objective is unlikely to be exceeded where road transport is the main source of pollution. This concentration has been used to screen whether the one-hour mean objective is likely to be achieved (Defra, 2009).

Significance

3.3.9 There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) in the document 'Land-use Planning & Development Control: Planning for Air Quality'[5] has therefore been used.

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

3.3.10 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

3.3.11 **Table 3.5** sets out the impact magnitude descriptors, whilst **Table 3.6** sets out the impact descriptors.

Table 3.5: Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (% Change in Concentration)	Annual Mean NO_2 and PM_{10} ($40\mu g/m^3$)	Annual Mean $PM_{2.5}$ ($25\mu g/m^3$)	Annual Mean $32\mu g/m^3$ equating to PM_{10} 35 days above $50\mu g/m^3$
Large	> $4\mu g/m^3$	> $2.5\mu g/m^3$	> $3.2\mu g/m^3$
Medium	> 2 – ≤ $4\mu g/m^3$	> 1.25 – ≤ $2.5\ \mu g/m^3$	> 1.6 – ≤ $3.2\mu g/m^3$
Small	> 0.4 – ≤ $2\mu g/m^3$	> 0.25 – ≤ $1.25\mu g/m^3$	> 0.32 – ≤ $1.6\mu g/m^3$
Imperceptible	≤ $0.4\mu g/m^3$	≤ $0.25\mu g/m^3$	≤ $0.32\mu g/m^3$

Table 3.6: Impact Descriptor for Changes in Concentration at a Receptor

% Change in Concentration with the Development in relation to Objective / Limit Value	Change in concentration			
	Imperceptible	Small	Medium	Large
> 110 (a)	Moderate	Substantial	Substantial	Substantial
> 102 – ≤ 110 (b)	Moderate	Moderate	Substantial	Substantial
> 95 – ≤ 102 (c)	Slight	Moderate	Moderate	Substantial
> 75 – ≤ 95 (d)	Negligible	Slight	Moderate	Moderate
≤ 75 (e)	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.
(a) NO_2 and PM_{10}: >$44\mu g/m^3$ annual mean; $PM_{2.5}$ >$27.5\mu g/m^3$ annual mean; PM_{10} >$35.2\mu g/m^3$ annual mean (days)
(b) NO_2 and PM_{10}: >40.8 - ≤$44\mu g/m^3$ annual mean; $PM_{2.5}$ >25.5 – ≤$27.5\mu g/m^3$ annual mean; PM_{10} >32.64 – ≤$35.2\mu g/m^3$ annual mean (days)
(c) NO_2 and PM_{10}: >38 - ≤$40.8\mu g/m^3$ annual mean; $PM_{2.5}$ >23.75 – ≤$25.5\mu g/m^3$ annual mean; PM_{10} >30.4 – ≤$32.64\mu g/m^3$ annual mean (days)
(d) NO_2 and PM_{10}: >30 - ≤$38\mu g/m^3$ annual mean; $PM_{2.5}$ >18.75 – ≤$23.75\mu g/m^3$ annual mean; PM_{10} >24 – ≤$30.4\mu g/m^3$ annual mean (days)
(e) NO_2 and PM_{10}: ≤$30\mu g/m^3$ annual mean; $PM_{2.5}$ ≤$18.75\mu g/m^3$ annual mean; PM_{10}≤$24\mu g/m^3$ annual mean (days)

3.3.12 The guidance states that the assessment of significance should be based on professional judgement, taking into account the following factors, with the overall air quality effect of the scheme described as either 'insignificant', or of 'minor', 'moderate' or 'major' significance:

- Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance;

- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 3.5** and **3.6** findings;
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced;
- Uncertainty, including the extent to which worst-case assumptions have been made; and
- The extent to which an objective or limit value is exceeded.

4 Baseline Conditions

4.1 LAQM

4.1.1 LBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. A whole borough Air Quality Management Area (AQMA) has been declared due to exceedances of the annual and hourly mean nitrogen dioxide objectives, and the daily mean PM_{10} objective.

4.2 Monitoring

Nitrogen Dioxide

4.2.1 LBC operate four automatic monitoring sites, the closest one is Swiss Cottage (CD1) located approximately 1.9km from the site. LBC also monitors nitrogen dioxide concentrations using diffusion tubes. Data from those sites within approximately 1.9km from the proposed development site are presented in **Tables 4.1** and **4.2** and shown in **Figure 1**.

Table 4.1: Measured Nitrogen Dioxide Concentrations, 2010-2014

ID	Site Type	Annual Mean (µg/m^3)				
		2010	2011	2012	2013	2014
Automatic Site						
CD1a	Kerbside	**82**	**71**	**70**	**63**	**66***
Diffusion Tubes						
CA7	Urban Background	29	31.5	28.9	32	-
CA15 (Triplicate)	Kerbside	**71**	**73**	**72.7**	**83**	-
CA25	Roadside	-	**41.5**	**46**	**57.9**	-
CA17	Roadside	**73**	**58.4**	**61.2**	**65.2**	-
Objective		**40**				

Exceedances highlighted in bold.
2010 – 2013 data taken from the 2014 Air Quality Progress Report provided by LB Camden.
*Data taken from the London Air Quality Network website available at:
http://www.londonair.org.uk/LondonAir/Default.aspx
[a]Used for model verification.

Table 4.2: Measured Exceedances of the Hourly Mean Nitrogen Dioxide Objective, 2010 - 2014

Site	Number of Hours >200µg/m^3				
	2010	2011	2012	2013	2014
Automatic Site					
CD1	**128**	**79**	**43**	**28**	13*
Objective		**18 (200)**			

Exceedances highlighted in bold.
2010 – 2013 data taken from the 2014 Air Quality Progress Report provided by LB Camden.
*Data taken from the London Air Quality Network website available at:
http://www.londonair.org.uk/LondonAir/Default.aspx

4.2.2 Measured concentrations have been above the objective at three of the monitoring locations for the period 2010 – 2013. Concentrations exceeded the objective at the automatic monitoring location CD1 in 2014.

Particulates

4.2.3 The results of the PM_{10} monitoring at CD1 monitoring site are shown in **Table 4.3.**

Table 4.3: Measured oPM_{10} Concentrations, 2010 – 2014.

Site ID	Site Type	2010	2011	2012	2013	2014
Annual Mean (µg/m^3)						
CD1	Kerbside	26	27	23	20	22
Objective		**40**				
Number of days > 50 µg/m^3						
CD1	Kerbside	10	31	20	7	11
Objective		**35**				

2010 – 2014 data taken from the London Air Quality Network.

4.2.4 PM_{10} measured concentrations have been below objectives since 2010.

4.3 Background Concentrations

4.3.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (**Table 4.4**; Defra, 2014).

Table 4.4: Estimated Annual Mean Background Concentrations (µg/m^3)

Year	NO_x	NO_2	PM_{10}
2014	49.8	31.0	22.2
Objectives	**-**	**40**	**40**

4.3.2 The background concentrations are all below the relevant objectives.

5 Impact Assessment

5.1 Construction

5.1.1 The main potential effects during construction are dust deposition and elevated PM_{10} concentrations. The following activities have the potential to cause emissions of dust:

- Site preparation including delivery of construction material, erection of fences and barriers;
- Demolition of existing buildings on site;
- Earthworks including digging foundations and landscaping;
- Excavation works;
- Materials handling such as storage of material in stockpiles and spillage;
- Construction and fabrication of units; and
- Disposal of waste materials off-site.

5.1.2 Typically the main cause of unmitigated dust generation on construction sites is from demolition and vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

5.1.3 Based on the SPG criteria (**Table 3.1**), the risk of dust emissions is considered to be medium. The study area is considered to be of high sensitivity (**Table 3.2**). Appropriate mitigation corresponding to a medium risk site is therefore required during the construction phase (**Table 3.3**) (see **paragraph 6.1.1**).

5.2 Road Traffic

5.2.1 Predicted concentrations at the three modelled receptors are presented in **Appendix G**. Concentrations were predicted at a height of 1.5m representing residential exposure at ground floor level (see **Figure 2**).

5.2.2 There are no predicted exceedances of the annual or daily mean objective for PM_{10} at any receptor. NO_2 concentrations are not predicted to exceed the objective at any of the modelled receptors at ground level.

Uncertainty

5.2.3 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

5.2.4 A disparity between the national road transport emission projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years[6]. Whilst

[6] Carslaw, D, Beevers, S, Westmoreland, E and Williams, M, 2011. Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Available at: http://uk-air.defra.gov.uk/library/reports?report_id=645

projections suggest that both annual mean nitrogen oxides and nitrogen dioxide concentrations from road traffic emissions should have fallen by around 15-25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase. Monitoring data compiled for this assessment indicate that measured nitrogen dioxide concentrations have remained stable in recent years.

5.2.5 In order to take account of uncertainties in future year vehicle emission factors, the assessment has been carried out for 2014, utilising 2014 emission factors and background concentrations. This is considered to provide a conservative assessment of concentrations on site.

5.3 Air Quality Neutral' Development Assessment

Transport Emissions

5.3.1 The development is not predicted to generate a significant volume of vehicles to the local road network. Therefore, the transport emissions generated by the proposed development has been scoped out from the 'Air Quality Neutral' Development Assessment.

Building Emissions

5.3.2 In accordance with the SPG and the Air Quality Neutral Planning Support GLA 80371 (May, 2013), in order to calculate the building emissions from the proposed development; the benchmarks for a particular development should be identified and the emissions from the proposed development then compared with the benchmark emissions. The development Building Emissions Benchmarks (BEBs) are obtained by multiplying the Gross Floor Area (GFA) (m^2) (classified by Land Use) by the BEBs in the SPG. **Table 5.1** presents the benchmarked NO_x emissions for the proposed development.

Table 5.1: Calculation of Benchmarked NO_x Emissions Using Building Emissions Benchmarks (BEBs) for each Land-Use Category

Land Use	GFA (m^2)	BEB[a] (gNO_x/m^2/annum)	Benchmarked Emissions ($kgNO_x$/annum
Residential (C3)	26,491	26.2	**694.1**

Note: PM_{10} benchmarks were not considered in the assessment as the proposed heating system to be used only utilises gas as fuel.
[a] Information based on Table C.1 in Appendix C.

5.3.3 The predicted NO_x emissions from the proposed heating system are described in **Table 5.2** below.

Table 5.2: Proposed Development Heating System NO_x Emissions

Type	NO_x (mg/kWh)	Predicted Annual Energy Demand (MWh)	NO_x (g/annum)	Total NO_x (kg/annum)
Boilers	35	1,875	65,625	**65.6**

5.3.4 The proposed development total NO_x buildings related emissions are significantly below the total benchmarked emissions for the proposed development presented in **Table 5.1.** Therefore, the proposed development is considered to be 'Air Quality Neutral' for buildings emissions.

6 Mitigation

6.1 Construction

6.1.1 The following standard medium risk mitigation measures from the SPG guidance are recommended. An Air Quality and Dust Management Plan (AQDMP) should be submitted to the Local Authority prior to works commencing on site.

Site Management

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- Develop Dust Management Plan;
- Display the name and contact details of persons accountable on the site boundary;
- Display the head or regional office information on the site boundary;
- Record and respond to all dust and air quality pollutant emissions complaints;
- Make a complaint log available to the local authority when asked;
- Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority when asked;
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken; and
- Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible;
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site;
- Fully enclosure site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Install green walls, screens or other green infrastructure to minimise the impact of dust and pollution;
- Avoid site run off of water or mud;
- Remove potentially dusty materials from site as soon as possible;
- Cover, seed or fence stockpiles to prevent wind whipping;

- Carry out regular dust soiling checks of buildings within 100m of site boundary and cleaning to be provided if necessary;
- Agree monitoring locations with the Local Authority;
- Where possible, commence baseline monitoring at least three months before phase begin; and
- Put in place real-time dust and air quality pollutants monitors across the site and ensure they are checked regularly.

Operating Vehicle/Machinery

- Ensure all on road vehicles comply with the London Low Emission Zone;
- Ensure all non-road mobile machinery (NRMM) comply with the standards; where applicable;
- Ensure all vehicles switch off engines when stationary;
- Avoid the use of diesel or petrol powered generators where possible;
- Impose and signpost a maximum speed limit of 10mph on surface haul and work areas;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- Implement a Travel Plan that supports and encourages sustainable travel (public transports, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding and sawing equipment with dust suppression equipment;
- Ensure an adequate supply of water on site for dust suppressant;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate; and
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- Avoid bonfires and burning of waste materials on site.

Demolition

- Use of soft strip inside buildings before demolition;
- Ensure effective water suppression is used during demolition operations;

- Avoid explosive blasting; and
- Bag and remove any biological debris or damp down such material before demolition.

Construction

- Avoid scabbling (roughening of concrete surfaces) if possible;
- Ensure sand and other aggregates are stored in bonded areas and are not allow to dry out;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emissions control systems to prevent escape of material and overfilling during delivery; and
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Trackout

- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary to remove any material track on the site;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transportation;
- Record all inspections of haul routes and any subsequent action in a site log book;
- Install hard surfaced haul routes which are regularly damped down with fixed or mobile sprinklers systems and regularly cleaned;
- Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- Implement a wheel washing system;
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits;
- Access gate to be located at least 10m from receptors where possible; and
- Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site.

6.2 Operation

6.2.1 The air quality effects for the proposed development are judged to be insignificant, especially regarding the conservative nature of the assessment. No additional mitigation is therefore required to directly address the impact of the development.

7 Conclusions

7.1.1 The air quality effects associated with the proposed development at Kidderpore Avenue located within the boundaries of the London Borough of Camden have been assessed.

7.1.2 A whole borough Air Quality Management Area (AQMA) has been declared in Camden due to exceedances of the annual and hourly mean nitrogen dioxide objectives, and the daily mean PM_{10} objective.

7.1.3 The construction works have the potential to create dust. During construction it is recommended that a package of mitigation measures is put in place to minimise the risk of elevated PM_{10} concentrations and dust nuisance in the surrounding area.

7.1.4 Annual mean NO_2 concentrations are not predicted to exceed the annual mean objective at any of the future receptor locations on the ground floor level. There are no exceedances of the PM_{10} objectives at any of the future receptor locations.

7.1.5 The buildings emissions for the development comply with the London SPG requirements for 'Air Quality Neutral'.

7.1.6 Overall, the air quality effects for the proposed development on future residents are considered to be insignificant.

Appendix A Glossary

AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CAZ	Central Activity Zone
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EFT	Emission Factor Toolkit
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes Includes HGVs and buses
LAQM	Local Air Quality Management
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides, generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
PM_{10}	Small airborne particles less than 10μm in diameter
Receptor	A location where the effects of pollution may occur

Appendix B References

Carslaw, D., Beevers, S., Westmoreland, E. and Williams, M. (2011). *Trends in NO_x and NO_2 emissions and ambient measurements in the UK*. Available: http://uk-air.defra.gov.uk/library/reports?report_id=645.

Department of the Environment, Food and Rural Affairs (Defra) (2014). *2011 Based Background Maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$.* Available: http://laqm.defra.gov.uk/maps/maps2010.html.

Department of the Environment, Food and Rural Affairs (Defra) in partnership with the Scottish Executive, The National Assembly for Wales and the Department of the Environment for Northern Ireland (2009). *Local Air Quality Management Technical Guidance, LAQM.TG (09).* HMSO, London.

Department of the Environment, Transport and the Regions (DETR, 2007) in Partnership with the Welsh Office, Scottish Office and Department of the Environment for Northern Ireland (2007). *The Air Quality Strategy for England, Scotland, Wales, Northern Ireland*, HMSO, London.

Environmental Act 1995, Part IV.

Institute of Air Quality Management (2014) Assessment of dust from demolition and construction, IAQM, London

Statutory Instrument 2000, No 921, *The Air Quality (England) Regulations 2000*, HMSO, London.

Statutory Instrument 2002, No 3034, *The Air Quality (England) (Amendment) Regulations 2002*, HMSO, London.

Statutory Instrument 2010, No. 1001, *The Air Quality Standards Regulations 2010*, HMSO, London

Appendix C Benchmarks

C.1 Air Quality Neutral Emissions Benchmarks for Buildings

C.1.1 The following table provides the Building Emissions Benchmarks based on the gross floor area for each type of development class.

Table C.1: 'Air Quality Neutral' Emissions Benchmarks for Buildings (BEBs)

Land Use Class	NO_x (g/m^2/annum)	PM_{10} (g/m^2/annum)
Class A1	22.6	1.29
Class A3 – A5	75.2	4.32
Class A2 and Class B1	30.8	1.77
Class B2 – B7	36.6	2.95
Class B8	23.6	1.90
Class C1	70.9	4.07
Class C2	68.5	5.97
Class C3	26.2	2.28
D1 (a)	43.0	2.47
D1 (b)	75.0	4.30
Class D1 (c - h)	31.0	1.78
Class D2 (a - d)	90.3	5.18
Class D2 (e)	284	16.3

The gross floor area (GFA) is used to define the area.

C.2 Air Quality Neutral Emissions Benchmarks for Transport

C.2.1 The following table provides the Transport Emissions Benchmarks based on the gross floor area and the location of the development.

Table C.2: 'Air Quality Neutral' Emissions Benchmarks for Transport (TEBs)

Land Use	CAZ	Inner	Outer
NO_x (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5

Land Use	CAZ	Inner	Outer
NO_x (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

Appendix D Emissions Standards

D.1.1 Developments are to meet these emission standards along with the 'air quality neutral' benchmark values. Where meeting these emission standards still does not allow the air quality neutral benchmarks to be met, further reduction or offsetting measures would be required.

D.1.2 The emission standards are 'end-of-pipe' concentrations expressed at specific reference conditions for temperature, pressure, oxygen and moisture content. Compliance with these standards should be demonstrated based on monitoring undertaken on the actual installed plant or, where this does not exist at planning application stage, based on manufacturer guaranteed performance levels supported by type approval monitoring undertaken by the equipment supplier. At the very least, a statement of intent to only include combustion plant within the development that meets these standards must be made at application stage. Providing further details on actual installed combustion plant and emissions performance prior to full operation of the development should be made compulsory by way of planning condition. It is not permissible for emission factors (e.g. g/kWh, g/GJ etc.) to be converted into an equivalent concentration for compliance purposes.

D.1.3 To deliver both reductions in carbon dioxide emissions and improve air quality a tiered approach has been developed for applicable emission standards. This approach is based upon differentiation according to the baseline air quality in the area of development and will be dependent upon whether or not the development falls into the two tiers defined below.

Table D.1: Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input range 50kWth – 20 MWth

Band	Applicable Range	
	Baseline Annual Mean NO_2 and PM_{10}	Baseline 24-Hour Mean PM_{10}
Band A	>5% below national objective	>1-day less than national objective
Band B	Between 5% below or above national objective	1 day below or above national objective

D.1.4 The emission standards below are target minimum standards. If an assessment indicates that significant air quality effects may occur even when meeting the emission standards, additional measures (such as stack height increase, enforcement of more stringent standards etc.) should be considered in order to produce an acceptable level of impact.

Table D.2: Emission Standards for Solid Biomass Boilers and CHP Plant in the Thermal Input Range 50kWth to less than 20MWth for development in Band A

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Spark ignition engine (natural gas/biogas)[B]	NO_x	250	329	Advanced lean burn operation (lean burn engines) NSCR (rich burn engines)

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Compression ignition engine (diesel / bio-diesel)[B]	NO_x	400	526	SCR
Gas turbine[C]	NO_x	50	177	None above standard technology for modern turbines
Solid biomass boiler (including those involved in CHP applications)[D]	NO_x	275	386	Modern boiler with staged combustion and automatic control
	PM	25	35	Modern boiler with staged combustion and automatic control including cyclone / multicyclone
All (stack heat release less than 1MW)[E]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[E]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

[A] Combustion appliances operating less than 500 hours per annum are exempt from these standards
[B] Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O_2, dry gas
[C] Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O_2, dry gas
[D] Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O_2, dry gas
[E] The stack heat release can be calculated as per equation (3) in the D1 guidance note:

$$Q = \frac{V\left(1-\frac{283}{T}\right)}{2.9}$$

Where:
Q= Stack heat release (MW)
V = Volume flow of stack gases at discharge conditions (Am^3s^{-1})
T = Discharge temperature (K)
N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Table D.3: Emission Standards for Solid Biomass Boilers and CHP Plant in Thermal Input Range 50kWth to less than 20MWth for development in Band B

Combustion Applicance[A]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg Nm^{-3})	Equivalent Concentration at 0% O_2 (mg Nm^{-3})	Likely Technique Required to Meet Emissions Standard
Spark ignition engine (natural gas/biogas)[B]	NO_x	95	125	SCR (lean burn engines) NSCR (rich burn engines)
Compression ignition engine (diesel / bio-diesel)[B]	NO_x	400	526	SCR
Gas turbine[C]	NO_x	20	71	Latest generation DLN burners and / or SCR
Solid biomass boiler < $1MW_{th}$ input (including those involved in CHP applications)[D]	NO_x	180	252	Modern boiler with staged combustion and / or SNCR
	PM	5	7	Fabric / ceramic filter
Solid biomass boiler ≥ $1MW_{th}$ input (including those involved in CHP applications)[D]	NO_x	125	175	Modern boiler with staged combustion, automatic control and / or SNCR
	PM	5	7	Fabric / ceramic filter
All (stack heat release less than 1MW)[E]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[E]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

[A] Combustion appliances operating less than 500 hours per annum are exempt from these standards
[B] Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O_2, dry gas
[C] Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O_2, dry gas
[D] Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O_2, dry gas
[E] The stack heat release can be calculated as per equation (3) in the D1 guidance note:

$$Q = \frac{V\left(1-\frac{283}{T}\right)}{2.9}$$

Where:
Q= Stack heat release (MW)
V = Volume flow of stack gases at discharge conditions (Am^3s^{-1})
T = Discharge temperature (K)

N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Appendix E Verification

Nitrogen Dioxide

Most nitrogen dioxide is produce in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NO_x = NO + NO_2). The model has been run to predict the 2014 annual mean road-NO_x contribution at the Swiss Cottage (CD1) kerbside automatic monitoring site (identified in **Table 4.1**), which is the most representative of the proposed development.

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was determined from the measured nitrogen dioxide concentration using the NO_x from NO_2 calculator and the adjusted background NO_2 concentrations from the Defra background map.

An adjustment factor was determined as follows:

- Measured NO_2: 66µg/m^3
- Measured road-NO_x: 82.61µg/m^3
- Modelled road-NO_x = 47.67µg/m^3
- Road-NO_x adjustment factor: 82.61/47.67 = 1.7326

This factor implies that the model is under-predicting the road-NO_x contribution. This is a common experience with this and most other models.

PM_{10}

PM_{10} data capture for the automatic monitoring site CD1 was below 75%; therefore the adjustment factor calculated for nitrogen dioxide concentrations has been applied to the modelled road-PM_{10} concentrations.

Appendix F Traffic Data

Table F.1: Traffic Data

Location	2014	
	AADT	%HDV
Platt's Lane	7,528	4
Heath Drive	3,804	4
Kidderpore Avenue	1,000	0
College Crescent	47,347	7
Avenue Road	21,941	10
Finchley Road	21,941	10
A596 Finchley Road	14,381	8
Finchley Road A41	47,347	7
Fortune Green Road	145,445	5
Mill Lane	9,217	4
West End Lane	9,007	6
Hendon Way	44,791	4
Buckland Crescent	11,991	8

Appendix G Predicted Concentrations

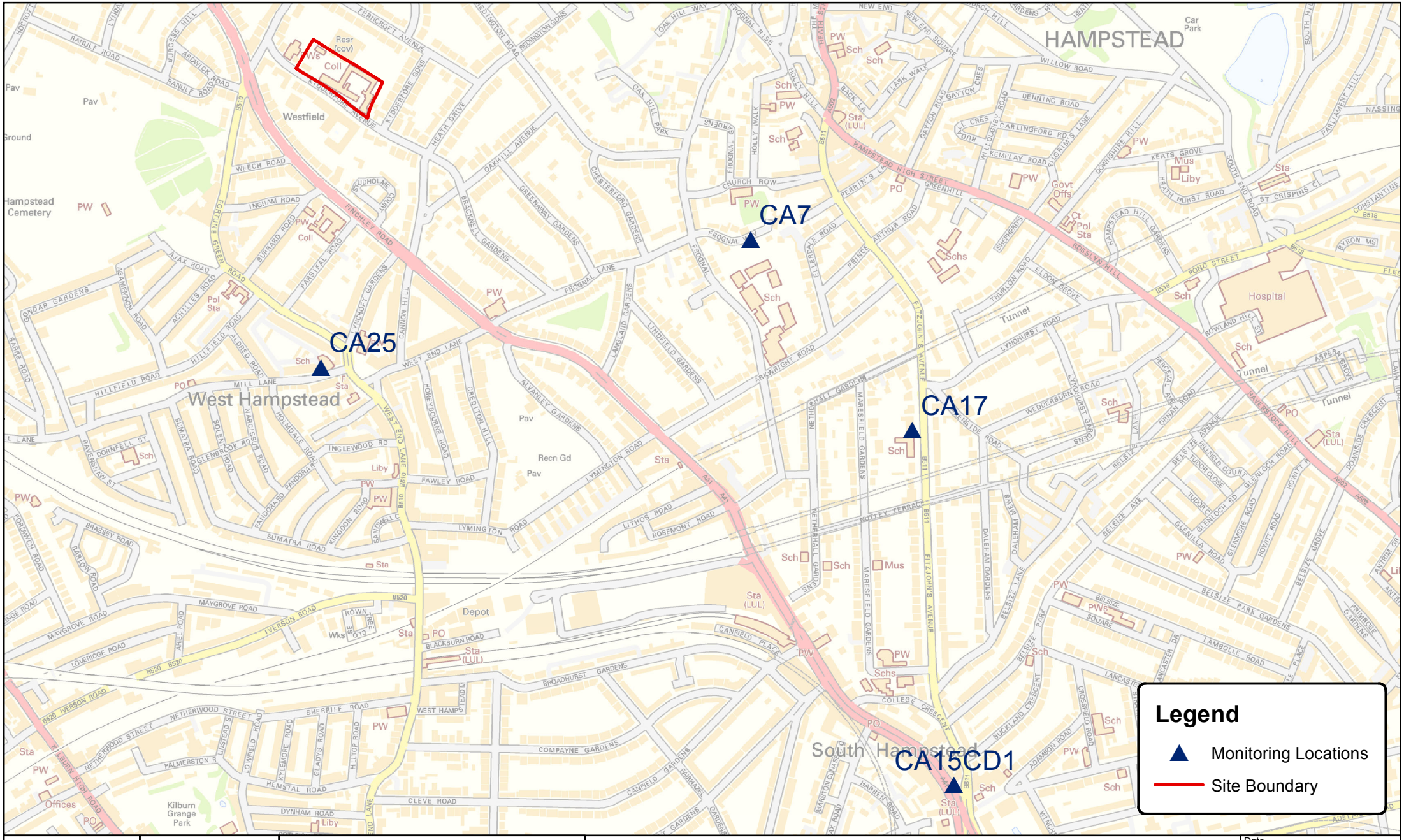
Table G.1: Predicted Annual Mean NO_2 Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3) Ground Floor (1.5m)
PR1	35.0
PR2	33.9
PR3	33.4
Objective	**40**

Table G.2: Predicted PM_{10} Concentrations at Proposed Receptors, 2014

Receptor	Annual Mean (µg/m^3) Ground Floor (1.5m)
PR1	22.7
PR2	22.5
PR3	22.5
Objective	**40**

Appendix H Figures



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Client

MOUNTAVIL

0 0.15 0.3 Kilometres

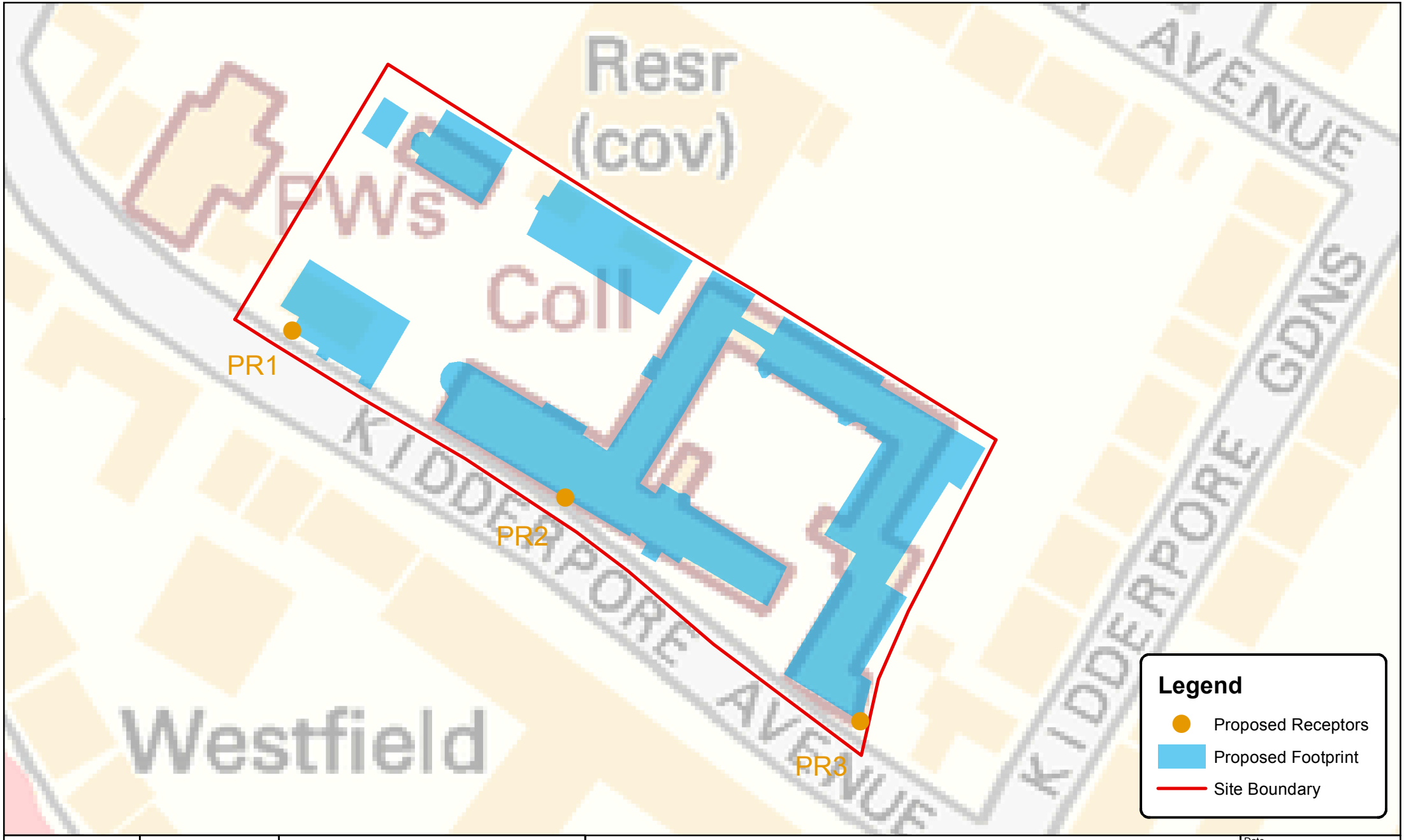
N

Kidderpore Avenue

Air Quality Monitoring Locations

Date	15/06/2015
Scale	1:9,960 @ A4
Drawn By	YO
Checked By	GH
Revision Number	01
Figure Number	**Figure 1**

PBA BRISTOL Drive: J:\32290 Kidderpore Avenue Hampstead\Plans and Figures\ArcGIS\Kidderpore Avenue Figure 1.mxd



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MOUNTAVIL

0 20 40 Metres

N

Kidderpore Avenue

Proposed Receptors

Date	22/06/2015
Scale	1:1,136 @ A4
Drawn By	YO
Checked By	GH
Revision Number	01
Figure Number	**Figure 2**

PBA BRISTOL Drive: J:\32290 Kidderpore Avenue Hampstead\Plans and Figures\ArcGIS\Kidderpore Avenue Figure 2.mxd