156 West End Lane

a2dominion

Revised Air Quality Assessment

June 2016

156 West End Lane, West Hampstead

Air Quality Assessment

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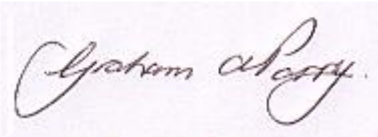
Approved By	 Graham Parry Managing Director
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1. INTRODUCTION

ACCON UK Limited (ACCON) has been instructed by Silver Development and Construction Consultancy on behalf of A2 Dominion Developments Limited to carry out an air quality assessment which is required for a planning application submission to the London Borough of Camden (LBC). The whole of the LBC administrative area was declared an Air Quality Management Area (AQMA) in September 2002.

The proposal is to redevelop the site (156 West End Lane), which is located east of West End Lane and north of West Hampstead Thameslink Station. The proposed development includes the demolition of all existing buildings and redevelopment of the site to provide 163 mixed-tenure homes (Use Class C3), new floorspace for town centre uses (Use Classes A1, A2, A3, D1 or D2), new employment floorspace (including four dedicated units for start-up businesses) (Use Class B1), a community meeting room and new and improved public open spaces, together with associated new landscaping, on-site access, servicing and disabled car parking

This assessment has been completed in order to determine whether the proposed development achieves compliance against the National Air Quality Objectives, along with National and Local planning policy.

This assessment will be undertaken in accordance with the Department for Environment, Food and Rural Affairs' (DEFRA's) current Technical Guidance on Local Air Quality Management (LAQM) (DEFRA, 2016) and will cover the temporary effects on local air quality during construction, as well as the effects of local air quality on the development itself.

The report assesses the overall levels of nitrogen dioxide (NO_2) and particulates (PM_{10}; $PM_{2.5}$) at the site. A glossary of terms is detailed in **Appendix 1** and the location of the site is displayed in **Appendix 2.** The constraints that existing air quality may have on the proposed development have been considered as part of this assessment. It is anticipated that the development will be completed in 2020.

The potential constraints on development have been assessed on the basis of the findings of detailed dispersion modelling using Breeze Roads GIS Pro Version 5.1.10, which has been undertaken in the context of relevant National Air Quality Objectives (NAQO) and Limit values and relevant guidance.

This revised Air Quality Assessment reflects the design revisions made as a result of the feedback received and further information requested by the London Borough of Camden officers following the November 2015 planning submission.

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2. AIR POLLUTION POLICY CONTEXT

2.1. Introduction

In the UK at the present time, emissions from road transport account for a substantial proportion of national air pollutant emissions. Road transport currently contributes almost 22% of national carbon dioxide emissions[1]. Whilst the UK is set to meet its international commitments on carbon dioxide emission reductions, the transport sector carbon dioxide emissions are continuing to grow.

Private car ownership has grown from 20.5 million in 1994 to 28.5 million in 2009[2] and in 2008, car traffic accounted for 78 per cent of road traffic, this proportion has remained stable since 1980[3]. Whilst total pollutant emissions peaked in 1990/91 and then started to decline, emissions began increasing again in approximately 2010.

It is evident that continued growth in private car ownership and usage will continue to result in a further deterioration of air quality in urban areas and increasing emissions of greenhouse gases. Whilst current technological improvements extended the reduction in emissions to approximately 2010, additional measures are now required in order to prevent re-growth of emissions, both to meet ambient air quality targets in urban areas and to offer an alternative to the car for urban journeys. Consequently, where new development can be located in relatively close proximity to public transport and local services, a contribution to the UK's target of reducing emissions will have been made.

2.2. Legislation

In 1997 the United Kingdom National Air Quality Strategy (NAQS) was published and this document, set out an analysis of the magnitude and potential health and environmental problems associated with air pollutant emissions, particularly those emanating from road traffic.

The strategy proposed a schedule of air quality objectives, which were to be met for various pollutants in the years up to 2005. In setting these objectives, due account was taken of health and socio-economic cost-benefit factors, together with consideration of the practical and pragmatic aspects of whether targets would be achievable. Whilst it was identified in the Strategy that the objectives for benzene, butadiene, lead and carbon monoxide could be achieved as a result of improvement measures already put in place, complying with targets for NO_2 and PM_{10} would be more difficult. In considering what additional measures would have to be introduced to counter these apparent shortfalls, the Government voiced the following thought: "*changes in planning and transport policies (are needed) which would reduce the need to travel and reliance on the car*". With regard to the necessity for encouraging a shift away from private car usage, the Strategy commented, in terms of the new package approach to transport funding, "*As a general rule, traffic demand management and restraint measures should be included and this, together with proposals*

[1] Environmental Protection UK. (2010). Car Pollution. Available from www.environmental-protection.org.uk
[2] Department for Transport. (2010). Regional Transport Statistics: Tables. Available from www.dft.gov.uk
[3] Department for Transport. (2010). Transport Trends 2009. Available from www.dft.gov.uk

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to promote and enhance other modes of transport, should aim to achieve modal shifts away from the private car".

The White Paper on Integrated Transport (July 1998) proposed a range of measures at both national and local level to address issues of congestion and environmental effects. During the consultation process in 1997, the environmental issue most frequently cited by responses was air quality and it is therefore clear that this problem is uppermost in the mind of the public. The implementation of measures to relieve congestion in urban areas, by means of improvements in provision of public transport and encouragement of a modal shift, will also benefit urban air quality.

A review of the UK Air Quality Strategy was undertaken in 1998 and a consultation document was published in January 1999, outlining proposals for amending the Strategy. In August 1999, in response to the consultation, the Government then published an Air Quality Strategy for England, Scotland, Wales and Northern Ireland. The Air Quality Regulations (England) 2000 enacted in April 2000, and the Air Quality (England) (Amendment) Regulations 2002 gave legal force to the air quality standards set out in the Strategy. A new strategy was released in July 2007 with various amendments to the air quality objectives. The proposals, in brief, consisted of recommendations to adopt the provisions of the EU Air Quality Daughter Directives.

Schedule 2 of the Air Quality Standards Regulations 2010 implements a limit value for $PM_{2.5}$ to be achieved by 2015, although they are yet to come into force and only apply to England. The Air Quality Standards (AQS) included in the Air Quality Standards Regulations 2010 are set out in **Appendix 4**.

The 'standards' are set as concentrations below which health 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 a particular 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 the costs, benefits, feasibility and practicality of achieving the standards. The objectives are prescribed within The Air Quality (England) Regulations 2000 (Stationery Office, 2000) and The Air Quality (England) (Amendment) Regulations 2002 (Stationery Office, 2002) (termed the 'Regulations'). Air Quality Objectives included in the Regulations and current legislation (CAFE Directive) which are relevant to the current study (NO_2 and PM_{10}) are outlined in **Appendix 4**.

The Air Quality Objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants). The annual mean objectives apply to all locations where members of the public might be regularly exposed; these include building façades of residential properties, schools, hospitals and care homes. The 24-hour mean objective applies to all locations where the annual mean objective would apply, together with hotels and gardens of

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residential properties[4]. The 1-hour mean objective also applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1-hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

Measurements across the UK have shown that the 1-hour mean NO_2 objective is unlikely to be exceeded unless the annual mean NO_2 concentration is greater than 60µg/m^3 (Laxen and Marner, 2003). Thus exceedances of 60µg/m^3 as an annual mean NO_2 concentration are used as an indicator of potential exceedances of the 1-hour mean NO_2 objective.

Similarly, studies (DEFRA, 2003) have also established a relationship between the annual mean PM_{10} concentration and number of exceedances of the 24-hour mean objective: those areas where the annual mean concentrations are greater than 32µg/m^3 were demonstrated to be at risk of exceeding the 24-hour mean objective. Thus exceedances of 32µg/m^3 as an annual mean PM_{10} concentration are used as an indicator of potential exceedances of the 24-hour mean PM_{10} objective.

2.3. Planning Policy

2.3.1. National Planning Policy Framework

The new National Planning Policy Framework released in March 2012, and replaced the Planning Policy Guidance which previously covered planning and pollution control and new development in England. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. 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.

In relation to air quality planning policies, they 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. In addition, when determining planning applications, local planning

[4] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

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authorities should ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source.

2.3.2. National Planning Practice Guidance

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

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.
- 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.

Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met.

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.

2.3.3. Regional Planning Policy – the London Plan (FALP - March 2015)

The regional development strategy applicable for the site is the London Plan. This plan addresses the spatial implications of the Mayor's Air Quality Strategy. In 2011, the Greater London Authority (GLA) and Mayor of London published the London Plan

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2011, replacing the London Plan of 2008. Since 2011, the Revised Early Minor Alterations to the London Plan (REMA) was published in 2013 and the Further Alterations to the London Plan (FALP) in March 2015. The London Plan is the overarching strategic plan for London which provides an integrated framework for economic, environmental, social and transport development up to the year 2031. It forms part of the wider development context for Greater London and provides the framework to which local authorities' planning policies and decisions must conform.

The main Policy for Air Quality in the London Plan (2015) is Policy 7.14 ("Improving Air Quality"). This policy states that development proposals should:

- minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and 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 as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans;
- 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 from construction and demolition';
- 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));
- ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site 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;
- 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.

2.3.4. London Construction Dust Supplementary Planning Guidance

The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance (SPG) was published in July 2014. The guidance should be considered as a material planning consideration by London Borough Councils in their development of Local or Neighbourhood Planning Documents.

It recommends that Local Authorities therefore consider requesting that developers submit an Air Quality and Dust Risk Assessment when planning applications are received.

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At post-application phase, it recommends that the developer should provide an Air Quality and Dust Risk Assessment summarising how demolition, earthworks, construction and trackout activities could cause dust soiling or impact on human health or environmentally sensitive receptors (see **Section 4.7).** The dust assessment procedure replicates that previously set out in the Institute of Air Quality Management's 2014 guidance on the Assessment of Dust from Demolition and Construction, but stipulates that a higher level of mitigation would be required if the effects of background PM_{10} and construction dust combined would increase ambient PM_{10} concentrations to within 10% of the annual NAQO. It should also confirm that a Dust Management Plan will be submitted to the Local Planning Authority before works commence.

The SPG recommends that planning conditions or section 106 agreements could be used to inform an Air Quality and Dust Management Plan which should be submitted before works commence on site. These plans should detail the following:

- *"Confirmation of dust and air quality emission control measures to be implemented;*
- *Confirmation of what monitoring methods are to be implemented;*
- *From 2015, confirmation that construction standards will meet [Non-Road Mobile Machinery] standards, where possible."*

During the construction phase, the developer and planning authority should monitor demolition and construction works, reviewing and implementing control measures where required.

It recommends that all developments where construction dust risks are at least 'low' should implement monitoring mechanisms such as by reviewing "occupational exposure standards to minimise worker exposure and breaches of air quality objectives that may occur outside the site boundary", and by logging and acting upon public complaints. Further recommendations are outlined for sites where the assessed risk is greater.

2.3.5. Camden Local Development Framework - Policy CS9 Achieving a Successful Central London and Policy DP32 Air Quality and Camden's Clear Zone

The Council's Core Strategy highlights the need to promote higher standards of air quality within the borough. It is recognised that parts of Camden have some of the poorest air quality levels in London and consequently the whole of the borough has been declared an Air Quality Management Area. The Council has produced an Air Quality Action Plan that identifies actions and mitigating measures necessary to improve air quality in the borough. Core Strategy Policy CS9 seeks to continue to designate Central London as a Clear Zone Region, which aims to reduce congestion, air and noise pollution and improve the urban realm.

<u>Camden's Clear Zone</u>

Development Policy DP32 "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

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that are located in areas of poor air quality". The site is located within a Growth Area (West Hampstead Interchange) and the supporting text advises that developments in these areas need to be well protected against air and noise pollution, with the Council expecting high standards of energy efficient design to be incorporated into development schemes.

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3. BASELINE CONDITIONS

3.1. Air Quality Review and Assessment

As previously indicated, Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the limit values. Where these objectives are unlikely to be achieved, local authorities must designate these areas as AQMA's and prepare a written action plan to achieve the AQS's.

The review of air quality takes on several prescribed stages, of which each stage is reported. LBC's latest Air Quality Report (April 2014) states that there is one Air Quality Management Area, which includes the whole Local Authority area and was designated for exceedances of the annual mean NO_2 AQS's in 2002.

Further details on the monitoring data used for model verification purposes are provided in **Section 3.2**.

3.2. Local Air Quality Monitoring

By selecting the closest appropriate roadside monitoring locations to the site, the most representative sites used for model verification purposes were located within both LBC and in the neighbouring London Borough of Barnet (LBB). The monitoring locations selected were the diffusion tubes at Emmanuel Primary School (CA25) and Chetwynd Road (CA24) from LBC, and Golders Green Lane (PBN9) from LBB. These are located approximately 0.3km southwest, 3.1km east and 2.2km northwest of the site respectively.

The 2013 annual mean NO_2 concentrations for all of the monitoring sites are shown in **Table 3.1** below. The annual mean NO_2 NAQO is exceeded at all of the monitoring locations.

Table 3.1: Local Monitoring Data Suitable for Model Verification

Location	Distance to nearest Kerb (m)	Grid Reference		2013 Annual Mean NO_2 (µg/m^3)	2013 Data Capture (%)
		X	Y		
CA24	1.5	528723	185949	**47.8**	100
CA25	2.5	525325	185255	**62.9***	100*
PBN9	5.5	524691	187506	**56.0**	92

* Data from CA25 were annualised in accordance with LAQM TG.16 (using data from the Harrow Stanmore, Haringey Priory Road and Thurrock London Road urban background AURN sites) as the original data capture was below 90%. Before adjustment 2013 Annual Mean was 57.9µg/m^3.

3.3. Background Concentration of Air Pollutants

Background concentrations of air pollutants for the modelling were obtained from the 2011 pollutant concentration maps which were published by DEFRA in June 2014. These updated maps are based on monitoring and meteorological data for 2011 and incorporate updated road forecasts and NO_x emission rates.

As the background concentrations from DEFRA are mapped in 1km by 1km grid squares and the monitoring stations and development receptors are located in different grid squares

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compared to the development site, their respective background concentrations have been used for verification and adjustment purposes.

Table 3.2: Background Concentrations of Pollutants

Year	NO_x µg/m³	NO_2 µg/m³	PM_{10} µg/m³	$PM_{2.5}$ µg/m³
2013 Development Site and Existing Receptors (525500, 184500)	52.3	32.1	22.2	15.3
2020 Development Site and Existing Receptors (525500, 184500)	40.4	25.8	20.6	13.8
2013 CA24 (528500, 185500)	49.8	31.0	22.1	15.3
2020 CA24 (528500, 185500)	37.7	24.47	20.5	13.8
2013 CA25 (524500, 184500)	53.4	32.1	22.8	15.7
2020 CA25 (524500, 184500)	36.9	23.8	21.0	14.1
2013 PBN9 (524500, 187500)	50.4	30.9	22.7	15.6
2020 PBN9 (524500, 187500)	40.4	25.5	21.2	14.21

Note: The ratio between PM_{10} and $PM_{2.5}$ in 2013 at the site is 0.69.

Table 3.2 shows that the estimated background concentrations for annual mean NO_2 and PM_{10} used in the assessment are below the annual mean objective limit of 40µg/m³.

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4. METHODOLOGY AND ASSESSMENT CRITERIA

4.1. Methodology

In the UK, the Department for Environment, Food & Rural Affairs (DEFRA) provides guidance on the most appropriate methods to estimate pollutant concentrations for use in Local Air Quality Management (LAQM). DEFRA regularly updates its Technical Guidance, with the latest LAQM Technical Guidance TG (16) published in April 2016. The methodology in TG (16) directs air quality professionals to a number of tools published by DEFRA to predict and manage air quality. For example, it is necessary to use the updated NO_x to NO_2 calculator to derive NO_2 concentrations from the NO_x outputs from BREEZE ROADS modelling. This is because NO_2 concentrations within the model are predicted using the CALINE4 NO_x to NO_2 conversion methodology, which should not be used within the model as current evidence shows that the proportion of primary NO_2 in vehicle exhausts has increased since the model was developed, which would affect the relationship between NO_x and NO_2 at roadside locations.

In order to determine the extent to which air quality issues will affect the development of the site, the study has considered the following:

- Any air quality measurements carried out in the area near the proposed development; and
- London Borough of Camden Council's most recent (2013) air quality data.

4.2. BREEZE ROADS Modelling of Pollutant Concentrations

Dispersion modelling has been undertaken using BREEZE ROADS to determine air quality concentrations across the site. BREEZE ROADS is an air dispersion modelling software suite that predicts air quality impacts of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter (PM), and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roadways and roadway intersections.

BREEZE ROADS can be used in conjunction with the MOBILE5, EMFAC emission models or other emissions data, to demonstrate compliance with the UK's National Air Quality Strategy. BREEZE ROADS predicts air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles operating under free-flow conditions and idling vehicles. In addition, 1-hour and running 8-hour averages of CO or 24-hour and annual block averages of PM_{10} can be calculated.

4.3. Model Set-up Parameters

The most recent Emissions Factor Toolkit (version 6.0.2, July 2014) was used to derive emissions factors (in grams per kilometre) for vehicle movement along roads incorporated into the model. This version includes updates to COPERT NO_x emissions factors for some light duty vehicles, and particulate matter and hydrocarbons are now based on COPERT emissions factors. There have also been updates to the vehicle fleet and age information.

Meteorological data from the nearby Northolt Meteorological Station has been used in the model. Sensitive receptors are also included in the model, focusing on the proposed

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residential properties on the site. The receptor locations used in this model are displayed in **Appendix 2.**

4.4. Local Air Quality Management Technical Guidance (2009) Recommendations

The Local Air Quality Management Technical Guidance (TG(16)) has made recommendations of where the AQS should and should not be applied, as summarised in **Table 4.1**.

As it is not always possible to be prescriptive in this matter, Local Authorities may apply local knowledge and judgement when considering the application of the AQS. The examples given in **Table 4.1** are not intended to be a comprehensive list.

Table 4.1: Examples of Where AQS Should Be Applied

Averaging Period	AQS Should Apply:	AQS Should Not Apply:
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of: • Residential properties • Schools • Hospitals • Care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. • Hotels, unless people live there as their permanent residence. • Residential gardens • Kerbside sites or any other location where public exposure is expected to be short term.
24-hour and 8-hour mean	All locations where the annual mean objective would apply. • Hotels • Residential gardens	Kerbside sites or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. • Kerbside sites (e.g. pavements of busy shopping streets) • Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might spend one hour or more. • Any outdoor locations where members of the public might spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

4.5. Applying the AQS to this Development

This planning application includes rooms which will be used for residential purposes, which according to **Table 4.1** is a location where the AQS calendar year limit value applies. The 24-hour and 1-hour mean objectives will also be considered.

4.6. Assessment Criteria

A detailed assessment was considered appropriate for this proposed development with model results being verified against local monitoring data. This was carried out using the detailed dispersion model BREEZE ROADS.

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For the purposes of this assessment, the limit values assigned to individual pollutants as set out in the Air Quality Standards Regulations 2010 should form the basis of the air quality assessment. The limit values are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether, under normal circumstances, the air quality in the vicinity of a development is likely to be detrimental to human health.

4.7. Construction Phase

During the construction phase, there will be a number of activities undertaken that have the potential to generate and/or re-suspend dust and $PM_{10}/PM_{2.5}$. At the time of assessment the exact activities to be undertaken during construction are unknown. In order to evaluate the magnitude and extent of potential adverse impacts likely to result from the proposed development, the following construction activities have therefore been assumed:

- Demolition;
- site clearance and preparation;
- landscaping;
- construction and fabrication processes;
- internal and external finishing and refurbishment; and
- materials handling, storage, potential spillage and disposal.

The magnitude of the potential impacts of a construction site on air quality is mainly determined by its size, the range of activities undertaken across the site, proximity to sensitive receptors, prevailing wind direction, complexity of terrain and any barriers between sources and receptors.

A qualitative assessment of the potential impacts during construction has been undertaken using information in guidance documents produced by the Building Research Establishment (Control of Dust from Construction and Demolition Activities, 2003) and the recent document produced by the Institute of Air Quality Management (Guidance on the Assessment of Dust from Demolition and Construction, 2014).

Following the release of the IAQM Guidance in January 2014, the assessment criteria have been revised. The dust assessment criteria have now been broken down into five steps;

- Step 1: Screen the need for a detailed assessment;
- Step 2: Assess the risk of dust impacts;
    - Step 2A – determine the scale and nature of the works;
    - Step 2B – assess the sensitivity of the area;
    - Step 2C – combine 2A and 2B to determine the risk of dust impacts;
- Step 3: Site Specific Mitigation;
- Step 4: Determine Significance of Effects;
- Step 5: Dust Assessment Report.

According to this guidance; human receptors include locations where people spend time and where property may be affected by dust. In terms of annoyance effects, this will most commonly relate to the loss of amenity due to dust deposition or visible dust plumes, often related to people making complaints, but not necessarily sufficient to be a statutory nuisance.

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According to IAQM guidance (2014), activities on construction sites can be divided into four types to reflect their different potential impacts, with the potential for dust emissions to be assessed only for each activity taking place:

- demolition;
- earthworks;
- construction; and
- Trackout.

The assessment methodology is to consider three separate dust effects:

- annoyance due to soiling;
- harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10}.

Account is also to be taken of the distance of the receptors that may experience these effects. Receptors, such as residential properties, are generally considered to be of a medium or high sensitivity to the effects of demolition, earthworks and construction when they are situated within 200m of the site boundary. However, depending on the development size, the effects of trackout may be experienced up to 500m from the site exit.

The Windrose in **Appendix 4** identifies the prevailing wind direction in the region is from the south-west. As such, it is expected that receptors located to the north-east of the site will be at most risk of construction dust impacts.

The assessment procedure assumes no mitigation measures are applied to determine a worst case scenario. In practice a significant number of mitigation measures will be implemented on site (please see details in **Section 6.1**) which will result in a negligible risk of dust nuisance. **Tables 4.2** to **4.5** set out the risk category from each of the four types of activity.

Table 4.2: Risk Category from Demolition Activities

Sensitivity of the Area	Dust Emission Class		
	Large	Medium	Small
High	High Risk Site	Medium Risk Site	Medium Risk Site
Medium	High Risk Site	Medium Risk Site	Low Risk Site
Low	Medium Risk Site	Low Risk Site	Negligible

Table 4.3: Risk Category from Earthworks Activities

Sensitivity of the Area	Dust Emission Class		
	Large	Medium	Small
High	High Risk Site	Medium Risk Site	Low Risk Site
Medium	Medium Risk Site	Medium Risk Site	Low Risk Site
Low	Low Risk Site	Low Risk Site	Negligible

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Table 4.4: Risk Category from Construction Activities

Sensitivity of the Area	Dust Emission Class		
	Large	Medium	Small
High	High Risk Site	Medium Risk Site	Low Risk Site
Medium	Medium Risk Site	Medium Risk Site	Low Risk Site
Low	Low Risk Site	Low Risk Site	Negligible

Table 4.5: Risk Category from Trackout

Sensitivity of the Area	Dust Emission Class		
	Large	Medium	Small
High	High Risk Site	Medium Risk Site	Low Risk Site
Medium	Medium Risk Site	Low Risk Site	Negligible
Low	Low Risk Site	Low Risk Site	Negligible

4.8. Operation Phase

The main pollutants of concern for road traffic are generally considered to be NO_2 and PM_{10}. Once construction has been completed, it is not anticipated that the proposed development will have a significant effect on local pollution concentrations as there will be will only be 12 disabled parking spaces on site. As a result it is considered that the traffic generation onto the local highway network associated with the development will be negligible.

The BREEZE ROADS methodology has been used for this assessment to predict the constraints on development. For the assessment, the following scenarios were considered:

- 2013 Model Verification; and
- 2020 Opening Year.

4.9. Identification of Relevant Receptors

To assess the impacts and constraints on development, sensitive receptor locations were identified on the façades of the proposed residential units (Development Receptors) and at local sensitive receptors e.g. residential properties (Existing Receptors). The plans in **Appendix 2** and **Appendix 3** identify the Existing Receptor (ER) and Development Receptor (DR) locations respectively.

4.10. Traffic Data

The BREEZE prediction model requires the user to provide various input data, including the Annual Average Hourly Traffic (AAHT) flow, the proportion of heavy duty vehicles (HDVs), the distance of the road centreline from the receptor and the vehicle speed. Traffic speeds have been estimated from local speed restrictions. Vehicle speeds near junctions, crossings and bus stops were revised downwards to account for queuing traffic.

The traffic information utilised for this assessment is detailed in **Table 4.6** and **Table 4.7** below for both the verification and assessment scenarios. Traffic flow data used in the predictions have been obtained independently from the Department for Transport website.

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The data has been adjusted for the proposed occupation date of 2020 using a worst case traffic growth factor of 1.5% per year between the surveyed years and 2020.

Table 4.6: Traffic Flow Data for Verification (2013)

Location	AAHT	Speed (km/h)	HDV (%)
Model Verification			
Chetwynd Road	541	15	3.4
Finchley Road (north of Golders Green Road)	792	28	6.4
Finchley Road (Golders Green Road to Fortune Green Road)	721	30	9.0
Finchley Road (south of Fortune Green Road)	2,032	22	7.2
Fortune Green Road	663	20	5.4
Golders Green Road	534	14	7.9
Gordon House Road	523	21	6.5
Highgate Road (north of Chetwynd Road)	619	30	7.0
Highgate Road (south of Chetwynd Road)	988	22	6.5
Hodford Road	386	19	6.3
Mill Lane	396	26	4.4
Redington Gardens	163	22	4.1
West End Lane (north of Lymington Road)	364	20	12.0

Table 4.7: Traffic Flow Data Opening Year (2020)

Location	AAHT 2020	Speed (km/h)	HDV (%)
Model Adjustment			
West End Lane	404	20	12.3

4.11. Validation and Verification of the Model

Model validation undertaken by the software developer will not have been carried out in the vicinity of the site being considered in this assessment. As a result, it is necessary to perform a comparison of the modelled results with local monitoring data at suitable locations. This verification process aims to minimise model uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

In respect of NO_2 concentrations, this exercise resulted in an average difference between the modelled and monitored NO_2 roads results of -74.6% (-32.8% for NO_2 total), which indicates that the models are significantly under predicting. When the monitored and modelled results are compared as recommended in TG.16 the road NO_X adjustment factor is **4.4864** (as shown in **Table 4.8**). This factor was applied to all modelled NO_x results prior to calculating modelled NO_2 using the NO_x to NO_2 calculator. In the absence of PM_{10} monitoring within close proximity to the site, the NO_x adjustment factor has also been applied to the PM_{10} modelled concentrations, in accordance with the guidance provided in LAQM TG.16.

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Table 4.8: NO_2 Annual Mean Verification for 2013

Site	Monitored		Modelled		% Difference (NO_2 Total) Before Adjustment	% Difference (NO_2 Total) After Adjustment	Road NO_X Factor
	Road NO_2 µg/m³	Road NO_X[5] µg/m³	Road NO_2 µg/m³	Road NO_X µg/m³			
CA24	16.8	40.7	7.5	17.0	-19.4	24.8	**4.4864**
CA25	30.8	84.1	4.5	10.0	-41.8	-20.1	
PBN9	25.1	64.4	4.2	9.2	-37.3	-14.1	

4.12. CHP and Boiler Assessment

The development proposals include for the provision of 2 No. CHP units and 4 No. boiler units. The exact design and models have not as yet been determined. As a result typical units, which will meet the energy criteria requirements for the development have been used as part of this air quality assessment.

It has been assumed that as a worst case the CHP unit(s) will operate on full load approximately 17 hours a day and the boilers have been modelled for a 24 hour a day operation. Dispersion modelling has been undertaken to determine whether the CHP and boiler units will have a detrimental impact on air quality on the development and existing sensitive receptors.

4.13. Breeze AERMOD Modelling of Pollutant Concentrations

Breeze AERMOD is designed to estimate pollutant concentrations and deposition from an industrial source complex. The model predicts pollutant concentrations from continuous point, flare, area, line, volume, and open pit sources. The model enables the user to estimate concentrations from virtually any type of source emitting a non-reactive pollutant.

AERMOD is an advanced new-generation model developed by the U.S. EPA. This versatile model is the preferred model by the U.S. EPA because of many features including, but not limited to its ability to:

- predict air dispersion fundamentally based on planetary boundary layer turbulence structure;
- estimate concentrations from nearly any type of source emitting non-reactive pollutants;
- process complex and simple terrain data; and
- handle both surface and elevated sources.

4.14. Model Set-up Parameters

The CHP and boiler emission rates and stack specifications are provided within **Table 4.9** below. As NO_x (NO_2) is the primary issue, this will be the only pollutant modelled. The CHP and boiler units which will be used on the proposed development site have not been decided at this point and therefore the modelling has used the following units as examples:

- Boiler system – 4 x Ultramax R604 boilers; and

[5] Obtained from NO_X to NO_2 Calculator Spreadsheet available from http://laqm.defra.gov.uk/

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- CHP system – 2 x EC Power XRGI CHP engines

Meteorological data from the nearby Northolt Meteorological Station has been used in the model.

Table 4.9: Emissions Data for the CHP unit

Input parameter	CHP Unit (2 No. Units)	Boiler Units (4 No. Units)
Stack height (m)	23.5	23.5
Stack internal diameter (m)	0.15	0.40
NO_X Emission rate (g/s)	0.005	0.012
Temperature (°C)	140	70
Volume Flow Rate (m/s)	3.5	2.75
Operating Regime (operating hours per day)	17	24 (worst case)

4.15. Treatment of Model Output

For the purpose of this assessment, the NO_x levels which are determined using the AERMOD dispersion model will be converted to NO_2 using the Air Quality Modelling and Assessment Unit's (AQMAU) Conversion Ratios for NO_x and NO_2.

For the annual mean predicted environmental concentration, the predicted process contributions; (NO_x) from the CHPs, are added to the local background contributions (DEFRA background pollutant concentration maps), and the modelled roads contribution to give a total concentration for the opening year of the development scheme (2020).

4.16. Assessment of $PM_{2.5}$

The 2007 Air Quality Strategy introduced a new exposure reduction regime for $PM_{2.5}$, tiny particles associated with respiratory and cardio-vascular illness and mortality which have no known safe limit for human exposure. The new regime will attempt to reduce the exposure of all urban dwellers, alongside the existing method of reducing hotspots of PM exposure. $PM_{2.5}$ typically makes up two thirds of PM_{10} emissions and concentrations. However, objectives for $PM_{2.5}$ (as shown in **Table 4.10**) are not currently incorporated into Local Air Quality Management regulations, therefore there is no statutory obligation to review and assess air quality against them.

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Table 4.10: National Exposure Reduction Target, Target Value and Limit Value for $PM_{2.5}$

Time Period	Objective/Obligation	To be achieved by
Annual mean	Target value of 25 µg/m³	2010
Annual mean	Limit value of 25 µg/m³	2015
Annual mean	Stage 2 indicative limit value of 20µg/m³	2020
3 year Average Exposure Indicator (AEI)[6]	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
3 year Average Exposure Indicator (AEI)[6]	Exposure concentration obligation of 20µg/m³ (of vegetation)	2015

Presently, BREEZE ROADS does not predict the concentration of $PM_{2.5}$ as part of the methodology therefore the future concentration of $PM_{2.5}$ will be calculated using the typical ratio between the background concentrations of PM_{10} and $PM_{2.5}$ for the opening year of development. This predicted concentration will then be compared against the annual mean Objective Limit value of 25µg/m³.

[6] The 3 year running mean of AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

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5. IMPACTS ON AIR QUALITY

5.1. Predicted Construction Impacts

The main source of dust and PM_{10} during construction activities include:

- Haulage routes, vehicles and construction traffic;
- Materials handling, storage, stockpiling, potential spillage and disposal;
- Exhaust emissions from site plant;
- Site preparation;
- Construction and fabrication processes; and
- Internal and external finishing and refurbishment.

The majority of the releases are likely to occur during the typical 'working-week'. Depending on wind speed and turbulence it is likely that the majority of dust will be deposited in the area immediately surrounding the source (up to 200 metres away). The Windrose in **Appendix 4** shows that the prevailing wind direction for the site is from the south-west. Therefore, properties within 200m to the north-east of the site have the greatest potential to be effected by construction dust. The risk of effects are summarised in **Table 5.1** below.

Table 5.1: Summary of Risk Effects with No Mitigation

Source	Dust Soiling Effects	Ecological Effects	PM_{10} Effects
Demolition	Medium risk	Not applicable	Medium risk
Earthworks	Medium risk	Negligible risk	Medium risk
Construction	Medium risk	Negligible risk	Medium risk
Trackout	Medium risk	Negligible risk	Medium risk

In consideration of the factors described above, an appropriate level of mitigation will be applied to the site during the demolition and construction phases in order to minimise the impact of the construction on the local sensitive receptors to a negligible level.

5.2. Air Quality Impact of Traffic - Acceptability Criteria

It is common in the UK to use the Environmental Protection UK's (EPUK) Guidance[7] on Air Quality Assessments for Planning Applications to assess the impact of a development. This advises that an air quality assessment will be required where the development is anticipated to give rise to significant changes in air quality. There will also be a need to assess air quality implications of a development where a significant change in relevant exposure is anticipated. A full air quality assessment should normally be undertaken where proposals give a rise to significant changes in either volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of +-5% or +-10%, depending on local circumstances, or in vehicle speed (or both), usually on a road with more than 10,000 AADT (5,000 if narrow and congested). It also advises of the need for an assessment where the proposals will:

- generate or increase congestion;
- alter the traffic composition on local roads;

[7] Environmental Protection UK (2010 Update) – Development Control: Planning for Air Quality

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- include significant new car parking;
- significantly affect nitrogen deposition on sensitive habitats;
- introduce new exposure close to existing sources of air pollutants;
- include biomass boilers or biomass-fuelled CHP plant;
- include centralised boilers of CHP;
- give rise to potentially significant impacts during construction; or
- include a large, long-term construction site.

5.3. Air Quality Impact of Traffic - Assessment

In 2013, the average number of vehicles per day on West End Lane was 8,747 vehicles. Over time, the transport sector is expected to grow by approximately 1.5% per year, which will bring this daily traffic flow up to approximately 9,283 vehicles by 2020, the opening year of the proposed development.

The scheme proposes only 12 on-site disabled parking spaces and therefore the development will not have an adverse air quality impact in respect of generated traffic flows onto the local highway network.

5.4. Air Quality Impacts

In May 2015, Environmental Protection UK (EPUK) and the Institution of Air Quality Management (IAQM) updated their guidance on "Land-Use Planning and Development Control: Planning for Air Quality". The guidance provides a methodology for determining the impacts of increased pollutant concentrations at sensitive receptor locations resulting from emission sources such as the generate traffic from the site.

Table 5.2: Impacts of Pollutants

Long Term Average Concentration in Assessment Year	% Change in Concentration relative the Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

The AQAL is the Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level'

5.5. Predicted Constraints on Development

To characterise the air quality at the proposed development, predictions of air pollutant concentrations have been made for an occupation year of 2020 using the BREEZE ROADS dispersion model. The results of the predictions which include the road NO_X adjustment factor (**Table 4.8**) can be seen in **Tables 5.3** to **5.5**.

5.6. Annual Mean NO_2 Concentrations

Pollutant concentrations of NO_2 have been compared to the annual mean limit value. The maximum concentration predicted for the site is 31.0µg/m^3, which is predicted at receptor DR07 and therefore no mitigation is required.

Due to the small predicted changes in traffic from the redevelopment of the site, the development will have an imperceptible change on local NO_2 annual mean concentrations at the existing sensitive receptors.

As the dispersion of air pollution generated by vehicle traffic improves with elevation above ground level and because exceedances were not identified on the second to fifth floors, exceedances of the NO_2 annual mean NAQO would also not occur on any of the floors above.

5.7. NO_2 1-hour Exposure Assessment

According to guidance, there is only a risk that the NO_2 1-hour objective (200µg/m^3) could be exceeded if the annual mean NO_2 concentration is greater than 60µg/m^3. At the development site, the worst case annual mean predicted is 31.1µg/m^3; therefore hourly exceedances would not be expected

Table 5.3: Predicted NO_2 Concentrations – Development site 2020

Receptor Locations	Receptor ID	Air Quality Objective Level µg/m^3	Total NO_2 Roads µg/m^3	Total NO_2 Roads + CHP µg/m^3
Lower Ground Floor	DR01	40	26.9	28.2
	DR02	40	26.9	28.8
	DR03	40	26.9	28.2
	DR04	40	26.6	26.7
	DR05	40	26.6	26.9
	DR06	40	26.7	27.2
Ground Floor	DR07	40	28.2	28.3
	DR08	40	27.2	27.6
	DR09	40	26.6	26.7
	DR10	40	26.6	26.9
	DR11	40	27.4	27.6
	DR12	40	28.0	28.1
First Floor	DR13	40	31.0	31.1
	DR14	40	28.1	28.2
	DR15	40	27.2	27.6
	DR16	40	26.6	26.7
	DR17	40	26.6	26.9
	DR18	40	27.4	27.6
	DR19	40	28.1	28.2

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Second Floor	DR20	40	30.0	30.1
	DR21	40	30.0	30.1
	DR22	40	27.9	28.0
	DR23	40	27.1	27.4
	DR24	40	26.6	26.7
	DR25	40	26.5	26.8
	DR26	40	27.3	27.4
	DR27	40	27.9	28.0
Third Floor	DR28	40	28.3	28.4
	DR29	40	28.3	28.4
	DR30	40	27.1	27.3
	DR31	40	26.5	26.6
	DR32	40	26.5	26.9
	DR33	40	27.0	27.4
	DR34	40	27.7	27.8
Fourth Floor	DR35	40	27.4	27.5
	DR36	40	27.4	27.5
	DR37	40	27.0	27.2
	DR38	40	26.5	26.7
	DR39	40	26.5	26.9
	DR40	40	26.9	27.0
	DR41	40	27.5	27.6
Fifth Floor	DR42	40	26.9	27.0
	DR43	40	26.9	27.0
	DR44	40	26.9	27.4
	DR45	40	26.5	26.8
	DR46	40	26.5	27.0
	DR47	40	26.9	27.5
	DR48	40	27.1	27.3

5.8. Annual Mean NO_2 Concentrations – Existing Receptors

Based on the modelling undertaken the maximum increase in NO_2 concentrations at the sensitive receptors in close proximity to the development site is 0.5µg/m^3 (ER04 and ER05) (identified in **Table 5.4**). According to the EPUK & IAQM Guidance, this would fall within 2-5% of the AQAL (1.5% would be rounded up to 2%, the nearest whole value).

At the worst case receptor (ER04) the annual predicted NO_2 pollutant concentrations would be within the 76% and 94% band of the AQAL and therefore the impact of CHP plant and boilers on the worst case closest sensitive receptor would be “slight”.

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Table 5.4: Predicted NO_2 Concentration - Impacts from development in 2020

Receptor ID	Air Quality Objective Level µg/m³	Total NO_2 without CHP (µg/m³)	Total NO_2 with CHP development (µg/m³)	Total NO_2 Change (µg/m³)
ER01	40	34.8	34.9	0.1
ER02	40	33.8	33.9	0.1
ER03	40	27.1	27.4	0.3
ER04	40	26.7	27.2	0.5
ER05	40	26.6	27.1	0.5

5.9. Annual Mean PM_{10} Concentrations

The highest predicted annual PM_{10} concentration at the site is 21.1µg/m³. The pollutant concentrations in **Table 5.3** have been compared to the annual mean limit value for PM_{10} and it is apparent that the concentrations at the site are significantly below the Objective Level.

The number of days exceeding the 50µg/m³ limit is below the 35 days Objective identified in the NAQO at the modelled receptor locations. Accordingly, it is considered that PM_{10} in 2020 will not be a constraint on the development of the site, and that no mitigation measures are necessary to protect the future residential occupants from exceedances of PM_{10}.

5.10. PM_{10} 24-hour Exposure Assessment

There are no exceedances of 32µg/m³ as an annual mean PM_{10} predicted concentration; therefore exceedances of the 24-hour mean objective are unlikely with the implementation of the proposed development.

Table 5.5: Predicted PM_{10} Concentrations 2020

Receptor Locations	Receptor ID	Air Quality Objective Level µg/m³	Total PM_{10} Do-Something µg/m³ (Days >50 µg/m³)[8]
Lower Ground Floor	DR01	40	20.8 (4)
	DR02	40	20.7 (4)
	DR03	40	20.7 (4)
	DR04	40	20.7 (4)
	DR05	40	20.7 (4)
	DR06	40	20.7 (4)
Ground Floor	DR07	40	20.8 (5)
	DR08	40	20.7 (4)
	DR09	40	20.7 (4)
	DR10	40	20.7 (4)
	DR11	40	20.8 (4)
	DR12	40	20.8 (4)

[8] Not to be exceeded more than 35 times a year

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First Floor	DR13	40	21.1 (5)
	DR14	40	20.8 (5)
	DR15	40	20.7 (4)
	DR16	40	20.7 (4)
	DR17	40	20.7 (4)
	DR18	40	20.8 (4)
	DR19	40	20.8 (4)
Second Floor	DR20	40	21.0 (5)
	DR21	40	21.0 (5)
	DR22	40	20.8 (4)
	DR23	40	20.7 (4)
	DR24	40	20.7 (4)
	DR25	40	20.7 (4)
	DR26	40	20.8 (4)
	DR27	40	20.8 (4)
Third Floor	DR28	40	20.9 (5)
	DR29	40	20.9 (5)
	DR30	40	20.7 (4)
	DR31	40	20.7 (4)
	DR32	40	20.7 (4)
	DR33	40	20.7 (4)
	DR34	40	20.8 (4)
Fourth Floor	DR35	40	20.8 (4)
	DR36	40	20.8 (4)
	DR37	40	20.7 (4)
	DR38	40	20.7 (4)
	DR39	40	20.7 (4)
	DR40	40	20.7 (4)
	DR41	40	20.8 (4)
Fifth Floor	DR42	40	20.7 (4)
	DR43	40	20.7 (4)
	DR44	40	20.7 (4)
	DR45	40	20.7 (4)
	DR46	40	20.7 (4)
	DR47	40	20.7 (4)
	DR48	40	20.7 (4)

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5.11. Annual Mean $PM_{2.5}$ Concentrations

The pollutant concentrations in **Table 5.4** have been compared to the annual mean limit value for $PM_{2.5}$ and it is apparent that the concentrations at the site are well below the Objective Level. In terms of the development receptors, a maximum concentration of 14.6µg/m^3 was calculated using the PM_{10} predicted concentration and the ratio between PM_{10} and $PM_{2.5}$. Accordingly, $PM_{2.5}$ in 2020 will not be a constraint on the development of the site, and no mitigation measures are necessary to protect the future residential occupants from exceedances of $PM_{2.5}$.

Table 5.6: Predicted $PM_{2.5}$ Concentrations 2020

Receptor Locations	Receptor ID	Air Quality Objective Level µg/m^3	Total $PM_{2.5}$ Do-Something µg/m^3
Lower Ground Floor	DR01	25	14.3
	DR02	25	14.3
	DR03	25	14.3
	DR04	25	14.3
	DR05	25	14.3
	DR06	25	14.3
Ground Floor	DR07	25	14.4
	DR08	25	14.3
	DR09	25	14.3
	DR10	25	14.3
	DR11	25	14.3
	DR12	25	14.4
First Floor	DR13	25	14.6
	DR14	25	14.4
	DR15	25	14.3
	DR16	25	14.3
	DR17	25	14.3
	DR18	25	14.3
	DR19	25	14.4
Second Floor	DR20	25	14.5
	DR21	25	14.5
	DR22	25	14.4
	DR23	25	14.3
	DR24	25	14.3
	DR25	25	14.3
	DR26	25	14.3
	DR27	25	14.4
Third Floor	DR28	25	14.4

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	DR29	25	14.4
	DR30	25	14.3
	DR31	25	14.3
	DR32	25	14.3
	DR33	25	14.3
	DR34	25	14.4
Fourth Floor	DR35	25	14.3
	DR36	25	14.3
	DR37	25	14.3
	DR38	25	14.3
	DR39	25	14.3
	DR40	25	14.3
	DR41	25	14.3
Fifth Floor	DR42	25	14.3
	DR43	25	14.3
	DR44	25	14.3
	DR45	25	14.3
	DR46	25	14.3
	DR47	25	14.3
	DR48	25	14.3

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6. MITIGATION

6.1. Construction Phase

There are a number of Best Practice mitigation measures that can be used by contractors to ensure that the impacts experienced in close proximity to the construction site are minimal. These include:

- Effective site planning:
    - On site boundary, display name of site air quality manager for the site, and contact details for head office;
    - Compile a risk-based Dust Management Plan and get approval by LBC;
    - Record details of all dust and air quality complaints made and of all significant air quality incidents. Make complaints log available to LBC upon request;
    - Erect solid barriers around the site boundary or dust-generating activities being undertaken for an extensive period;
    - Remove dust generating activities from site and cover or screen potentially dusty objects (e.g. stockpiles, goods coming into site);
    - Use mains powered generators and switch off vehicles when idle;
    - Employ dust suppression or minimisation techniques during site operations and ensure dust suppression equipment is accessible; and,
    - Minimise drop heights from conveyors and loading shovels, etc.
- Demolition measures:
    - Ensure water suppression mechanisms in place during demolition works;
    - Avoid explosive blasting; and,
    - Soft strip buildings and/or dampen materials before demolition takes place.

If Best Practice mitigation techniques are implemented, it is considered that the potentially significant impact from the construction phase would be negligible.

6.2. Operation Phase

There are no predicted exceedences of any of the pollutants on the proposed development and therefore mitigation will not be required.

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7. RESIDUAL EFFECTS

7.1. Construction Impacts on Local Air Quality

The implementation of Best Practice mitigation techniques will ensure the formation of dust and harmful emissions from the construction site are minimised as much as practicable. As such, the likely significant impact from the construction phase will reduce to negligible with the implementation of Best Practice mitigation.

7.2. Operation Impacts on Local Air Quality

Due to the very small increase in traffic movements as a result of the development, there will not be any significant impacts on air quality

The worst case impact of the CHP and boilers on two local sensitive receptors to the north of the site will be “slight”, and there will be no exceedences of the AQAL and therefore the impact is not considered to be significant.

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8. CONCLUSIONS

During the construction phase, the estimated magnitude of impacts associated with the proposed development, assuming the mitigation measures recommended in **Section 6.1** are implemented, is negligible.

In terms of the operation phase, BREEZE Roads calculations have predicted that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ will not exceed the NAQO's. As a result, the development of this site should not be constrained in any way by air quality.

Additionally, as there will not be any significant vehicle movements associated with the development, traffic generation onto the local traffic network will have an insignificant impact on air quality for occupiers of existing local residential property. There will be a "slight" impact at two of the local sensitive existing receptors however this will not result in the exceedence of the AQAL.

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Appendix 1
Glossary of Terms

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Appendix 1: Glossary of Terms

Air Quality Standard (AQS): The concentrations of pollutants in the atmosphere, which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive sub groups.

Air Quality Management Area (AQMA): An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.

Benzene: A VOC which is a minor constituent of petrol. The main sources of benzene in the atmosphere in Europe are the distribution and combustion of petrol. Of these, combustion by petrol vehicles is the single biggest source (70% of total emissions).

Calendar Year: The average of the concentrations measured for each pollutant for one year. In the case of the AQS this is for a calendar year.

Concentration: The amount of a (polluting) substance in a volume (of air), typically expressed as a mass of pollutant per unit volume of air (for example, micrograms per cubic metre, $\mu g/m^3$) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).

Exceedance: A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.

Nitrogen Oxides: Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released to the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO_2), which is harmful to health. NO_2 and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).

Particulate Matter: Fine Particles are composed of a wide range of materials arising from a variety of sources including combustion sources (mainly road traffic), and coarse particles, suspended soils and dust from construction work. Particles are measured in a number of different size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM_{10} (less than 10 microns in aero-dynamic diameter), but the finer fractions such as $PM_{2.5}$ (less than 2.5 microns in aero-dynamic diameter) is becoming of increasing interest in terms of health effects.

$\mu g/m^3$ micrograms per cubic metre of air: A measure of concentration in terms of mass per unit volume. A concentration of 1 $\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

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Appendix 2
Site Location with Existing Receptors

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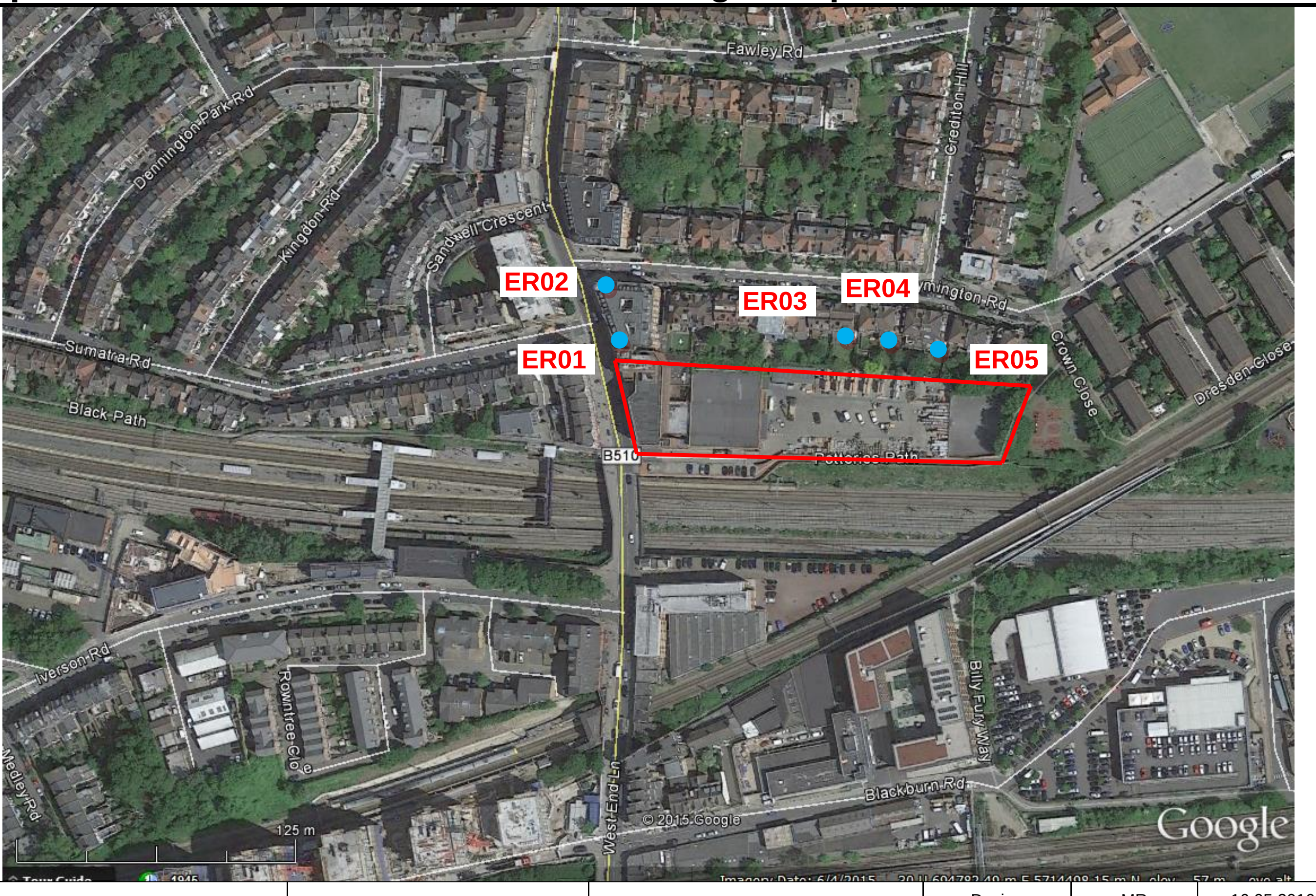
Appendix 2: Site Location Plan with Existing Receptors



LEGEND

Site Boundary

Client: A2 Dominion Development Limited	Description: Site Location Plan		Design	MR	16.05.2016	accon UK ENVIRONMENTAL CONSULTANTS	
			Drawn	MR	16.05.2016		
Rev: A	Description: FINAL	Project: West End Lane	Checked	MR	16.05.2016	*Appendix 2.1*	
			Approved	GP	16.05.2016	Scale	Not to Scale

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Appendix 3
Proposed Plans with Development Receptors

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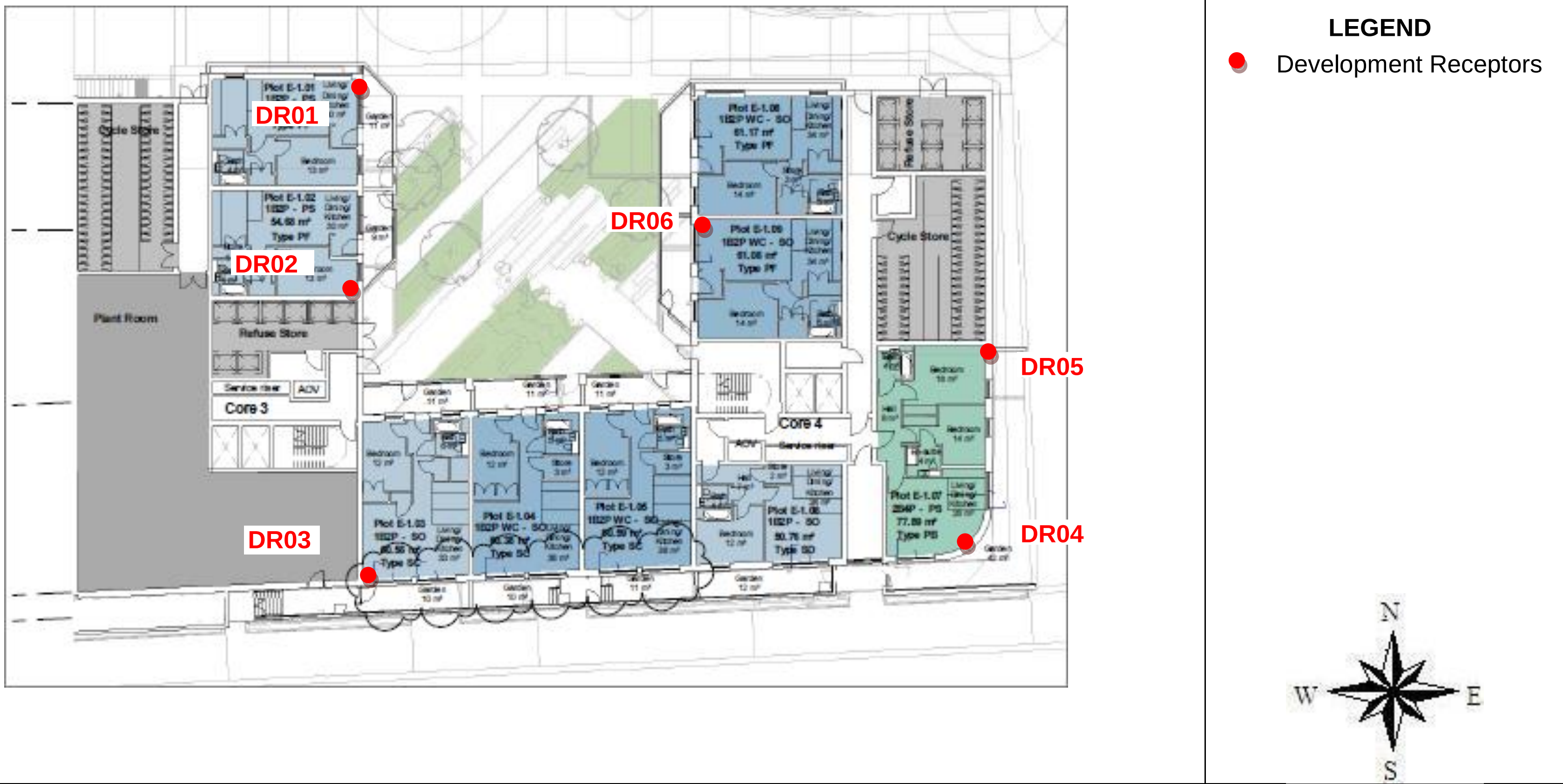
Appendix 3: Lower Ground Floor Site Plan with Development Receptor Locations



Client: A2 Dominion Development Limited		Description: Lower Ground Floor Site Plan with Development Receptor Locations	Design	MR	16.05.2016	ACCON UK ENVIRONMENTAL CONSULTANTS
			Drawn	MR	16.05.2016	
Rev: A	Description: FINAL	Project: 156 West End Lane, West Hampstead	Checked	MR	16.05.2016	*Appendix 3*
			Approved	GP	16.05.2016	Scale: Not to Scale

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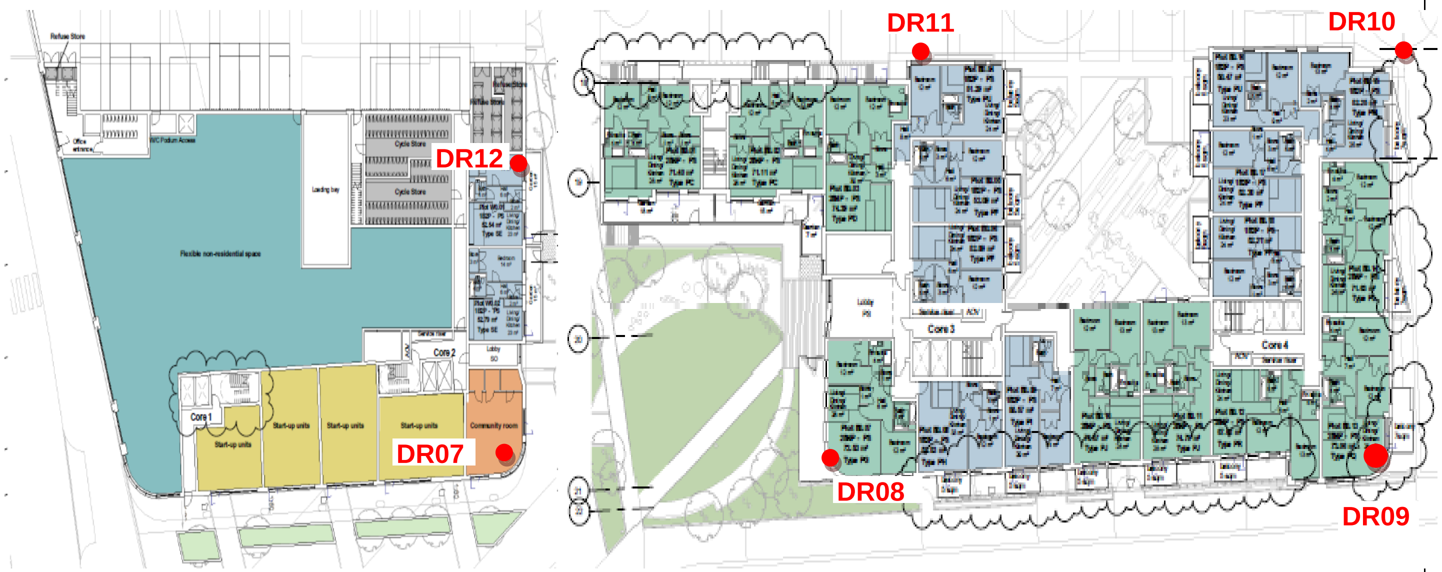
Appendix 3: Ground Floor Site Plan with Development Receptor Locations

LEGEND

Development Receptors



Client: A2 Dominion Development Limited		Description: Ground Floor Site Plan with Development Receptor Locations		Design	MR	16.05.2016	ACCON UK ENVIRONMENTAL CONSULTANTS	
				Drawn	MR	16.05.2016		
Rev: A	Description: FINAL	Project: 156 West End Lane, West Hampstead		Checked	MR	16.05.2016	*Appendix 3*	
				Approved	GP	16.05.2016	Scale	Not to Scale

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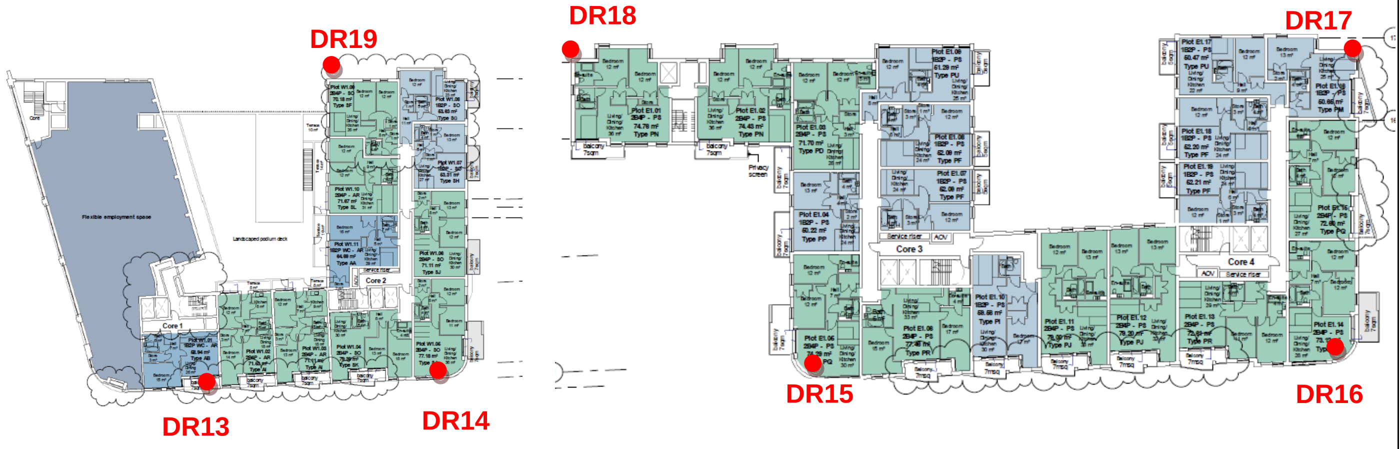
Appendix 3: First Floor Site Plan with Development Receptor Locations



LEGEND

Development Receptors

Client: A2 Dominion Development Limited		Description: First Floor Site Plan with Development Receptor Locations		Design	MR	16.05.2016	ACCON UK ENVIRONMENTAL CONSULTANTS
				Drawn	MR	16.05.2016	
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				Approved	GP	16.05.2016	Scale: Not to Scale

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Appendix 3: Second Floor Site Plan with Development Receptor Locations

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Development Receptors

Client: A2 Dominion Development Limited		Description: Second Floor Site Plan with Development Receptor Locations	Design	MR	16.05.2016	ACCON UK ENVIRONMENTAL CONSULTANTS
			Drawn	MR	16.05.2016	
Rev: A	Description: FINAL	Project: 156 West End Lane, West Hampstead	Checked	MR	16.05.2016	*Appendix 3*
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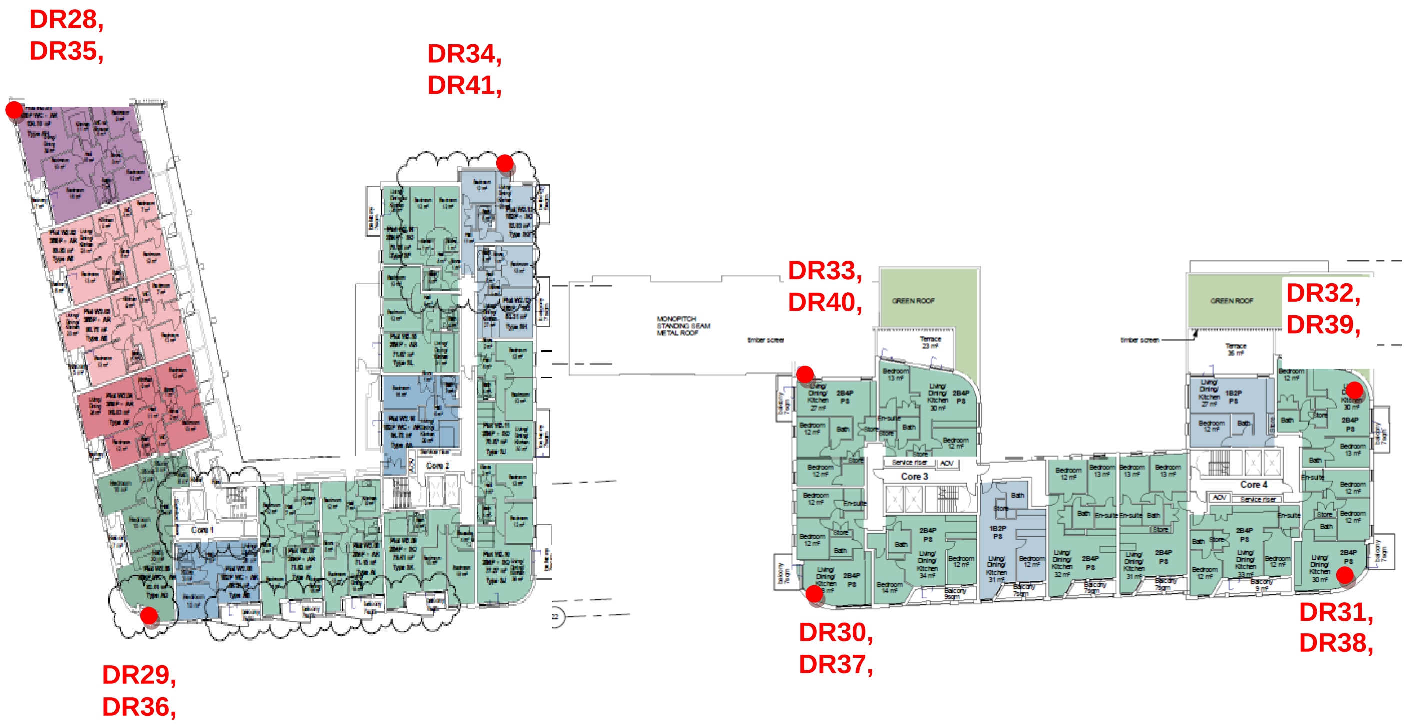
Appendix 3: Third, and Fourth Floor Site Plans with Development Receptor Locations



LEGEND

● Development Receptors

DR28-DR34 = Third Floor

DR35-DR41 = Fourth Floor

Client: A2 Dominion Development Limited		Description: Third – & Fourth Floor Site Plan with Development Receptor Locations		Design	MR	16.05.2016
				Drawn	MR	16.05.2016
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				Approved	GP	16.05.2016

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Scale	Not to Scale

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Appendix 3: Fifth Floor Site Plan with Development Receptor Locations

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Development Receptors

DR42 – DR48 = Fifth Floor

Client: A2 Dominion Development Limited		Description: Fifth Floor Site Plan with Development Receptor Locations	Design	MR	16.05.2016	ACCON UK ENVIRONMENTAL CONSULTANTS
			Drawn	MR	16.05.2016	
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			Approved	GP	16.05.2016	Scale: Not to Scale

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Appendix 4
Air Quality Standards

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Appendix 4: Air Quality Standards

Pollutant	Averaging Period	Limit Value	Margin of Tolerance
Benzene	Calendar Year	5µg/m3	
Carbon Monoxide	Maximum daily running 8 Hour Mean	10mg/m3	
Lead	Calendar Year	0.5µg/m3	100%
Nitrogen Dioxide	One Hour	200µg/m3 Not to be exceeded more than 18 times per year	
	Calendar Year	40µg/m3	
Particles (PM_{10})	One day	50µg/m3 Not to be exceeded more than 35 times per year	50%
	Calendar Year	40µg/m3	20%
Particles ($PM_{2.5}$)	Calendar Year	25µg/m3	20%
Sulphur Dioxide	One Hour	350µg/m3 Not to be exceeded more than 24 times per calendar year	150 µg/m3
	One Day	150µg/m3 Not to be exceeded more than 3 times per calendar year	

Notes:
µg/m3 - micrograms per cubic metre
mg/m3 - milligrams per cubic metre

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Appendix 5
Northolt Meteorological Station Windrose

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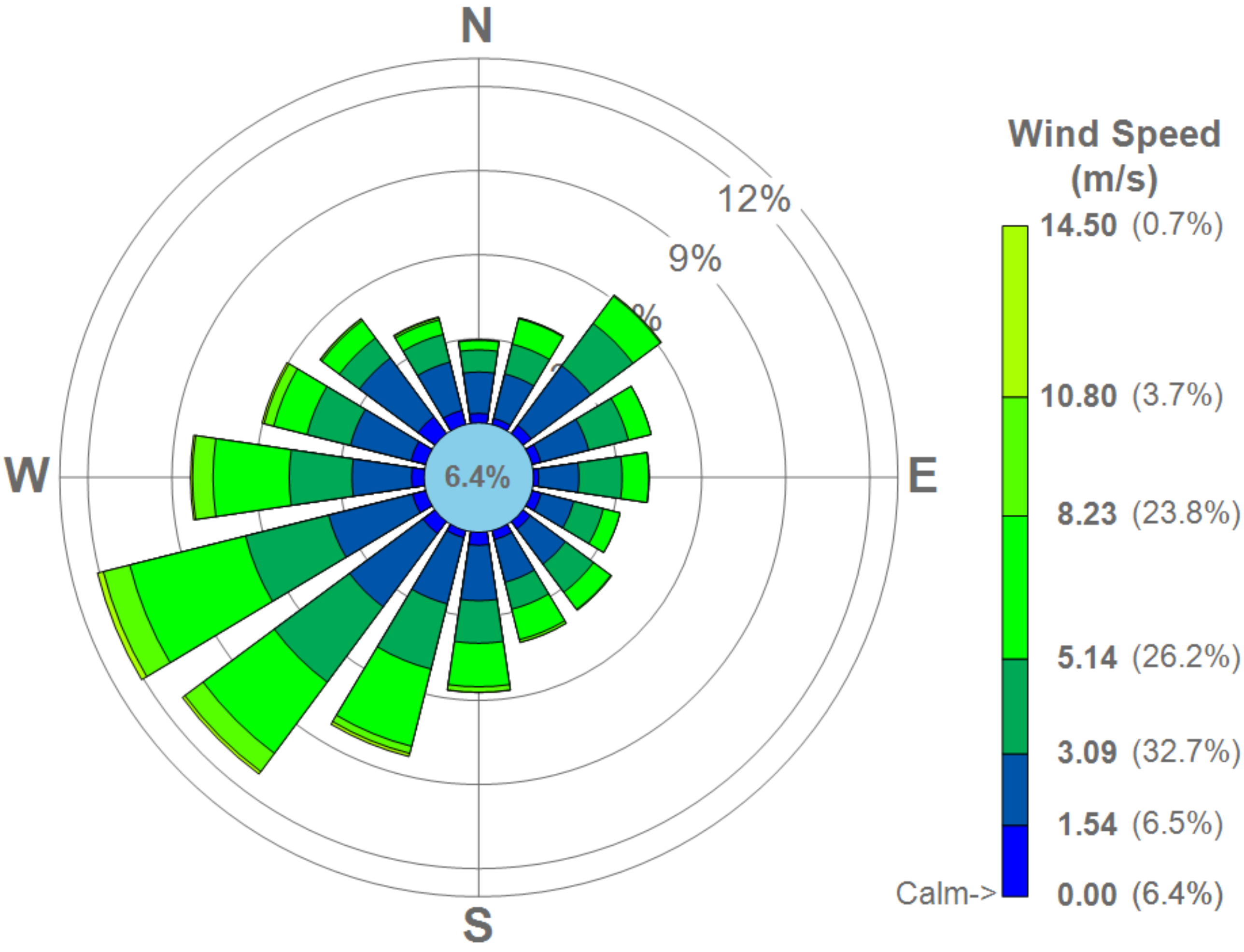
Appendix 5: Northolt Meteorological Station Windrose



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