Air Quality Assessment:
Belgrove House, Camden

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Experts in air quality
management & assessment

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed commercial development of Belgrove House. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Precis Advisory / Access Self Storage.

1.2 The proposed development involves the redevelopment of Belgrove House as a part five, part ten storey building, for use as office and research laboratory floorspace for the life sciences sector incorporating public access at ground level, which are sensitive to the short-term air quality objectives. St Chad's Street to the south east of the proposed development will be permanently closed at the start of construction. The application site lies within a borough-wide Air Quality Management Area (AQMA) declared by the London Borough of Camden (LBC) for exceedances of both the annual mean nitrogen dioxide (NO_2) objective and the 24-hour mean particulate matter (PM_{10}) objective. The proposed development will lead to changes in vehicle flows on local roads, which may impact on air quality at existing residential properties. The users of Belgrove House will also be subject to the impacts of emissions from the adjacent road network. Although offices are not considered relevant exposure with respect to the air quality objectives, assessment of these locations has been carried out at the request of the client. The main air pollutants of concern related to road traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.3 The proposed development will be provided with heat and hot water by air source heat pumps, which will not result in any local emissions to air. There will, however, be two emergency backup generators, emissions from which may impact on air quality at both existing residential receptors and the future users of the proposed development itself.

1.4 The Greater London Authority's (GLA's) London Plan (GLA, 2016) requires new developments to be air quality neutral. The air quality neutrality of the proposed development has, therefore, been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

1.5 The GLA has also released Supplementary Planning Guidance on the Control of Dust and Emissions from Construction and Demolition (GLA, 2014b). The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will need to be applied. A construction dust assessment has been undertaken and the appropriate mitigation has been set out.

1.6 This report describes existing local air quality conditions (base year 2019), and the predicted air quality in the future assuming that the proposed development does or does not proceed. The assessment of traffic-related impacts focuses on 2024, which is the anticipated year of opening. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.7 This report has been prepared taking into account of all relevant local and national guidance and regulations, and follows a methodology agreed with LBC.

2 Policy Context and Assessment Criteria

2.1 The United Kingdom formally left the European Union (EU) on 31 January 2020; until the end of 2020 there will be a transition period while the UK and EU negotiate additional arrangements. During this period EU rules and regulations will continue to apply to the UK. All European legislation referred to in this report is written into UK law and will remain in place beyond 2020, unless amended, although there is uncertainty at this point in time as to who will enforce the requirements of some of this legislation.

Air Quality Strategy

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

The Environmental Permitting (England and Wales) (Amendment) Regulations 2018

2.3 The Medium Combustion Plant Directive (MCPD) (The European Parliament and the Council of the European Union, 2015) regulates pollutant emissions from combustion plant with a rated input between 1 and 50 megawatts (MW_{th}) and was transposed into UK law in January 2018 through an amendment to the Environmental Permitting Regulations (2018). The legislation sets emission limits to be applied from December 2018 for new plant and from 2025 or 2030 for existing plant (depending on the rated input). The backup generators within the proposed development will be tested for fewer than 50 hours per year and are exempt from requiring a permit.

Clean Air Act 1993 & Environmental Protection Act

2.4 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993 (1993). This requires the local authority to approve the chimney height. Plant which are smaller than 366 kW have no such requirement. The local authority’s approval will, therefore, be required for the emergency diesel generators to be installed in the proposed development.

2.5 Measures to ensure adequate dispersion of emissions from discharging stacks and vents are included in Technical Guidance Note D1 (Dispersion) (1993), issued in support of the Environmental Protection Act (1990).

Clean Air Strategy 2019

2.6 The Clean Air Strategy (Defra, 2019a) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

2.7 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

2.8 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The Government has since announced *"plans to bring forward an end to the sale of new petrol and diesel cars and vans to 2035, or earlier if a faster transition is feasible, subject to consultation, as well as including hybrids for the first time"*. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

Planning Policy

National Policies

2.9 The National Planning Policy Framework (NPPF) (2019a) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which is an environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently,

minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.10 To prevent unacceptable risks from air pollution, the NPPF states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality".

and

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".

2.11 More specifically on air quality, the NPPF makes clear that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan".

2.12 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019b), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified".

2.13 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

2.14 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*". In addition, the PPG makes clear that *"Odour and dust can also be a planning concern, for example, because of the effect on local amenity"*.

2.15 Regarding the need for an air quality assessment, the PPG states that:

"Whether 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 have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity".

2.16 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

2.17 The PPG also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".

London-Specific Policies

2.18 The key London-specific policies are summarised below, with more detail provided, where required, in Appendix A1.

The London Plan

2.19 The London Plan (GLA, 2016) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to air quality.

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

2.21 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

2.22 The 'Intend to Publish' version of the new London Plan was published in December 2019 (GLA, 2019a), incorporating consolidated changes to previous versions suggested by the Mayor of London, as well as addressing the Inspectors' recommendations following the 2019 Examination in Public. Despite not yet being adopted, the 'Intend to Publish' London Plan is a material consideration in planning decisions and is afforded considerable weight. Policy SI1 on 'Improving Air Quality' states that:

"Development plans, through relevant strategic, site specific and area-based policies should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality".

2.23 It goes on to detail that development proposals should not:

- *"lead to further deterioration of existing poor air quality*
- *create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits*
- *create unacceptable risk of high levels of exposure to poor air quality".*

London Environment Strategy

2.24 The London Environment Strategy was published in May 2018 (GLA, 2018a). The strategy considers air quality in Chapter 4; the Mayor's main objective is to create a *"zero emission London by 2050".* Policy 4.2.1 aims to *"reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport".* An implementation plan for the strategy has also been published which sets out what the Mayor will do between 2018 and 2024 to help achieve the ambitions in the strategy.

Mayor's Transport Strategy

2.25 The Mayor's Transport Strategy (GLA, 2018b) sets out the Mayor's policies and proposals to reshape transport in London over the next two decades. The Strategy focuses on reducing car dependency and increasing active sustainable travel, with the aim of improving air quality and creating healthier streets. It notes that development proposals should *"be designed so that walking and cycling are the most appealing choices for getting around locally".*

GLA SPG: Sustainable Design and Construction

2.26 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a) provides details on delivering some of the priorities in the London Plan. Section 4.3 covers Air Pollution. It defines when developers will be required to submit an air quality assessment, explains how location and transport measures can minimise emissions to air, and provides emission standards for gas-fired boilers, Combined Heat and Power (CHP) and biomass plant. It also sets out, for the first time, guidance on how Policy 7.14B(c) of the London Plan relating to 'air quality neutral' (see Paragraph 2.21, above) should be implemented.

GLA SPG: The Control of Dust and Emissions During Construction and Demolition

2.27 The GLA's SPG on The Control of Dust and Emissions During Construction and Demolition (GLA, 2014b) outlines a risk assessment based approach to considering the potential for dust generation from a construction site, and sets out what mitigation measures should be implemented to minimise the risk of construction dust impacts, dependent on the outcomes of the risk assessment. This guidance is largely based on the Institute of Air Quality Management's (IAQM's) guidance (IAQM, 2016), and it states that "*the latest version of the IAQM Guidance should be used*".

Air Quality Focus Areas

2.28 The GLA has identified 187 air quality Focus Areas in London. These are locations that not only exceed the EU annual mean limit value for nitrogen dioxide, but also have high levels of human exposure. They do not represent an exhaustive list of London's air quality hotspot locations, but locations where the GLA believes the problem to be most acute. They are also areas where the GLA considers there to be the most potential for air quality improvements and are, therefore, where the GLA and Transport for London (TfL) will focus actions to improve air quality. The proposed development is located within the Marylebone Road from Marble Arch/Euston/King's Cross Junction air quality Focus Area and close to the King's Cross/Caledonian Road air quality Focus Area.

Local Transport Plan

2.29 Objective 5 of the Healthy Streets, Healthy Travel, Healthy Lives: Camden Transport Strategy 2019-2041 (London Borough of Camden, 2019c) aims to 'reduce and mitigate the impact of transport-based emissions…' through a number of policies, which include, but at not limited to:

- Continuing to develop a comprehensive network of electric vehicle charging points;
- Working towards the World Health Organisation limits for particulate matter and nitrogen dioxide by 2030;
- Using air quality indicators as key factors in prioritising locations for LIP-funding through the Healthy Streets projects;

- Incentivising the update of electric vehicles; and
- Establishing the highest standards for the Council's own vehicle fleet.

Local Policies

2.30 Camden adopted its Local Plan in July 2017 (London Borough of Camden, 2017). This document sets out the planning policies for the Borough and replaces the Core Strategy and Development Policies planning documents.

2.31 Policy A1 on managing the impact of development states that *"The Council will seek to protect the quality of life of occupiers and neighbours"* and will *"seek to ensure that the amenity of communities, occupiers and neighbours is protected […] and require mitigation measures where necessary".* Factors that will be considered include odour, fumes and dust.

2.32 Policy CC4 on air quality states that *"The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough. The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both exposure of occupants to air pollution and the effect of the development on air quality. […] Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors in locations of poor air quality will not be acceptable unless designed to mitigate the impact. Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emission impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan."*

2.33 LBC has also published a 'Camden Planning Document' specifically pertaining to air quality, which forms a Supplementary Planning Document (SPD) (London Borough of Camden, 2019a). This provides information on air quality in the borough and supports Local Plan Policy CC4 Air Quality.

Air Quality Action Plans

National Air Quality Plan

2.34 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018a) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a CAZ. There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.35 LBC has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough. The Council has since developed a Clean Air Action Plan (London Borough of Camden, 2016). This sets out a series of measures to monitor air quality, reduce emissions from buildings and transport, and raise awareness. Action 14 in reducing emissions from buildings is to *"minimise emissions from the construction and operation of new developments by requiring developers to adhere to current and any superseding best practice guidance and supplementary planning guidance."*

Assessment Criteria

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

2.37 The UK-wide objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2018b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour mean PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 $\mu g/m^3$ (Defra, 2018b). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 $\mu g/m^3$ it is unlikely that the 24-hour mean objective will be exceeded.

2.38 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2018b). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels or offices. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

2.39 The proposed development will include office space with public events space to be located at ground level. The annual mean objectives thus do not apply at the proposed development, with the 1-hour mean nitrogen dioxide objective applying at ground level only, where public events will be held. However, at the request of the client, and in order to ensure the proposed design accounted for exposure to air pollution and provided future users with 'acceptable' air quality, compliance with the annual mean and 24-hour mean objectives has also been considered in this assessment, and has formed the basis of the conclusions presented in this report.

2.40 EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010). The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU).

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

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

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m³
Fine Particles (PM_{10})	24-hour Mean	50 µg/m³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m³ [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m³

[a] A proxy value of 32 µg/m³ as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2018b).

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Construction Dust Criteria

2.42 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the IAQM[1] (2016) has been used (the GLA's SPG (GLA, 2014b) recommends that the assessment be based on the latest version of the IAQM guidance). Full details of this approach are provided in Appendix A2.

Screening Criteria for Road Traffic Assessments

2.43 Environmental Protection UK (EPUK) and the IAQM recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality impacts. The approach, as described in Appendix A3, first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment. The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required, although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative"*, and *"it may be appropriate to amend them on the basis of professional judgement"*.

Screening Criteria for Point Source Assessments

2.44 EPUK and the IAQM have developed an approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from point sources, such as combustion plant, have the potential for significant air quality impacts. The first step of the approach, as described in Appendix A3, is to screen the emissions and the emissions parameters to determine whether an assessment is necessary:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

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

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

2.45 This screening approach requires professional judgement, and the experience of the consultants preparing the assessment is set out in Appendix A4.

2.46 If it is determined that an assessment of the point source emissions is required then there is a further stage of screening that can be applied to the model outputs. The approach is that any change in concentration smaller than 0.5% of the long-term environmental standard will be *negligible*, regardless of the existing air quality conditions. Any change smaller than 1.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 94% of the standard and any change smaller than 5.5% of the long-term environmental standard will be *negligible* so long as the total concentration is less than 75% of the standard. The guidance also explains that:

"Where peak short term concentrations (those averaged over periods of an hour or less) from an elevated source are in the range 11-20% of the relevant Air Quality Assessment Level (AQAL), then their magnitude can be described as small, those in the range 21-50% medium and those above 51% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. In most cases, the assessment of impact severity for a proposed development will be governed by the long-term exposure experienced by receptors and it will not be a necessity to define the significance of effects by reference to short-term impacts. The severity of the impact will be substantial when there is a risk that the relevant AQAL for short-term concentrations is approached through the presence of the new source, taking into account the contribution of other local sources".

2.47 As a first step, the assessment of the emissions from the energy plant within the proposed development has considered the predicted process contributions using the following criteria:

- is the long-term (annual mean) process contribution less than 0.5% of the long-term environmental standard?; and
- is the short-term (24-hour mean or shorter) process contribution less than 10% of the short-term environmental standard?

2.48 Where both of these criteria are met, then the impacts are *negligible* and thus 'not significant'. Where these criteria are breached then a more detailed assessment, considering total concentrations (incorporating local baseline conditions), has been provided.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

2.49 Guidance from IAQM (2016) is that, with appropriate mitigation in place, the effects of construction dust will be ‘not significant’. This is the latest version of the guidance upon which the assessment methodology set out in the GLA guidance (GLA, 2014b) is based (the GLA guidance advises that the latest version of the IAQM guidance should always be used). The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be ‘not significant’.

Operational Significance

2.50 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A3. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A4.

3 Assessment Approach

Existing Conditions

3.1 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2020a). Local sources have also been identified through examination of the Council's Air Quality Review and Assessment reports.

3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the 2017-based national pollution maps published by Defra (2020b). These cover the whole of the UK on a 1x1 km grid.

3.3 Whether or not there are any exceedances of the annual mean EU limit value for nitrogen dioxide in the study area has been identified using the maps of roadside concentrations published by Defra (2019b) (2020c), as well as from any nearby Automatic Urban and Rural Network (AURN) monitoring sites (which operate to EU data quality standards). These maps are used by the UK Government, together with the AURN results, to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2020c), which are available for the years 2009 to 2018, show no exceedances of the limit values anywhere in the UK in 2018.

Construction Impacts

3.4 The construction dust assessment considers the potential for impacts within 350 m of the site boundary; or within 50 m of roads used by construction vehicles. The assessment methodology follows the GLA's SPG on the Control of Dust and Emissions During Construction and Demolition (GLA, 2014b), which is based on that provided by IAQM (2016). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A2 explains the approach in more detail.

Road Traffic Impacts

Screening

3.5 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 2.43 and detailed further in

Appendix A3. Where impacts can be screened out there is no need to progress to a more detailed assessment. The following sections describe the approach to dispersion modelling of road traffic emissions, which has been required for this project.

Sensitive Locations

3.6 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations both within, and close to, the proposed development. Receptors have been identified to represent a range of exposure within the development, including the worst-case locations (these being at the façades closest to the sources). Existing receptors have been selected alongside Argyle Square where traffic will be diverted as a result of St Chads Street closure. This is the only road with relevant exposure where the screening criterion (i.e. an increase in traffic greater than 100 LDV AADT) is exceeded.

3.7 Three existing residential properties, relevant for both long- and short-term objectives (receptors E1 – E3), and nine proposed receptor locations, within the development (receptors B1 – B9, modelled at each floor-level), have been identified. Concentrations have also been modelled at several worst-case rooftop locations where relevant exposure could occur with respect to the short-term objectives. These locations are described in Table 2 and shown in Figure 1. In addition, concentrations have been predicted at two monitoring sites located at the roadside of Euston Road, in order to verify the model outputs (see Appendix A5 for verification method).

3.8 Although the annual mean objectives do not apply at the proposed development, it has been requested that conditions are assessed in relation to the annual mean objectives to ensure occupants of the proposed development have a high level of amenity.

Table 2: Description of Receptor Locations

Receptor	Description	Modelled Floors	Objectives Considered	
Existing Receptors			**NO_2**	**PM_{10}**
E1	Residential property at the northern end of Argyle Square	Ground	Annual Mean and 1-hour	Annual Mean and 24-hour
E2	Residential property near the centre of Argyle Square		Annual Mean and 1-hour	Annual Mean and 24-hour
E3	Residential property at the southern end of Argyle Square		Annual Mean and 1-hour	Annual Mean and 24-hour
Proposed Receptors				
B1	North west corner	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B2	Euston Road Façade (centre)	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B3	North east corner	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B4	Crestfield Street Façade (north)	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B5	Crestfield Street Façade (centre)	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B6	South east corner	Ground – 4th	Annual Mean and 1-hour	Annual Mean and 24-hour
B7	South west corner	Ground – 4th	Annual Mean and 1-hour	Annual Mean and 24-hour
B8	Belgrove Street Façade (centre)	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B9	Belgrove Street Façade (north)	Ground – 9th	Annual Mean and 1-hour	Annual Mean and 24-hour
B10	Roof terrace	5th floor	1-hour	24-hour Mean
B11	Roof terrace	5th floor	1-hour	24-hour Mean
B12	Roof terrace	5th floor	1-hour	24-hour Mean
B13	Roof terrace	5th floor	1-hour	24-hour Mean

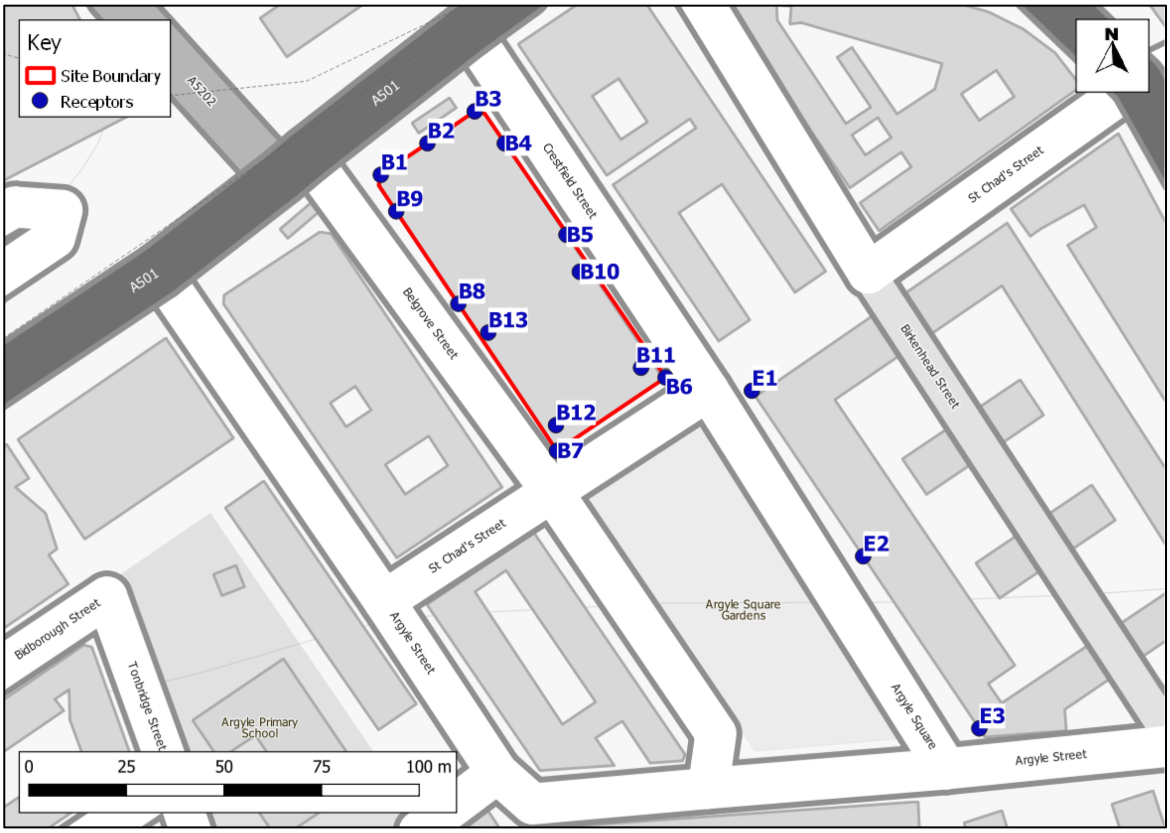

Figure 1: Receptor Locations

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Modelling Methodology

3.9 Concentrations have been predicted using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v9.0) (Defra, 2020b). Details of the model inputs, assumptions and the verification are provided in Appendix A5, together with the method used to derive base and future year background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Assessment Scenarios

3.10 Nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been predicted for a base year (2019) and the proposed year of opening (2024). For 2024, predictions have been made assuming both that the development does (With Scheme) and does not proceed (Without Scheme).

3.11 In addition to the set of 'official' predictions, which use Defra's EFT and background maps to take into account the expected improvement in vehicle emission rates and background concentrations in future years, at the specific request of LBC, a sensitivity test has been carried out which effectively assumes that there will be no improvement in either vehicular emissions or background concentrations beyond the base year (2019). This approach is very much worst-case, as monitoring data indicates that there has been a clear downward trend in both roadside and background concentrations in Camden over the last five years.

Traffic Data

3.12 Traffic data for the assessment have been provided by TTP Consulting, who have undertaken the Transport Assessment for the proposed development. These data were derived from interactive web-based map provided by DfT (2020), supplemented by traffic counts collected for the Transport Assessment. Further details of the traffic data used in this assessment are provided in Appendix A5.

Uncertainty

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

3.14 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A5). This can only be done for the road traffic model. The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment (see Appendix A5). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2019) concentrations.

3.15 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

3.16 European type approval ('Euro') standards for vehicle emissions apply to all new vehicles manufactured for sale in Europe. These standards have, over many years, become progressively more stringent and this is one of the factors that has driven reductions in both predicted and measured pollutant concentrations over time.

3.17 Historically, the emissions tests used for type approval were carried out within laboratories and were quite simplistic. They were thus insufficiently representative of emissions when driving in the real world. For a time, this resulted in a discrepancy, whereby nitrogen oxides emissions from new diesel vehicles reduced over time when measured within the laboratory, but did not fall in the real world. This, in turn, led to a discrepancy between models (which predicted improvements in nitrogen dioxide concentrations over time) and measurements (which very often showed no improvements year-on-year).

3.18 Recognition of these discrepancies has led to changes to the type approval process. Vehicles are now tested using a more complex laboratory drive cycle and also through 'Real Driving Emissions' (RDE) testing, which involves driving on real roads while measuring exhaust emissions. For Heavy Duty Vehicles (HDVs), the new testing regime has worked very well and NOx emissions from the latest vehicles (Euro VI[2]) are now very low when compared with those from older models (ICCT, 2017).

3.19 For Light Duty Vehicles (LDVs), while the latest (Euro 6) emission standard has been in place since 2015, the new type-approval testing regime only came into force in 2017. Despite this delay, earlier work by AQC (2016) showed that Euro 6 diesel cars manufactured prior to 2017 tend to emit significantly less NOx than previous (Euro 5 and earlier) models.

3.20 AQC has analysed trends in measured NOx concentrations against trends in Defra's EFT model predictions for the period 2013 to 2019 (AQC, 2020). This has demonstrated that, while the EFT typically over-stated the improvements over the period 2013 to 2016, it has tended to under-state the improvements since 2016. Wider consideration of the assumptions built into the EFT suggests that, on balance, the EFT is unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice, the balance of evidence thus suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by the EFT, especially against a base year of 2016 or later. Using EFT v9.0 for future-year forecasts in this report (for the 'official' predictions) thus provides a robust assessment, given that the model has been verified against measurements made in 2019. It is therefore extremely unlikely that the sensitivity test that assumes no future reductions in concentrations, requested by Camden, will predict realistic concentrations in the opening year.

3.21 The Mayor of London confirmed in June 2018 that changes will be made to the existing LEZ in 2020, and that the Ultra Low Emission Zone (ULEZ) will be expanded in 2021. The changes are described in detail in Appendix A1, and can be expected to significantly reduce NOx emissions in London from 2020 onwards; however, they are not reflected in Defra's latest EFT and thus have not been considered in this assessment. The assessment presented in this report is, therefore, very much worst-case in this regard, and it is expected that background concentrations, baseline concentrations, and the impacts of the proposed development, will be lower than described in Sections 4 and 6 of this report. Appendix A6 discusses uncertainties regarding the future fleet mix in London and the scale of the reduction in NOx emissions that can be expected with the adoption of these changes.

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2 Euro VI refers to HDVs while Euro 6 refers to LDVs.

Impacts of the Proposed Backup Generators

3.22 The proposed development will include two emergency backup diesel generators located at roof level. The assumed specifications for these plant are set out in Appendix A5.

Screening

3.23 The first step in considering the emergency diesel generators impacts has been to screen the pollutant emissions against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraphs 2.44 and 2.45. Where impacts can be screened out there is no need to progress to a more detailed assessment. The following sections describe the approach to dispersion modelling of the plant emissions, which has been required for this project.

Sensitive Locations

3.24 Concentrations associated with the generator emissions were modelled at selected receptor locations (described in Table 2 and shown in Figure 1) as well as across a gridded area at 1.5 m elevation which includes both on-site and off-site receptors.

Assessment Scenarios

3.25 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out assuming that the generators are operational in 2024.

Modelling Methodology

3.26 The emissions from the proposed emergency diesel generators have been modelled using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model input parameters are set out in Appendix A5. The air quality modelling has been carried out based on a number of necessary assumptions, detailed further in Appendix A5. Where possible a realistic worst-case approach has been adopted.

3.27 Entrainment of the plume into the wake of buildings has been simulated within the model. ADMS-5 takes a relatively simplistic approach to modelling building downwash effects, thus additional uncertainty is introduced when using the buildings module. In order to ensure a worst-case assessment, sensitivity tests have been carried out whereby the model has been run with no buildings and with the proposed development buildings. In order to account for the variations in meteorological conditions, and to again provide a conservative assessment, the with and without buildings models were modelled for three meteorological years. The maximum predicted concentration from these six scenarios has been used throughout this assessment.

Emissions Data

3.28 The emissions input into the model have been determined from the technical datasheets for the plant, which were provided by Atelier Ten (the mechanical and engineering consultants). Emissions were based upon the fuel consumption, fuel composition, typical operating conditions and combustion chemistry. Further details of the emissions data used in this assessment are provided in Appendix A5.

3.29 For consideration of concentrations in relation to the short-term objective, the worst-case assumption has been made that the generators will run continuously and at full (100%) load. This will have led to an over-prediction in modelled concentrations. For consideration of concentrations in relation to the annual mean objective, the testing regime was taken into account. It has been confirmed that the generators will be tested for 16 hours a year, and modelled annual mean outputs based on continuous operation have been scaled to reflect this level of utilisation.

Uncertainty

3.30 The dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which in reality are variable as the plant will operate at different loads at different times. The actual plant to be installed will also not be confirmed until the proposed development is approved, and could be different to that assumed for this assessment. The assessment has addressed this by applying worst-case assumptions where necessary; provided that the actual plant installed adheres to the restrictions set out in Appendix A5, the conclusions of this assessment will remain valid.

3.31 There are additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs. Where parameters have been estimated the approach has been to use reasonable worst-case assumptions (see Appendix A5).

'Air Quality Neutral'

3.32 The guidance relating to air quality neutral follows a tiered approach, such that all developments are expected to comply with minimum standards for gas and biomass boilers and for CHP plant (GLA, 2014a). Compliance with 'air quality neutral' is then founded on emissions benchmarks that have been derived for both building (energy) use and road transport in different areas of London. Developments that exceed the benchmarks are required to implement on-site or off-site mitigation to offset the excess emissions (GLA, 2014a).

3.33 Appendix A7 sets out the emissions benchmarks. The approach has been to calculate the emissions from the development and to compare them with these benchmarks.

4 Site Description and Baseline Conditions

4.1 The proposed development is located off Euston Road, directly opposite King's Cross Station. The site is bounded by Euston Road, Crestfield Street, Argyle Square and Belgrove Street. It currently consists of an existing three storey brick faced building with a flat roof and basement, comprising a self-storage facility and ground floor retail units.

4.2 There are a number of existing residential properties located in close proximity to the Site on Crestfield Street and Belgrove Street to the east and west, as well as alongside Argyle Square and Argyle Street to the south.

Industrial sources

4.3 A search of the UK Pollutant Release and Transfer Register (Defra, 2020a) has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality.

Air Quality Management Areas

4.4 LBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. In September 2002, an AQMA was declared for the entire borough for exceedances of both the annual mean nitrogen dioxide and 24-hour mean PM_{10} objectives.

4.5 In January 2001, the neighbouring LB of Islington also declared a borough-wide AQMA for exceedances of the annual mean and 1-hour mean nitrogen dioxide objectives, as well as the 24-hour mean PM_{10} objective.

Air Quality Focus Areas

4.6 The proposed development is located within the Marylebone Road from Marble Arch/Euston/King's Cross Junction Air Quality Focus Area, and is close to the King's Cross/Caledonian Road Air Quality Focus Area. These are two of 187 air quality Focus Areas in London, and are locations that not only exceed the EU annual mean limit value for nitrogen dioxide but also locations with high levels of human exposure.

Local Air Quality Monitoring

4.7 LBC operates three automatic monitoring stations within its area, two of which are in close proximity to the proposed development; namely, the roadside site at Euston Road site and the urban background site at London Bloomsbury. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Gradko (using the 50% TEA in acetone method). These include two roadside sites on Euston Road and Brill Place, and two urban background sites at Wakefield Gardens and Tavistock Garden. Results for the years 2014 to 2019 are summarised in Table 3 and the monitoring locations are shown in Figure 2.

Table 3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2014-2019) [a,b]

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019[c]
Automatic Monitors - Annual Mean (µg/m³)								
Bloomsbury	Urban Background	Bloomsbury Square	**45.0**	**48.0**	**42.0**	38.0	36.0	31.5
Euston Road	Roadside	Euston Road	**98.0**	**90.0**	**88.0**	**83.0**	**82.3**	**69.9**
Objective			40					
Automatic Monitors - No. of Hours > 200 µg/m³								
Bloomsbury	Urban Background	Bloomsbury Square	0	0	0	0	0	0
Euston Road	Roadside	Euston Road	**221**	**54**	**39**	**25**	18	7
Objective			18					
Diffusion Tubes - Annual Mean (µg/m³)								
CA4	Roadside	Euston Road	**89.7**	**86.8**	**82.7**	**92.5**	**69.2**	**69.1**
CA6	Urban Background	Wakefield Gardens	36.4	35.8	31.3	-	26.7	24.7
CA10	Urban Background	Tavistock Garden	**46.5**	**44.6**	39.7	-	35.4	33.1
CA20	Roadside	Brill Place	**52.3**	**48.9**	**47.5**	**57.3**	**41.1**	**43.1**
Objective			40					

[a] Exceedances of the objectives are shown in bold.

[b] Data taken from LBC Air Quality Annual Status Report for 2018 (London Borough of Camden, 2019b).

[c] 2019 monitoring data provided by LBC in advance of the publication of the Annual Status Report for 2019.

4.8 Annual mean concentrations of nitrogen dioxide have exceeded the objective at all but one of the sites, in at least one year since 2014; three roadside sites recorded exceedances in 2019. In addition, the hourly mean objective for nitrogen dioxide has historically been exceeded at the Euston Road automatic site, but there have been no exceedances of the objective value in any year at the Bloomsbury site. These data indicate that the annual mean nitrogen dioxide objective is likely to be currently exceeded at the Euston Road façade of the proposed development, and there is potential for the 1-hour mean objective to also be exceeded. There has been a clear downward trend in annual mean concentrations and the number of 1-hour concentrations above 200 µg/m³ at the Bloomsbury and Euston Road automatic sites, the same general downwards trends is exhibited at the diffusion tube sites.

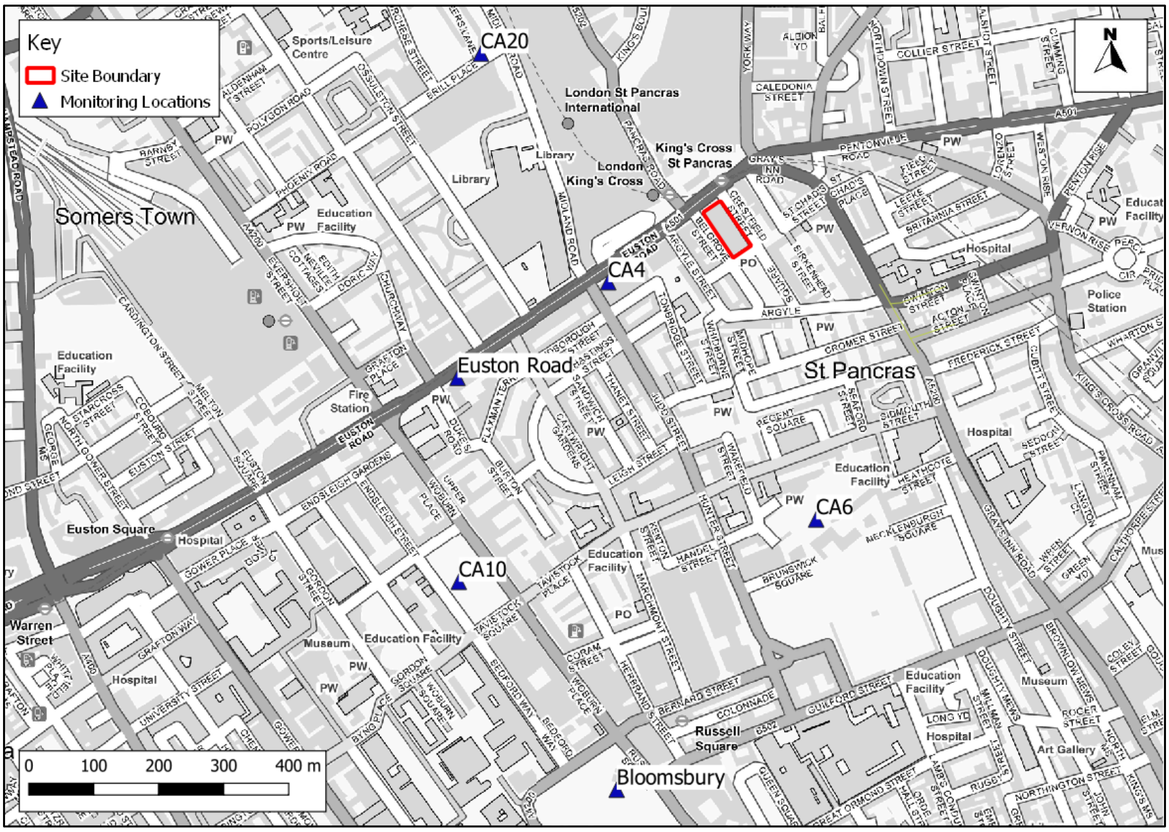

Figure 2: Monitoring Locations

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4.9 Both the London Bloomsbury and Euston Road automatic stations measure PM_{10} and $PM_{2.5}$ concentrations. Results for the years 2014 to 2019 are summarised in Table 4 and indicate a downward trend in concentrations over the period. There have been no recorded exceedances of the annual mean or 24-hour mean PM_{10} objective or the annual mean $PM_{2.5}$ objective at either site since 2014.

Table 4: Summary of PM_{10} and $PM_{2.5}$ Automatic Monitoring (2014-2019)

Site No.	Site Type	Location	2014	2015	2016	2017	2018	2019[b]
PM_{10} Annual Mean (µg/m^3)								
Bloomsbury	Urban Background	Bloomsbury Square	20.0	22.0	20.0	19.0	17.0	17.6
Euston Road	Roadside	Euston Road	29.0	18.0	24.0	20.0	22.6	21.5
Objective			**40**					
PM_{10} No. Days >50 µg/m^3								
Bloomsbury	Urban Background	Bloomsbury Square	11	6	9	6	1	11
Euston Road	Roadside	Euston Road	5	5	10	3	2	8
Objective			**35**					
$PM_{2.5}$ Annual Mean (µg/m^3)								
Bloomsbury	Urban Background	Bloomsbury Square	-	11.0	12.0	13.0	10.0	10.8
Euston Road	Roadside	Euston Road	-	17.0	17.0	14.0	15.6	13.6
Objective			**25** [a]					

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

[b] 2019 monitoring data downloaded from London Air website (King's College London, 2019)

Exceedances of EU Limit Value

4.10 There are several AURN monitoring sites within the Greater London Urban Area that have measured exceedances of the annual mean nitrogen dioxide limit value. Furthermore, Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2020c), which are used to report exceedances of the limit value to the EU, identify exceedances of this limit value in 2018 along many roads in London, including Grays Inn Road and Euston Road near to the proposed development. The Greater London Urban Area has thus been reported to the EU as exceeding the limit value for annual mean nitrogen dioxide concentrations. Defra's predicted concentrations for 2024 identify continued exceedances of the limit value along Euston Road, including the section alongside the Site. As such, there is considered to be a risk of a limit value exceedance at Euston Road next to the proposed development in the proposed opening year.

4.11 Defra's Air Quality Plan requires the GLA to prepare an action plan that will *"deliver compliance in the shortest time possible"*, and the 2015 Plan assumed that a CAZ was required. The GLA has already implemented a LEZ and a ULEZ, thus the authority has effectively already implemented the required CAZ. These have been implemented as part of a package of measures including 12 Low Emission Bus Zones, Low Emission Neighbourhoods, the phasing out of diesel buses and taxis and other measures within the Mayors Transport Strategy.

Background Concentrations

4.12 Estimated background concentrations at the proposed development have been determined for 2019 and the opening year 2024 using Defra's 2017-based background maps (Defra, 2020b). The background concentrations are set out in Table 5 and have been derived as described in Appendix A5. The background concentrations are all below the objectives.

4.13 The background concentrations for the 'official' predictions have been derived from the Defra maps and calibrated with monitoring data obtained from the London Bloomsbury automatic background monitoring site. The sensitivity test background concentrations are unadjusted from the Defra background maps and assume no improvement after 2019; thus, the 2019 concentrations have also been used for 2024. Further details of the background concentrations and calibrations are described in Appendix A5.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2019 and 2024 (μg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
'Official' predictions			
2019	31.5 – 31.7	17.5 – 17.6	10.7 – 10.8
2024	26.3 – 26.6	16.6 – 16.7	10.0
Sensitivity test			
2019	*37.8 – 38.0*	*19.2 – 19.3*	*12.7 – 12.8*
2024	*37.8 – 38.0*	*19.2 – 19.3*	*12.7 – 12.8*
Objectives	**40**	**40**	**25 [a]**

The range of values is for the different 1x1 km grid squares covering the study area.

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

Baseline Dispersion Model Results

4.14 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing and future receptor locations (see Figure 1 and Table 2 for receptor locations). The results, which cover both the existing (2019) and future year (2024) baseline (Without Scheme), are set out in Table 6, Table 7 and Table 8. The modelled road components of nitrogen oxides, PM_{10} and $PM_{2.5}$ have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A5 for the verification methodology).

Table 6: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m³) at Existing Receptors

Receptor	2019 Baseline		2024 Without Scheme	
	'Official' predictions	*Sensitivity Test*	'Official' predictions	*Sensitivity Test*
E1	34.1	*39.9*	28.1	*40.0*
E2	33.4	*39.3*	27.7	*39.4*
E3	33.1	*39.1*	27.6	*39.2*
Objective	**40**			

Table 7: Modelled Annual Mean Baseline Concentrations of PM_{10} at Existing Receptors (µg/m³) [a]

Receptor	2019 Baseline		2024 Without Scheme	
	'Official' predictions	*Sensitivity Test*	'Official' predictions	*Sensitivity Test*
E1	18.0	*19.6*	17.1	*19.6*
E2	17.9	*19.5*	17.0	*19.6*
E3	17.9	*19.5*	16.9	*19.5*
Criterion	**32 [a]**			

[a] While the annual mean PM_{10} objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

Table 8: Modelled Annual Mean Baseline Concentrations of $PM_{2.5}$ at Existing Receptors (µg/m³) [a]

Receptor	2019 Baseline		2024 Without Scheme	
	'Official' predictions	*Sensitivity Test*	'Official' predictions	*Sensitivity Test*
E1	13.0	*13.0*	12.1	*13.0*
E2	13.0	*13.0*	12.1	*13.0*
E3	13.0	*12.9*	12.0	*12.9*
Objective	**25 [a]**			

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

2019 and 2024 Baseline

4.15 The predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are below the objectives in 2019 and 2024 at all existing receptors. Furthermore, the annual mean PM_{10} concentrations are below 32 µg/m^3 and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

4.16 The annual mean nitrogen dioxide concentrations are below 60 µg/m^3 at every receptor; it is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded (see Paragraph 2.37).

Sensitivity Test

4.17 For the sensitivity test, the predicted annual mean nitrogen dioxide concentrations are just below the objective for all receptors in both 2019 and 2024.

4.18 The predicted annual mean concentrations of PM_{10} and $PM_{2.5}$ are below the objectives in both 2019 and 2024 at all receptors. Furthermore, the annual mean PM_{10} concentrations are below 32 µg/m^3 and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

5 Construction Phase Impact Assessment

5.1 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. Step 1 of the assessment procedure is to screen the need for a detailed assessment. There are receptors within the distances set out in the guidance (see Appendix A2), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

Demolition

5.2 There will be a requirement to demolish the existing brick building with an approximate total volume of 25,000 m^3. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for demolition is considered to be *medium.*

Earthworks

5.3 The characteristics of the soil at the Site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2020), as set out in Table 9. Overall, it is considered that, when dry, this soil has the potential to be highly dusty.

Table 9: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Deep
Soil Parent Material Grain Size	Argillaceous [a]
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Clayey Loam [b] to Silty Loam

[a] grain size < 0.06 mm.

[b] a loam is composed mostly of sand and silt.

5.4 The site covers approximately 2,750 m^2 and most of this will be subject to earthworks, involving removal of the foundations of the demolished buildings and excavation of basement areas. Dust will arise mainly from vehicles travelling over unpaved ground and from the handling of dusty materials (such as dry soil). Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for earthworks is considered to be *medium*.

Construction

5.5 Construction will involve a part five, part ten office-led building, with a total building volume of between 25,000 and 100,000 m^3. Dust will arise from vehicles travelling over unpaved ground and the handling and storage of dusty materials. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for construction is considered to be *medium*.

Trackout

5.6 The number of heavy vehicles accessing the site, which may track out dust and dirt, is currently unknown, but given the medium size of the site it is likely that there will be a maximum of between 10-50 outward heavy vehicle movements per day. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for trackout is considered to be *medium*.

5.7 Table 10 summarises the dust emission magnitude for the proposed development.

Table 10: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	Medium
Earthworks	Medium
Construction	Medium
Trackout	Medium

Sensitivity of the Area

5.8 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

5.9 The IAQM guidance, upon which the GLA's guidance is based, explains that residential properties are 'high' sensitivity receptors to dust soiling (Table A2.2 in Appendix A2). There are approximately 15 residential properties within 20 m of the site. Using the matrix set out in Table A2.3 in Appendix A2, the area surrounding the site is of 'high' sensitivity to dust soiling.

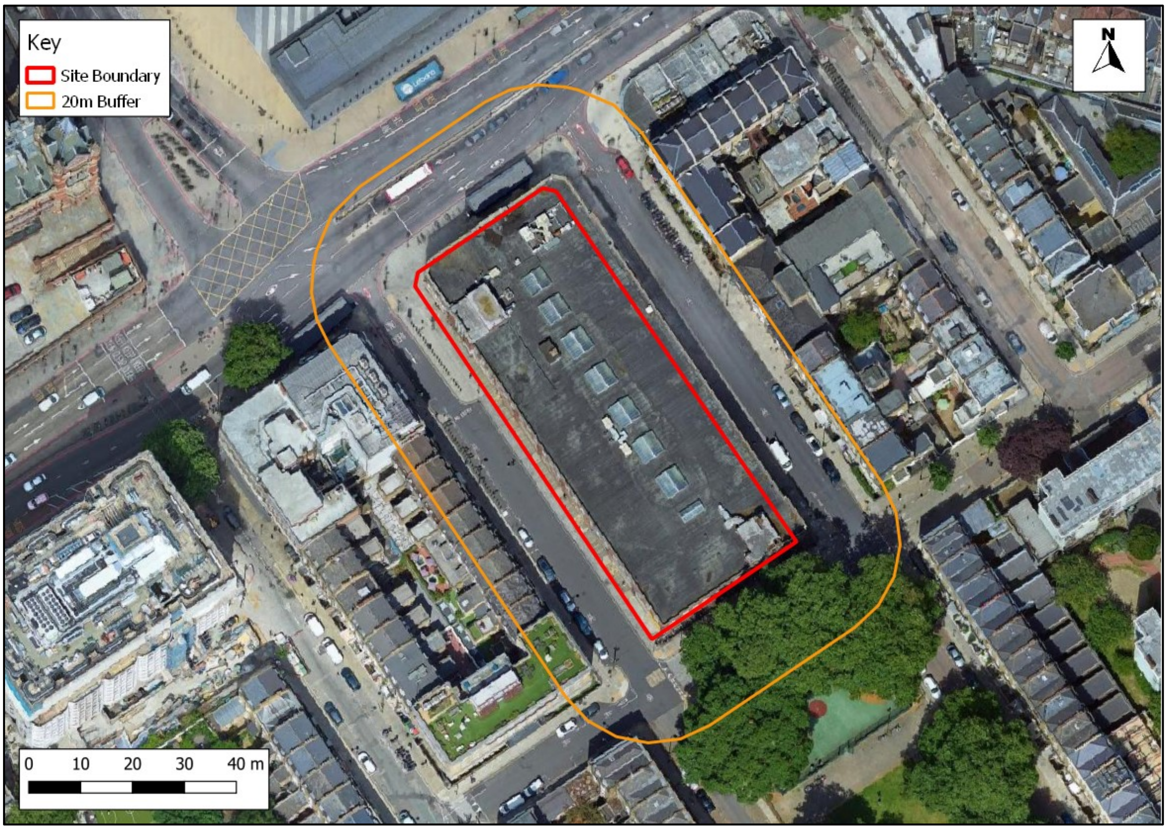

Figure 3: 20 m Distance Band around Site Boundary

Imagery ©2020 Google.

5.10 Table 10 shows that the dust emission magnitude for trackout is *medium* and Table A2.3 in Appendix A2 thus explains that there is a risk of material being tracked 200 m from the site exit. Since it is not known which roads construction vehicles will use, it has been assumed that all possible routes could be affected. There are approximately 50 residential properties within 20 m of the roads along which material could be tracked (see Figure 4), and Table A2.3 in Appendix A2 thus indicates that the area is of 'high' sensitivity to dust soiling due to trackout. Taking these points into account, it is judged that the areas surrounding the onsite works and surrounding roads along which material may be tracked from the site are of 'high' sensitivity to dust soiling.

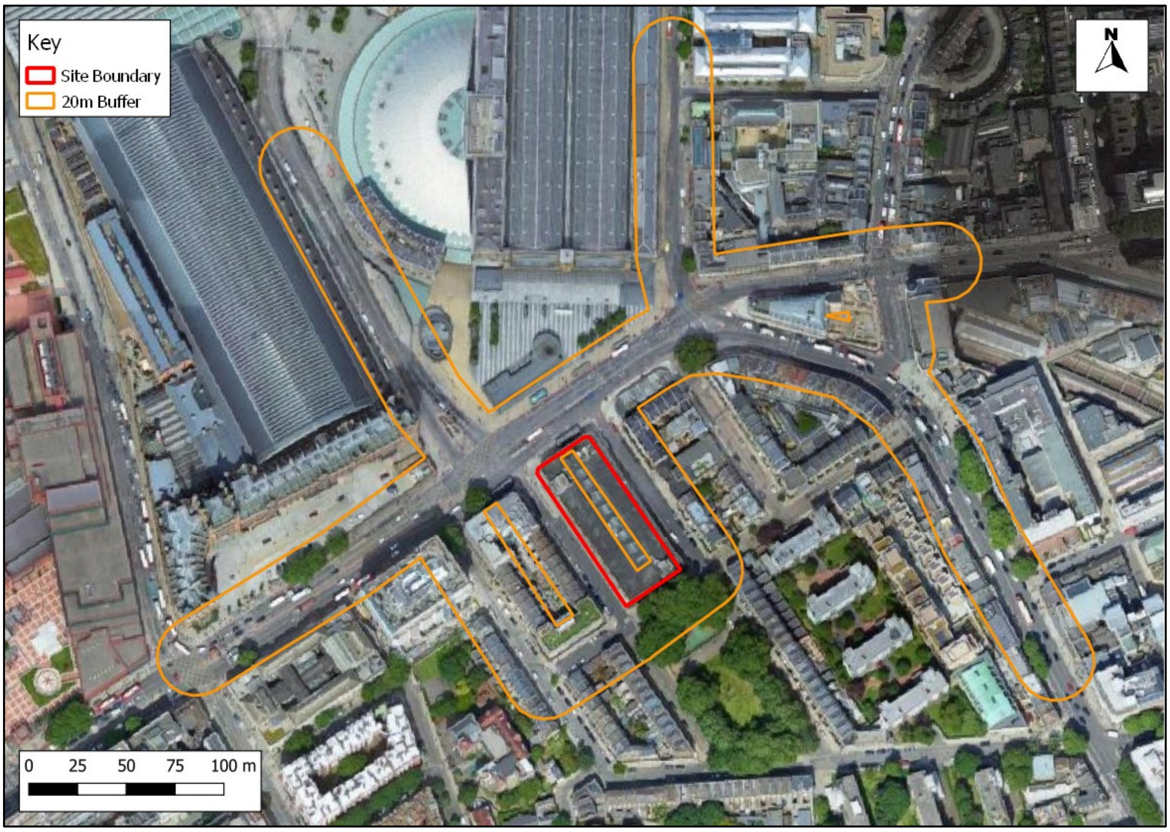

Figure 4: 20 m Distance Band around Roads Used by Construction Traffic Within 200 m of the Site

Imagery ©2020 Google.

Sensitivity of the Area to any Human Health Effects

5.11 Residential properties are also classified as being of 'high' sensitivity to human health effects. The matrix in Table A2.4 in Appendix A2 requires information on the baseline annual mean PM_{10} concentration in the area. It is considered that the maximum modelled PM_{10} concentration at the Site will best represent conditions near to the site, this being 20.0 µg/m^3 (see Table 4). Using the matrix in Table A2.4 in Appendix A2, the areas surrounding the onsite works and surrounding roads along which material may be tracked from the site are of 'low' sensitivity to human health effects.

Sensitivity of the Area to any Ecological Effects

5.1 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of the site boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

Summary of the Area Sensitivity

5.2 Table 11 summarises the sensitivity of the area around the proposed construction works.

Table 11: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	High Sensitivity	High Sensitivity
Human Health	Low Sensitivity	Low Sensitivity

Risk and Significance

5.3 The dust emission magnitudes in Table 10 have been combined with the sensitivities of the area in Table 11 using the matrix in Table A2.6 in Appendix A2, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 12. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 8 (step 3 of the assessment procedure).

Table 12: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition	Medium Risk	Low Risk
Earthworks	Medium Risk	Low Risk
Construction	Medium Risk	Low Risk
Trackout	Medium Risk	Low Risk

5.4 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (IAQM, 2016).

6 Operational Phase Impact Assessment

Impacts at Existing Receptors

Initial Screening Assessment of Development-Generated Road Traffic Emissions

6.1 The trip generation of the proposed development on local roads (as provided by TTP Consulting) has initially been compared to the screening criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017) (see Paragraphs A3.7 to A3.10 in Appendix A3). The proposed development, including the closure of St Chad's Street, is expected to increase Annual Average Daily Traffic (AADT) flows by 319 vehicles on Euston Road and 194 vehicles on Argyle Square, which are above the screening threshold of 100 LDVs for inside of an AQMA, thus a detailed assessment is required. There are no receptors sensitive to the annual mean objectives alongside the affected section of Euston Road, but there some existing properties at the roadside of Argyle Square; the focus of the detailed assessment of road traffic impacts is thus on these receptors at Argyle Square.

Initial Screening Assessment of Energy Plant Emissions

6.2 The calculated total NOx emission rate from the emergency generators (approximately 2,113 mg/s) exceeds the screening threshold of 5 mg/s set out in the EPUK/IAQM guidance (see Paragraph A3.11 in Appendix A3). As such, dispersion modelling has been undertaken. Further details of the emergency backup diesel generators emissions are provided in Appendix A5.

6.3 The maximum predicted nitrogen dioxide and PM_{10} contributions at existing off-site receptors associated with emissions from the generators are shown in Table 13. The maximum predicted contributions from any of the six considered scenarios are presented.

Table 13: Predicted Maximum Process Contributions to Pollutant Concentrations associated with Generator Emissions

Pollutant/Averaging Period	Maximum Off-Site Process Contribution		Objective Value ($\mu g/m^3$)
	$\mu g/m^3$	% of Objective	
Annual Mean NO_2	<0.1	0.2	**40**
99.79th %ile of 1-hour NO_2	69.2	34.6	**200**
Annual Mean PM_{10}	<0.1	<0.1	**40**
90.4th %ile of 24-hour PM_{10}	1.6	3.3	**50**
Annual Mean $PM_{2.5}$	<0.1	<0.1	**25**

6.4 These predicted maximum concentrations can be compared with the EPUK/IAQM screening criteria, as previously described in Section 2, and the following conclusions can be drawn:

- the predicted maximum annual mean nitrogen dioxide concentration (0.2% of the objective) is below the screening criterion (0.5%);
- the predicted maximum 99.79th percentile of 1-hour mean nitrogen dioxide concentrations (34.6% of the objective) is above the screening criterion (10%);
- the predicted maximum annual mean PM_{10} concentration (<0.1% of the objective) is well below the screening criterion (0.5%);
- the predicted maximum 90.4th percentile of 24-hour mean PM_{10} concentrations (3.3% of the objective) is well below the screening criterion (10%); and
- the predicted maximum annual mean $PM_{2.5}$ concentration (<0.1% of the objective) is well below the screening criterion (0.5%).

6.5 The predicted impacts exceed the screening criterion for hourly mean nitrogen dioxide concentrations, and thus require further detailed assessment. No further assessment is required for annual mean nitrogen dioxide and PM_{10} concentrations, nor for 24-hour mean PM_{10} concentrations, and impacts are considered to be *negligible*.

6.6 The process contribution to the 99.79th percentile of the 1-hour mean nitrogen dioxide concentrations reaches a maximum of 69.2 µg/m³ at any off-site location (specifically, at a residential receptor on St Chad's Street). This value is worst-case, as it is based on the diesel generators being in use 100% of the time, when in reality, they will only be operational 16 hours of the year for maintenance purposes. It is highly unlikely that the least favourable meteorological conditions will coincide with the testing regime, and that such process contributions will occur. Nevertheless, the 99.79th percentile of the 1-hour mean nitrogen dioxide concentrations has been calculated, taking into consideration all sources, at the worst affected off-site location to determine whether the objective could be exceeded as a result of the proposed diesel generators emissions. The calculated concentrations of 122.4 ug/m³ and 144.8 ug/m³, using the 'official' and 'sensitivity test' respectively are below the objective value of 200 µg/m³ at this worst-affected existing receptor (i.e. 61.2% of the objective value using the official method and 66.5% using the sensitivity test requested by LBC)[3]. Emissions from the proposed diesel generators will thus not lead to exceedances of the 1-hour mean nitrogen dioxide objective at any off-site location, and the potential for significant impacts on the 1-hour mean nitrogen dioxide concentrations can thus also be discounted.

6.7 The emissions from the emergency diesel generators are, however, considered in combination with the road traffic impacts later in this section, in order to ensure that the full impacts of development-related emissions are assessed.

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3 Calculated by adding the maximum process contribution to the 99.79th percentile of 1-hour mean nitrogen dioxide concentrations to 2 x the background annual mean concentration.

Detailed Assessment of Development-Generated Road Traffic Emissions

6.8 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ at existing receptors, as well as relevant percentiles for 1-hour mean nitrogen dioxide and 24-hour mean PM_{10}, are presented in Table 14, Table 15 and Table 16 for both the "Without Scheme" and "With Scheme" scenarios. The concentrations include the impacts of local traffic sources and emissions associated with the proposed emergency diesel generators. Concentrations have been calculated following the methodology set out in Section 3 and in Appendix A5.

Table 14: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations at Existing Receptors in 2024 (μg/m³) [a]

Receptor	'Official' Predictions				*Sensitivity Test*			
	Without Scheme	With Scheme	% Change [b]	Impact Descriptor	*Without Scheme*	*With Scheme*	*% Change [b]*	*Impact Descriptor*
E1	28.1	28.2	0	Negligible	*40.0*	***40.1***	*0*	*Negligible*
E2	27.7	27.8	0	Negligible	*39.4*	*39.5*	*0*	*Negligible*
E3	27.6	27.6	0	Negligible	*39.2*	*39.3*	*0*	*Negligible*
Objective	**40**		**-**	**-**	**40**		**-**	**-**

[a] Exceedances of the objective are shown in bold.

[b] % changes are relative to the objective and have been rounded to the nearest whole number.

Table 15: Predicted Impacts on Annual Mean PM_{10} Concentrations at Existing Receptors in 2024 (μg/m³)

Receptor	'Official' Predictions				*Sensitivity Test*			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
E1	17.1	17.1	0	Negligible	*19.7*	*19.7*	*0*	*Negligible*
E2	17.0	17.0	0	Negligible	*19.6*	*19.6*	*0*	*Negligible*
E3	16.9	17.0	0	Negligible	*19.5*	*19.6*	*0*	*Negligible*
Criterion	**32 [b]**		**-**	**-**	**32 [b]**		**-**	**-**

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] While the annual mean PM_{10} objective is 40 μg/m³, 32 μg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 μg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-

hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

Table 16: Predicted Impacts on Annual Mean $PM_{2.5}$ Concentrations at Existing Receptors in 2024 ($\mu g/m^3$)

Receptor	'Official' Predictions				*Sensitivity Test*			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
E1	12.1	12.1	0	Negligible	*13.0*	*13.0*	*0*	*Negligible*
E2	12.1	12.1	0	Negligible	*13.0*	*13.0*	*0*	*Negligible*
E3	12.0	12.1	0	Negligible	*12.9*	*13.0*	*0*	*Negligible*
Objective	25 [b]		-	-	25 [b]		-	-

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Nitrogen Dioxide

6.9 The annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, both without and with the proposed development, for the 'official' predictions. In the worst-case sensitivity test, a marginal exceedance of the objective is predicted at one receptor (E1) with the proposed development in operation.

6.10 The percentage changes in concentrations, relative to the air quality objective (when rounded), are zero at all of the receptors, for both the 'official' predictions and the sensitivity test. Using the matrix in Table A3.1 (Appendix A3), these impacts are described as *negligible.*

6.11 The changes to the LEZ and ULEZ described in Paragraphs A1.5 and A1.7, which the Mayor of London has confirmed are to be implemented, will result in significant reductions in NOx emissions across London. It has not, however, been possible to account for these in this assessment. Consequently, the results for nitrogen dioxide presented in Table 14 are likely to represent a significant over-prediction both in terms of total concentrations and impact magnitude (see Paragraph 3.21 and Appendix A6).

PM_{10} and $PM_{2.5}$

6.12 The annual mean PM_{10} and $PM_{2.5}$ concentrations are well below the annual mean criteria and objective at all receptors, with or without the proposed development, according to both the 'official' predictions and the sensitivity test. Furthermore, as the annual mean PM_{10} concentrations are below 32 $\mu g/m^3$, it is unlikely that the 24-hour mean PM_{10} objective will be exceeded at any of the receptors.

6.13 The percentage changes in both PM_{10} and $PM_{2.5}$ concentrations, relative to the applied annual mean criteria (when rounded), are predicted to be zero at all of the receptors for both the official predictions and sensitivity test. Using the matrix in Table A3.1 (Appendix A3), these impacts are described as *negligible.*

Impacts of Existing Sources on Future Users of the Development

6.14 The proposed development is located adjacent to Euston Road, and within the Camden AQMA. Although the annual mean air quality objective do not strictly apply at the proposed office development, as discussed in paragraph 2.39, a detailed assessment of the air quality conditions at the site was undertaken at the request of the client.

6.15 Predicted concentrations across the application site are set out in Table 17 and Table 18 for Receptors B1 to B9 (see Table 2 and Figure 1 for receptor locations). All of the concentrations are below the objectives for the 'official' predictions.

6.16 The results of the worst-case sensitivity test indicate potential exceedances of the annual mean nitrogen dioxide objective between ground and fifth floor levels at all receptors along the Euston Road façade, as well as at the B4 receptor on Crestfield Street and B9 on Belgrove Street. Additionally, exceedances are predicted up to the fourth floor at receptors B5 and B8, up to the third floor at receptor B6 and up to the first floor at receptor B7 at the rear of the application site. However, there are no locations where the 1-hour mean nitrogen dioxide objective is exceeded.

Table 17: 'Official' Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2024 for New Receptors ($\mu g/m^3$)

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B1_G	36.2	132.0	19.0	13.2
B1_1	34.2	128.0	18.5	12.9
B1_2	31.7	122.8	17.9	12.6
B1_3	29.9	119.4	17.5	12.3
B1_4	28.8	117.2	17.2	12.2
B1_5	28.2	116.0	17.0	12.1
B1_6	27.8	115.2	17.0	12.1
B1_7	27.5	114.6	16.9	12.0
B1_8	27.3	114.2	16.9	12.0
B1_9	27.2	114.0	16.8	12.0
B2_G	35.8	140.5	18.9	13.2
B2_1	33.9	136.7	18.4	12.9
B2_2	31.5	131.9	17.8	12.6
B2_3	29.8	128.5	17.4	12.3

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B2_4	28.8	126.5	17.2	12.2
B2_5	28.2	125.1	17.0	12.1
B2_6	27.8	124.3	17.0	12.1
B2_7	27.5	123.9	16.9	12.0
B2_8	27.3	123.5	16.9	12.0
B2_9	27.2	123.3	16.8	12.0
B3_G	35.6	98.6	18.9	13.1
B3_1	33.7	95.0	18.4	12.9
B3_2	31.4	90.4	17.8	12.5
B3_3	29.7	87.0	17.4	12.3
B3_4	28.7	85.0	17.2	12.2
B3_5	28.1	83.8	17.0	12.1
B3_6	27.8	83.0	17.0	12.1
B3_7	27.5	82.6	16.9	12.0
B3_8	27.3	82.2	16.9	12.0
B3_9	27.2	106.7	16.8	12.0
B4_G	32.7	134.6	18.2	12.7
B4_1	32.0	133.0	18.0	12.6
B4_2	30.8	130.8	17.7	12.5
B4_3	29.8	128.6	17.4	12.3
B4_4	28.9	127.0	17.2	12.2
B4_5	28.3	125.8	17.1	12.1
B4_6	27.9	125.0	17.0	12.1
B4_7	27.5	124.2	16.9	12.0
B4_8	27.4	123.8	16.9	12.0
B4_9	27.2	123.6	16.8	12.0
B5_G	30.0	129.0	17.5	12.4
B5_1	29.8	128.6	17.4	12.3
B5_2	29.4	127.8	17.4	12.3
B5_3	29.0	127.0	17.3	12.2
B5_4	28.6	126.2	17.2	12.2
B6_G	28.6	126.4	17.2	12.2
B6_1	28.5	126.2	17.2	12.2
B6_2	28.4	125.8	17.1	12.1
B6_3	28.2	125.6	17.1	12.1
B7_G	28.2	125.6	17.1	12.1

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B7_1	28.1	125.4	17.0	12.1
B7_2	28.0	125.2	17.0	12.1
B7_3	27.9	125.0	17.0	12.1
B8_G	29.7	128.6	17.4	12.3
B8_1	29.5	128.2	17.4	12.3
B8_2	29.2	127.6	17.3	12.2
B8_3	28.8	126.6	17.2	12.2
B8_4	28.4	125.8	17.1	12.1
B9_G	33.0	111.5	18.2	12.8
B9_1	32.1	109.7	18.0	12.6
B9_2	30.8	107.1	17.7	12.5
B9_3	29.6	104.7	17.4	12.3
B9_4	28.8	102.9	17.2	12.2
B9_5	28.2	101.7	17.0	12.1
B9_6	27.8	100.9	17.0	12.1
B9_7	27.5	100.5	16.9	12.0
B9_8	27.3	100.1	16.8	12.0
B9_9	27.2	99.9	16.8	12.0
Objective / Criterion	**40**	**200**	**32** [b]	**25** [c]

a Calculated by adding the 99.79th percentile of 1-hour mean nitrogen dioxide process contributions from the emergency diesel generator to two times the predicted annual mean concentration at each receptor (including the contribution of road traffic emissions under the "With Scheme" scenario), which is common practice.

b While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

c The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Table 18: Worst-Case Sensitivity Test Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2024 for New Receptors (µg/m^3)

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B1_G	**51.7**	163.0	21.5	14.2
B1_1	**48.8**	157.2	21.0	13.9

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B1_2	**45.2**	150.0	20.4	13.5
B1_3	**42.6**	144.8	20.0	13.2
B1_4	**41.0**	141.6	19.8	13.1
B1_5	**40.1**	139.8	19.6	13.0
B1_6	39.5	138.6	19.5	13.0
B1_7	39.1	137.8	19.5	12.9
B1_8	38.8	137.2	19.5	12.9
B1_9	38.6	136.8	19.4	12.9
B2_G	**51.2**	171.3	21.4	14.1
B2_1	**48.5**	165.7	20.9	13.8
B2_2	**45.0**	158.9	20.4	13.5
B2_3	**42.5**	153.9	20.0	13.2
B2_4	**41.0**	150.9	19.8	13.1
B2_5	**40.1**	149.1	19.6	13.0
B2_6	39.5	147.9	19.5	13.0
B2_7	39.1	147.1	19.5	12.9
B2_8	38.9	146.5	19.5	12.9
B2_9	38.7	146.1	19.4	12.9
B3_G	**50.8**	129.2	21.3	14.1
B3_1	**48.2**	123.8	20.9	13.8
B3_2	**44.8**	117.2	20.4	13.5
B3_3	**42.4**	112.4	20.0	13.2
B3_4	**40.9**	109.4	19.8	13.1
B3_5	40.0	107.6	19.6	13.0
B3_6	39.5	106.6	19.5	13.0
B3_7	39.1	105.8	19.5	12.9
B3_8	38.8	105.2	19.5	12.9
B3_9	38.7	129.5	19.4	12.9
B4_G	**46.7**	162.4	20.7	13.7
B4_1	**45.6**	160.2	20.5	13.5
B4_2	**43.9**	156.8	20.2	13.4
B4_3	**42.3**	153.8	20.0	13.2
B4_4	**41.2**	151.4	19.8	13.1
B4_5	**40.3**	149.6	19.7	13.0
B4_6	39.7	148.4	19.6	13.0
B4_7	39.2	147.4	19.5	12.9

Receptor	Annual Mean NO_2	99.79th %ile of Hourly Mean NO_2 [a]	Annual Mean PM_{10}	Annual Mean $PM_{2.5}$
B4_8	38.9	146.8	19.5	12.9
B4_9	38.7	146.4	19.4	12.9
B5_G	**42.7**	154.4	20.1	13.3
B5_1	**42.4**	153.8	20.0	13.2
B5_2	**41.8**	152.8	19.9	13.2
B5_3	**41.2**	151.6	19.8	13.1
B5_4	**40.6**	150.4	19.7	13.1
B6_G	**40.7**	150.4	19.8	13.1
B6_1	**40.5**	150.2	19.7	13.1
B6_2	**40.3**	149.8	19.7	13.0
B6_3	**40.1**	149.4	19.7	13.0
B7_G	**40.1**	149.4	19.6	13.0
B7_1	**40.1**	149.2	19.6	13.0
B7_2	39.9	149.0	19.6	13.0
B7_3	39.7	148.6	19.6	13.0
B8_G	**42.4**	154.0	20.0	13.2
B8_1	**42.1**	153.4	19.9	13.2
B8_2	**41.6**	152.4	19.9	13.1
B8_3	**41.0**	151.2	19.8	13.1
B8_4	**40.4**	149.8	19.7	13.0
B9_G	**47.2**	139.9	20.7	13.7
B9_1	**45.9**	137.3	20.5	13.6
B9_2	**44.0**	133.5	20.2	13.4
B9_3	**42.3**	129.9	20.0	13.2
B9_4	**41.0**	127.3	19.8	13.1
B9_5	**40.1**	125.7	19.6	13.0
B9_6	39.5	124.5	19.5	13.0
B9_7	39.1	123.7	19.5	12.9
B9_8	38.9	123.1	19.5	12.9
B9_9	38.7	122.7	19.4	12.9
Objective / Criterion	**40**	**200**	**32** [b]	**25** [c]

[a] Calculated by adding the 99.79th percentile of 1-hour mean nitrogen dioxide process contributions from the emergency diesel generator to two times the predicted annual mean concentration at each receptor (including the contribution of road traffic emissions under the "With Scheme" scenario), which is common practice.

[b] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[c] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

6.17 The changes to the LEZ and ULEZ described in Paragraphs A1.5 and A1.7, which the Mayor of London has confirmed are to be implemented, will result in significant reductions in NOx emissions across London. It has not, however, been possible to account for these in this assessment. Consequently, the results for nitrogen dioxide presented in Table 17 ('official' predictions) are likely to represent a significant over-prediction in terms of total concentrations.

6.18 This is especially true for the sensitivity test results which assume an artificially high background concentration (based on nationally estimated data) and no improvements in pollutant background concentrations and vehicle emission factors between 2019 and the opening year (2024). The 'official' predictions presented in this report follow an approach which is based on adopted national and regional guidance, and on a series of tools which have been developed by Defra and using LBC's own monitoring data to determine the background concentration. As such, when assessing air quality conditions in future years, predictions include projected improvements in pollutant concentrations. These projected improvements are based on new technologies leading to lower emissions from vehicles and other sources, and the greater uptake of electric and hybrid vehicles. This will be particularly true in central London with the implementation of the ULEZ. Whilst the concept of a precautionary approach is standard practice, the assumptions within the sensitivity test cannot be justified from trends in monitoring data in Greater London, and indeed within LBC. However, at the request of LBC, results of this worst-case approach have been presented and considered when drawing conclusions.

Significance of Operational Air Quality Effects

6.19 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A3, and takes account of the assessment that:

- the impacts associated with road traffic emissions are predicted to be *negligible* at all of the selected worst-case existing receptors situated along the local road network;
- emissions from the proposed emergency backup diesel generators will be associated with non-significant air quality effects at off-site receptors; and

- pollutant concentrations at worst-case public exposure locations within the proposed development will be below the relevant short-term objectives, thus future users will experience acceptable air quality.

6.20 This assessment has, however, also considered annual mean nitrogen dioxide concentrations across the proposed development. For the realistic 'official' predictions, concentrations are below the objective throughout the Site. Results from the worst-case sensitivity test indicate that annual mean nitrogen dioxide concentrations could exceed the objective at some locations. As such, design measures could be incorporated to ensure future users are exposed to pollutant levels below all the objectives, however, these would not be essential.

7 'Air Quality Neutral'

7.1 The purpose of the London Plan's requirement that development proposals be 'air quality neutral' is to prevent the gradual deterioration of air quality throughout Greater London. The 'air quality neutrality' of a proposed development, as assessed in this section, does not directly indicate the potential of the proposed development to have significant impacts on human health (this has been assessed separately in the previous section).

Building Emissions

7.2 The installed generators will operate for 16 hours per year at an emission rate of 0.58 g/s of NOx for the 500 kVA generator and 1.53 g/s for the 1,250 kVA generator (2.11 g/s in total). For PM_{10}, the emission rates are 0.03 g/s for the 500 kVA generator and 0.02 g/s for the 1,250 kVA generator. These will result in total annual emission rates of 121.7 kg of NOx and 2.8 kg of PM_{10} per year.

7.3 Appendix A7 shows the Building Emissions Benchmarks (BEBs) for each land use category. Table 19 shows the calculation of the BEBs for this development. The assumptions detailed in paragraph 7.6 regarding lack of available transport emission benchmarks (TEBs) for all land uses, i.e. the application of A1 benchmarks for A3 and A5 space, have also been applied to the BEB calculations for consistency. Similarly, the London Underground Limited (LUL) entrance space has been included in the A1 area.

Table 19: Calculation of Building Emissions Benchmark for the Development

Description		Value	Reference
A	Gross Internal Floor Area of A1 Retail Units (m^2)	1,428	Atelier Ten
B	NOx BEB for A1 Retail Units (g/m^2/annum)	22.6	Table A7.1
C	Gross Internal Floor Area of B1 Office space (m^2)	23,952	Atelier Ten
D	NOx BEB for B1 Office space (g/m^2/annum)	30.8	Table A7.1
Total BEB NOx Emissions (kg/annum)		770.0	(A x B + C x D) / 1000
E	Gross Internal Floor Area of A1 Retail Units (m^2)	1,428	Atelier Ten
F	PM_{10} BEB for A1 Retail Units (g/m^2/annum)	1.29	Table A7.1
G	Gross Internal Floor Area of B1 Office space (m^2)	23,952	Atelier Ten
H	PM_{10} BEB for B1 Office space (g/m^2/annum)	1.77	Table A7.1
Total BEB PM_{10} Emissions (kg/annum)		44.2	(E x F + G x H) / 1000

7.4 The Total Building NOx Emission of 121.7 kg/annum is less than Total BEB NOx Emission of 770.0 kg/annum and the Total Building PM_{10} Emission of 2.8 kg/annum is less than the Total BEB PM_{10} Emission of 44.2 kg/annum. The proposed development is thus better than air quality neutral in terms of building emissions.

Road Transport Emissions

7.5 The TEBs are based on the number of car trips generated by different land-use classes, together with the associated trip lengths and vehicle emission rates.

7.6 TTP Consulting has advised that the proposed development is expected to generate a total of 28,704 car trips per year from the B1 offices and a further 13,928 car trips per year from the A1 retail land use. Appendix A7 provides default values for the average trip length for B1 offices and A1 retail land use in Central London, as well as the average NOx and PM_{10} emissions per vehicle-kilometre. This information has been used to calculate the transport emissions generated by the development (Table 20). These have then been compared with the TEBs for the development set out in Table 21. As trip rates and benchmark emission rates are not available for all land uses, including the A3 and A5 land uses included in Belgrove House, the trip generation and GIAs for these land uses have been included in the calculations of the A1 retail emissions and benchmarks.

Table 20: Calculation of Transport Emissions for the Development

Description		Value		Reference
Retail (A1)				
A	Total Car Trips per Year [a]	13,928		TTP Consulting
B	Average Distance per Trip (km)	9.3		Table A7.3
		NOx	PM_{10}	-
C	Emissions per Vehicle-km (g)	0.4224	0.0733	Table A7.4
D	Retail Transport Emissions (kg/annum)	54.7	9.5	A x B x C / 1,000
Office (B1)				
E	Total Car Trips per Year [a]	28,704		TTP Consulting
F	Average Distance per Trip (km)	3.0		Table A7.3
		NOx	PM_{10}	
G	Emissions per Vehicle-km (g)	0.4224	0.0733	Table A7.4
H	Office Transport Emissions (kg/annum)	36.4	6.3	E x F x G / 1,000
Entire Development				
Total Transport Emission (kg/annum)		91.1	15.8	D + H

[a] Each trip is 1-way (i.e. a return journey would be two trips).

Table 21: Calculation of Transport Emissions Benchmarks for the Development

	Description	Value		Reference
Retail (A1)				
A	**Gross Internal Floor Area of Retail Units (m^2)**	1,428		Atelier Ten
		NOx	**PM_{10}**	-
B	**Benchmark Emissions ($g/m^2/annum$)**	169.0	29.3	Table A7.2
C	**Retail TEBs (kg/annum)**	241.3	41.8	A x B / 1000
Office (B1)				
D	**Gross Internal Floor Area of Offices (m^2)**	23,952		Atelier Ten
		NOx	**PM_{10}**	
E	**Benchmark Emissions ($g/m^2/annum$)**	1.27	0.22	Table A7.2
F	**Office TEBs (kg/annum)**	30.4	5.3	D x E / 1000
Entire Development				
Total TEBs (kg/annum)		271.8	47.1	C + F

7.7 The Total Transport Emissions are less than the Total Transport Emissions Benchmarks for both NOx and PM_{10}. The proposed development is thus better than air quality neutral in terms of transport emissions.

8 Mitigation

Mitigation Included by Design

8.1 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:

- adoption of a Dust Management Plan (DMP) or Construction Environmental Management Plan (CEMP) to minimise the environmental impacts of the construction works;
- use of air-source heat pumps to avoid the need for routine on-site combustion energy plant; and
- running of the backup generator flues to 1 m above roof level to ensure the best possible dispersion environment.

Recommended Mitigation

Construction Impacts

8.2 Measures to mitigate dust emissions will be required during the construction phase of the development in order to minimise effects upon nearby sensitive receptors.

8.3 The site has been identified as a *Medium* Risk site during all stages of demolition and construction, as set out in Table 12. The GLA's SPG on *The Control of Dust and Emissions During Construction and Demolition* (GLA, 2014b) describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on what monitoring should be undertaken during the construction phase. This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A8.

8.4 The mitigation measures should be written into a dust management plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring. The GLA's guidance suggests that, for a Medium Risk site, automatic monitoring of particulate matter (as PM_{10}) will be required. It also states that, on certain sites, it may be appropriate to determine the existing (baseline) pollution levels before work begins. However, the guidance is clear that the Local Authority should advise as to the appropriate air quality monitoring procedure and timescale on a case-by-case basis.

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

Road Traffic Impacts

8.6 The assessment has demonstrated that the overall effect of the proposed development will be 'not significant'. It is, therefore, not considered appropriate to propose further mitigation measures.

8.7 Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which is written into UK law). The local air quality plan that LBC is required to produce in order to address limit value exceedances in its area, as well as the new Draft London Plan (GLA, 2019a) will also help to improve air quality.

8.8 Future users of the proposed development will not be exposed to 1-hour mean nitrogen dioxide concentrations above the objective in the year of opening, thus it is not necessary to recommend additional mitigation measures. However, as discussed in paragraph 3.8, it was requested that concentrations at the site were assessed in relation to the annual mean objective. Although the official predictions show that annual mean nitrogen dioxide concentrations are below the objective at all on-site receptors, results from the sensitivity test show that there is a risk that annual mean nitrogen dioxide concentrations could be above the objective value of 40 $\mu g/m^3$ at some locations within the proposed development, in 2024. Although the annual mean objective does not strictly apply at these locations, a mechanical ventilation system could be implemented to draw air from the roof at the rear of the building, where pollutant concentrations have been shown to be below the objective values, or include NOx filtration. This could be detailed within the ventilation strategy for the proposed development.

Generator Impacts

8.9 The assessment has demonstrated that the proposed emergency diesel generators will have a negligible impact on air quality at off-site existing receptors, and not lead to exceedances of the air quality objectives at the proposed receptors, thus no additional mitigation measure are required.

8.10 The emergency diesel generators installed within the proposed development should, however, meet the specifications set out in Appendix A5; if the installed generators do not conform to these specifications, additional assessment and/or mitigation may be required.

9 Residual Impacts

Construction

9.1 The IAQM guidance, on which the GLA's guidance is based, is clear that, with appropriate mitigation in place, the residual effects will normally be 'not significant'. The mitigation measures set out in Section 8 and Appendix A8 are based on the GLA guidance. With these measures in place and effectively implemented the residual effects are judged to be 'not significant'.

9.2 The IAQM guidance does, however, recognise that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be 'not significant'.

Generator Impacts

9.3 The residual impacts on existing receptors will be the same as those identified in Section 6. The overall effects of the proposed development will be 'not significant'.

Road Traffic Impacts

9.4 The residual impacts will be the same as those identified in Section 6. The overall effects of the proposed development will be 'not significant'.

10 Conclusions

10.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emissions. With these measures in place, it is expected that any residual effects will be 'not significant'.

10.2 The proposed development will lead to increases in traffic on local roads. Impacts at existing receptors will be negligible and there will be no significant effects on air quality.

10.3 The proposed development will include two emergency diesel generators. The assessment showed that impacts at existing receptors would be negligible. In addition, based on the testing regime for the generators, it was demonstrated that plant emissions would not lead to any exceedances of the air quality objectives within the proposed development. Overall, emissions from the proposed emergency plant will have insignificant effects on air quality.

10.4 Future air quality conditions at the proposed development were also quantified. Both sets of results showed that the 1-hour mean nitrogen dioxide and 24-hour PM_{10} objectives are not predicted to be exceeded anywhere within the proposed development in the opening year. Future air quality conditions at the site will thus be acceptable for the proposed uses.

10.5 As discussed in paragraph 3.8, although the annual mean objectives do not apply at the site, consideration has also been given as to whether the annual mean nitrogen dioxide, PM_{10} and $PM_{2,5}$ objectives values are predicted to be exceeded within the Site in 2024. Annual mean PM_{10} and $PM_{2.5}$ concentrations are predicted to be well below the objective values for both sets of results. Although based on 'official' predictions, annual mean concentrations of nitrogen dioxide are predicted to be below the objectives across the Site, concentrations could potentially exceed the objective in some sections of the proposed development based on the results of the extremely worst-case sensitivity test. Whilst the annual mean objectives do not strictly apply at office accommodation, mitigation could be applied by way of mechanical ventilation either drawing air from the areas away from significant sources or including NOx filtration.

10.6 An air quality neutral assessment was also carried out and showed that the proposed development would be better than air quality neutral for both transport and building emissions.

10.7 The overall operational air quality effects of the development are thus judged to be ''not significant'.

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12 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
ADMS-5	Atmospheric Dispersion Modelling System model for point sources
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
BEB	Building Emissions Benchmark
CAZ	Clean Air Zone
CEMP	Construction Environmental Management Plan
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
EU	European Union
EV	Electric Vehicle
Focus Area	Location that not only exceeds the EU annual mean limit value for NO_2 but also has a high level of human exposure
GIA	Gross Internal Floor Area
GLA	Greater London Authority
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
ICCT	International Council on Clean Transportation

kph	Kilometres Per hour
kW	Kilowatt
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LB	London Borough
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
µg/m^3	Microgrammes per cubic metre
MCPD	Medium Combustion Plant Directive
MW$_{th}$	Megawatts Thermal
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
NRMM	Non-road Mobile Machinery
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
OLEV	Office for Low Emission Vehicles
PC	Process Contribution
PHV	Private Hire Vehicle
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
RDE	Real Driving Emissions
SCR	Selective Catalytic Reduction
SPG	Supplementary Planning Guidance

Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEB	Transport Emissions Benchmark
TEMPro	Trip End Model Presentation Program
TfL	Transport for London
TRAVL	Trip Rate Assessment Valid for London
ULEZ	Ultra Low Emission Zone
WHO	World Health Organisation
ZEC	Zero Emission Capable

13 Appendices

A1 London-Specific Policies and Measures

London Plan

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

"Development proposals should:

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

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

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

d) ensure that where provision needs to made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-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;

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

London Environment Strategy

A1.2 The air quality chapter of the London Environment Strategy sets out three main objectives, each of which is supported by sub-policies and proposals. The Objectives and their sub-policies are set out below:

"Objective 4.1: Support and empower London and its communities, particularly the most disadvantaged and those in priority locations, to reduce their exposure to poor air quality.

- *Policy 4.1.1 Make sure that London and its communities, particularly the most disadvantaged and those in priority locations, are empowered to reduce their exposure to poor air quality*
- *Policy 4.1.2 Improve the understanding of air quality health impacts to better target policies and action*

Objective 4.2: Achieve legal compliance with UK and EU limits as soon as possible, including by mobilising action from London Boroughs, government and other partners

- *Policy 4.2.1 Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport*
- *Policy 4.2.2 Reduce emissions from non-road transport sources, including by phasing out fossil fuels*
- *Policy 4.2.3 Reduce emissions from non-transport sources, including by phasing out fossil fuels*
- *Policy 4.2.4 The Mayor will work with the government, the London boroughs and other partners to accelerate the achievement of legal limits in Greater London and improve air quality*
- *Policy 4.2.5 The Mayor will work with other cities (here and internationally), global city and industry networks to share best practice, lead action and support evidence based steps to improve air quality*

Objective 4.3: Establish and achieve new, tighter air quality targets for a cleaner London by transitioning to a zero emission London by 2050, meeting world health organization health-based guidelines for air quality

- *Policy 4.3.1 The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners*
- *Policy 4.3.2 The Mayor will encourage the take up of ultra low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines*
- *Policy 4.3.3 Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality*
- *Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces"*

A1.3 While the policies targeting transport sources are significant, there are less obvious ones that will also require significant change. In particular, the aim to phase out fossil-fuels from building heating and cooling and from NRMM will demand a dramatic transition.

Low Emission Zone (LEZ)

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

A1.5 The Mayor of London confirmed in June 2018 that the LEZ will be amended such that a Euro VI standard will apply for heavy vehicles from 26 October 2020. Requirements relating to larger vans, minibuses and other specialist diesel vehicles will not change.

Ultra Low Emission Zone (ULEZ)

A1.6 London's ULEZ was introduced on 8 April 2019. The ULEZ currently operates 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches.

A1.7 The Mayor of London confirmed in June 2018 that, from 25 October 2021, the ULEZ will cover the entire area within the North and South Circular roads, applying the emissions standards set out in Paragraph A1.6 for light vehicles. The ULEZ will not include any requirements relating to heavy vehicle emissions beyond 26 October 2020, as these will be addressed by the amendments to the LEZ described in Paragraph A1.5.

Other Measures

A1.8 From 2018 all taxis presented for licencing for the first time must be zero emission capable (ZEC). This means they must be able to travel a certain distance in a mode which produces no air pollutants. From 2018 all private hire vehicles (PHVs) presented for licensing for the first time must meet Euro 6 emissions standards. From 1 January 2020, all newly manufactured PHVs presented for licensing for the first time must be ZEC (with a minimum zero emission range of 10 miles). The Mayor's aim is that the entire taxi and PHV fleet will be made up of ZEC vehicles by 2033.

A1.9 The Mayor has also proposed to make sure that TfL leads by example by cleaning up its bus fleet, implementing the following measures:

- TfL will procure only hybrid or zero emission double-decker buses from 2018;
- a commitment to providing 3,100 double decker hybrid buses by 2019 and 300 zero emission single-deck buses in central London by 2020;
- introducing 12 Low Emission Bus Zones by 2020;
- investing £50m in Bus Priority Schemes across London to reduce engine idling; and
- retrofitting older buses to reduce emissions (selective catalytic reduction (SCR) technology has already been fitted to 1,800 buses, cutting their NOx emissions by around 88%).

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM (2016), upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

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

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

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

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix A8.

STEP 4: Determine Significant Effects

A2.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant'.

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [4]

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

[4] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude for trackout, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.4: Sensitivity of the Area to Human Health Effects [4]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A2.5: Sensitivity of the Area to Ecological Effects [4]

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A3 EPUK & IAQM Planning for Air Quality Guidance

A3.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A3.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
  - Spark ignition engine: 250 mgNOx/Nm^3;
  - Compression ignition engine: 400 mgNOx/Nm^3;
  - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

“It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the “damage cost approach” used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential”.

A3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A3.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or
- the development will have a centralised energy facility or other centralised combustion process.

A3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

A3.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A3.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

A3.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A3.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

A3.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Impact Descriptors and Assessment of Significance

A3.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

Impact Descriptors

A3.16 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A3.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A3.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[a] Values are rounded to the nearest whole number.

[b] This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A3.17 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and

- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A3.18 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A3.19 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A4 Professional Experience

Penny Wilson, BSc (Hons) CSci MIEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than 19 years' relevant experience in the field of air quality. She has been responsible for numerous assessments for a range of infrastructure developments including power stations, road schemes, ports, airports and residential/commercial developments. The assessments have covered operational and construction impacts, including odours. She also provides services to local authorities in support of their LAQM duties, including the preparation of Review and Assessment and Action Plan reports, as well as audits of Air Quality Assessments submitted with planning applications. She has provided expert evidence to a number of Public Inquiries, and is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Pauline Jezequel, MSc MIEnvSc MIAQM

Miss Jezequel is a Principal Consultant with AQC with ten years' relevant experience. Prior to joining AQC she worked as an air quality consultant at AECOM. She has also worked as an air quality controller at Bureau Veritas in France, undertaking a wide range of ambient and indoor air quality measurements for audit purposes. She now works in the field of air quality assessment, undertaking air quality impact assessments for a wide range of development projects in the UK and abroad, including for residential and commercial developments, transport schemes (rail, road and airport), waste facilities and industrial sites. Miss Jezequel has also undertaken a number of odour surveys and assessments in the context of planning applications. She has experience in monitoring construction dust, as well as indoor pollutant levels for BREEAM purposes. She is a Member of the Institute of Air Quality Management.

Jack Buckley, BSc (Hons) MSc AMIEnvSc AMIAQM

Mr Buckley is a Consultant with AQC with two years' experience in the field of air quality. Prior to joining AQC in June 2019, he worked as a Consultant at Capita, where he gained experience in the assessment of air quality impacts for a range of projects, including road and rail infrastructure schemes, residential developments and industrial facilities sizes. He has experience in producing air quality assessments for EIA schemes, using qualitative and quantitative methods, including ADMS-Roads and air quality neutral calculations, and has undertaken diffusion tube monitoring studies. Prior to joining Capita, Jack completed a BSc (Hons) in Chemistry and an MSc in Environmental Science and Management, with both dissertations investigating the performance of low-cost air quality sensors. He is an Associate Member of both the Institute of Air Quality Management and the Institution of Environmental Sciences.

A5 Modelling Methodology

Model Inputs

Road Traffic

A5.1 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 9.0) published by Defra (2020b).

A5.2 Hourly sequential meteorological data from London City Airport for 2019 have been used in the model. The meteorological monitoring station is located at London City Airport, approximately 11.5 km to the east of the proposed Site. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed Site; both the Site and the meteorological monitoring station are located in London where they will be influenced by the effects of urban meteorology.

A5.3 For the purposes of modelling, it has been assumed that numerous roads in the vicinity of the proposed development, including Crestfield Street adjacent to the eastern façade of the proposed development, are within street canyons. These roads have a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. They have, therefore, been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from local mapping and photographs.

A5.4 AADT flows and vehicle fleet composition data have been provided by TTP Consulting, who have undertaken the transport assessment work for the proposed development. These have been derived from both weekday counts, which may over-predict annual average flows, and the interactive web-based map provided by DfT (2020). The 2019 AADT flows have been factored forwards to the assessment year of 2024 using growth factors derived using the TEMPro System v7.2 (DfT, 2017). Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A5.1. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2019).

Table A5.1: Summary of Traffic Data used in the Assessment

Road Link	2019		2024 (Without Scheme)		2024 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
A501 Grays Inn Road	23,619	7.0	25,143	7.0	25,218	7.1
A5200 Grays Inn Road	12,632	7.2	13,448	7.2	13,463	7.2
Argyle Street East	400	6.1	426	6.1	484	6.2
Argyle Street West	950	7.3	1,011	7.3	1,064	7.0
Argyle Square/Crestfield Street	561	6.9	597	6.9	791	6.6
A501 Euston Road	57,802	8.6	61,532	8.6	61,843	8.6

A5.5 Figure A5.1 shows the road network included within the model, along with the speed at which each link was modelled and the locations of any street canyons, and defines the study area.

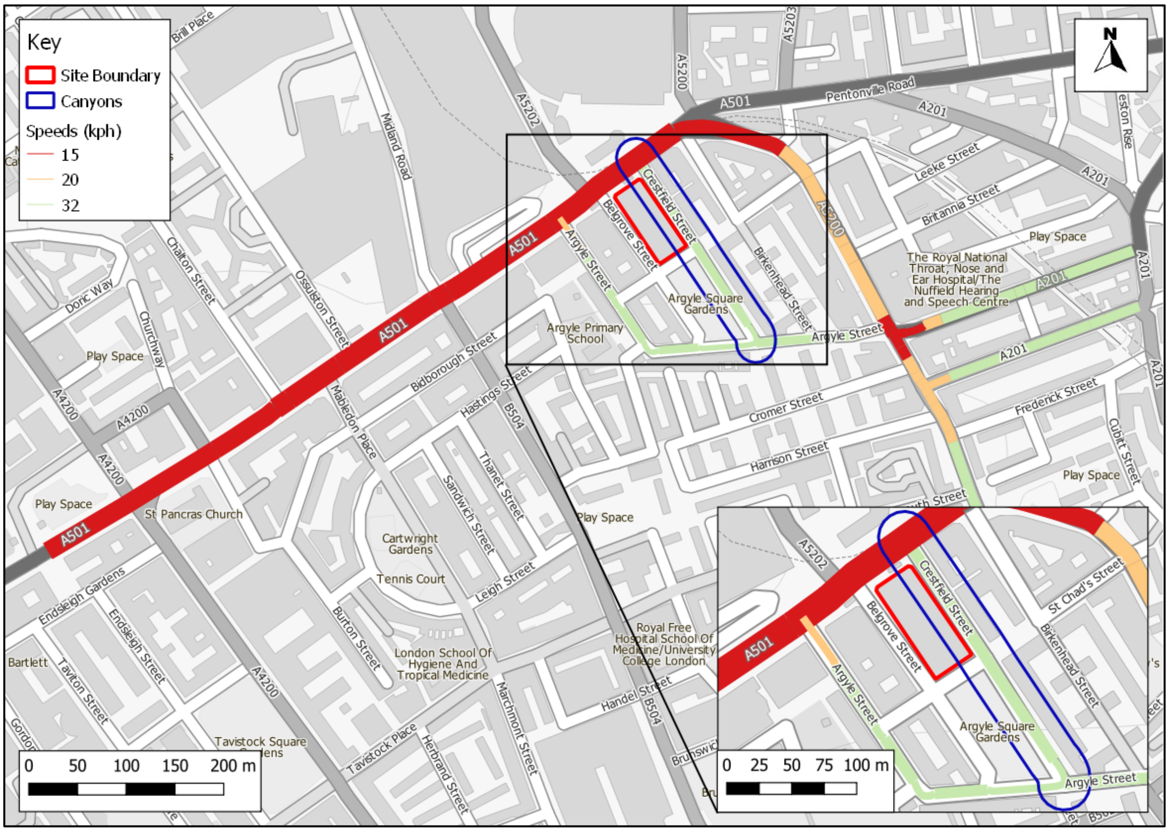

Figure A5.1: Modelled Road Network & Speed

Sensitivity Test

A5.6 As explained in Section 3, a worst-case sensitivity test has been carried out which assumes that background concentrations are equivalent to the Defra estimated concentrations with no adjustment based on local monitoring, and there is no improvement in vehicle emissions and background concentrations after 2019. This has been carried out at the request of LBC.

Point Sources

A5.7 The impacts of emissions from the proposed emergency backup generators have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model has been run to predict the contribution of the proposed generators emissions to annual mean concentrations of nitrogen oxides and PM (assumed to be both $PM_{2.5}$ and PM_{10}), the 99.79th percentile of 1-hour mean nitrogen oxides concentrations, and the 90.4th percentile of 24-hour mean PM_{10} concentrations.

A5.8 The two backup diesel generators proposed to be installed into the development will have assumed net fuel inputs of 2,645 kW_{th} and 1,008 kW_{th} which is equivalent to fuel consumptions of 266.3 and 101.5 litres per hour of diesel oil respectively. The generators will be capable of delivering 1,250 kVA and 500 kVA on demand. Although backup generator plant are not required to conform to emission limits, the generator plant will have maximum emissions of 1,800 mg/Nm^3 for NOx and 80 mg/Nm^3 for particulates. Emissions will rise to roof level in two separate flues. Atelier Ten Ltd has advised that the backup generator plant will operator for 16 hours per year in accordance with the maintenance schedule and it has been assumed that both generators will be tested simultaneously to ensure a conservative assessment.

A5.9 The emission parameters employed in the modelling are set out in Table A5.2. These have been derived from the datasheet for the diesel generators. The assumed composition of diesel fuel used in the emissions calculations is set out in Table A5.3.

Table A5.2: Plant Specifications and Modelled Emissions and Release Conditions

Parameter	Value
1250 kVA Generator	
Exit Velocity (m/s)	25.2
Flue Internal Diameter (m)	0.45
Actual Exhaust Volume Flow (m^3/s)	4.0
Hours of Use per Year (for testing)	16
NOx Emission Standard (mg/Nm^3)	1,800
PM_{10} Emission Standard (mg/Nm^3)	80
Calculated NOx Emission Rate (g/s)	1.53
Calculated PM_{10} Emission Rate (g/s)	0.02
Exhaust Temperature (C)	482
Flue Location (x,y)	530279,182873
Modelled Flue Height	45.7
500 kVA Generator	
Exit Velocity (m/s)	43.0
Flue Internal Diameter (m)	0.2
Actual Exhaust Volume Flow (m^3/s)	1.35
Hours of Use per Year (for testing)	16
NOx Emission Standard (mg/kWh)	1,800
PM_{10} Emission Standard (mg/kWh)	80
Calculated NOx Emission Rate (g/s)	0.58
Calculated PM_{10} Emission Rate (g/s)	0.03
Exhaust Temperature (C)	550
Flue Location (x,y)	530278,182872
Modelled Flue Height	45.7

Table A5.3: Typical Diesel Fuel Composition

Elemental Component	Diesel Oil
Carbon	86.5%
Hydrogen	13.2%
Oxygen	0.3%
Net Calorific Value (LHV) (MJ/kg)	42.82
Gross Calorific Value (HHV) (MJ/kg)	45.70
HHV/LHV	1.07
Liquid Density @ 15°C (kg/m^3)	835

A5.10 Entrainment of the plume into the wake of the buildings (the so-called building downwash effect) has been taken into account in the model. The building dimensions and flue location have been obtained from drawings provided by Allford Hall Monaghan Morris Architects Ltd. The locations of the flues are shown in Figure A5.2 along with the modelled buildings and their heights. The flues have been modelled at a height of 45.7 m (1 m above the roof level).

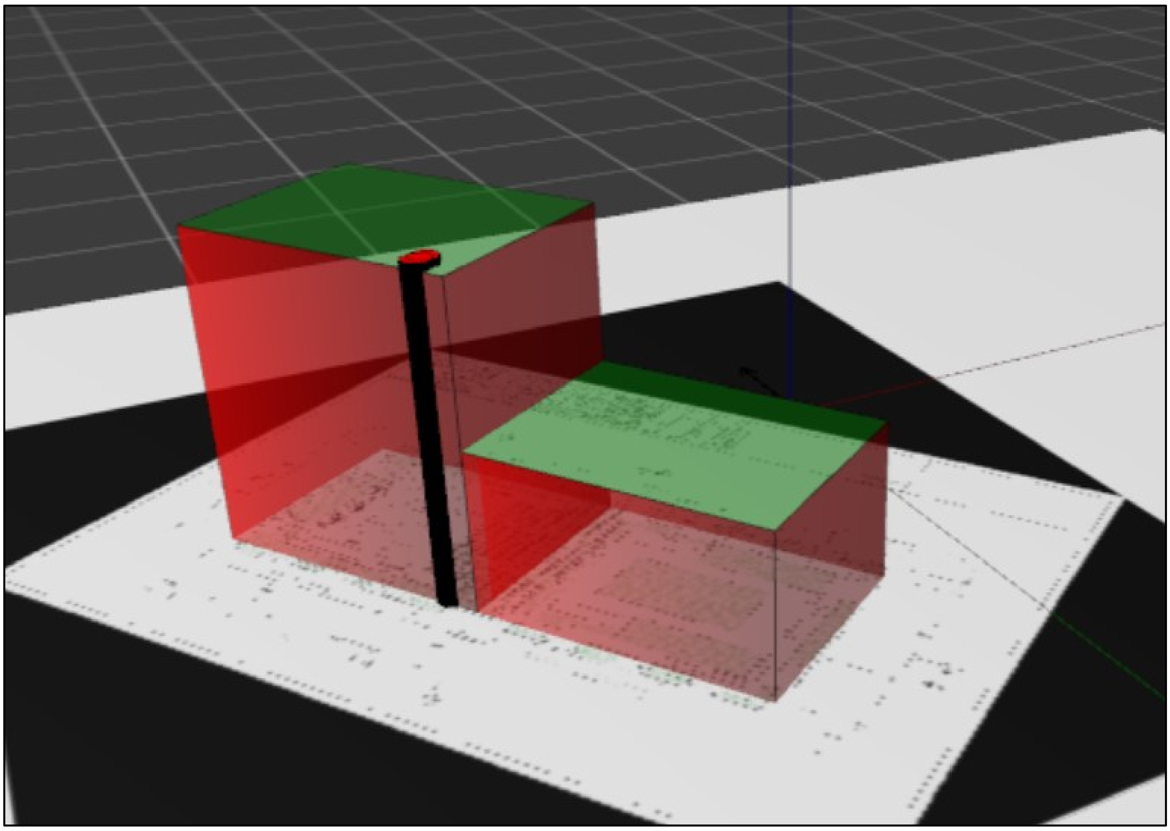

Figure A5.2: Flue Locations (black and red cylinders) & Modelled Buildings (red and green blocks)

Contains data from Allford Hall Monaghan Morris Architects Ltd drawing number 17002_A_A_(00)_112_02.

A5.11 Hourly sequential meteorological data from London City Airport for 2017, 2018 and 2019 have been used in the model.

Modelled Receptors

A5.12 A nested Cartesian grid at 1.5 m elevation has been used with receptors within 200 m of the grid centre spaced 5 m apart, those within 400 m at 25 m apart, those within 1000 m at 50 m apart, those within 2000 m at 25 m apart and those within 5000 m at 500 m apart. Additionally, concentrations have been modelled at all floors of Belgrove House and at the accessible roof terrace.

Modelling Assumptions

A5.13 It has been assumed that the generators will each operate for 16 hours per year, in line with the maintenance schedule, and annual mean model outputs have been scaled accordingly. This usage information has been provided by Atelier Ten Ltd, who developed the energy strategy for the proposed development.

Background Concentrations

A5.14 The background pollutant concentrations across the study area have been defined using the 2017-based national pollution maps published by Defra (2020b). These cover the whole of the UK on a 1x1 km grid and are published for each year from 2017 until 2030.

A5.15 The background maps for 2019 have been calibrated against local measurements made at the London Bloomsbury background automatic monitoring site for the 'official' predictions. The measured nitrogen dioxide concentration at this site in 2019 was 31.5 μg/m^3, while the mapped background for the grid square within which it lies was 37.8 μg/m^3. All mapped background nitrogen dioxide concentrations have therefore been calibrated by applying a factor of 0.833. The measured PM_{10} concentration at the London Bloomsbury site in 2019 was 17.6 μg/m^3, while the mapped background was 19.3 μg/m^3. All mapped background PM_{10} concentrations have therefore calibrated by applying a factor of 0.912. The measured $PM_{2.5}$ concentration at the London Bloomsbury site in 2019 was 10.8 μg/m^3, while the mapped background was 12.8 μg/m^3. All mapped background $PM_{2.5}$ concentrations have therefore calibrated by applying a factor of 0.844.

Background Concentrations for Sensitivity Test

A5.16 The unadjusted estimated Defra 2017-based background concentrations for 2019 have been used for all scenarios in the sensitivity testing, which assumes no improvements in background concentrations beyond 2019. This is a very worst-case approach, as LBC monitoring data indicates lower concentrations, as described in paragraph A5.15 and an on-going downward trend in concentrations.

Model Verification

A5.17 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. It is not practical, nor usual, to verify the ADMS-5 model, and, because ADMS-5 does not rely on estimated road-vehicle emission factors, the adjustment used for ADMS-Roads cannot be applied to ADMS-5. Predictions made using ADMS-5 have thus not been verified.

Official Predictions

Nitrogen Dioxide

A5.18 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides ($NOx = NO + NO_2$). The model has been run to predict the annual mean NOx concentrations during 2019 at the Euston Road automatic and CA4 diffusion tube monitoring sites. Concentrations have been modelled at 2 m and 1.5 m respectively, the heights of the monitors.

A5.19 The model outputs of road-NOx (i.e. the component of total NOx coming from road traffic) have been compared with the 'measured' road-NOx. Measured road-NOx have been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentrations using the NOx from NO_2 calculator (Version 7.1) available on the Defra LAQM Support website (Defra, 2020b).

A5.20 The unadjusted model has under predicted the road-NOx contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contributions and the model derived road contributions, forced through zero (Figure A5.3). The calculated adjustment factor of 1.6813 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A5.21 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A5.4 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

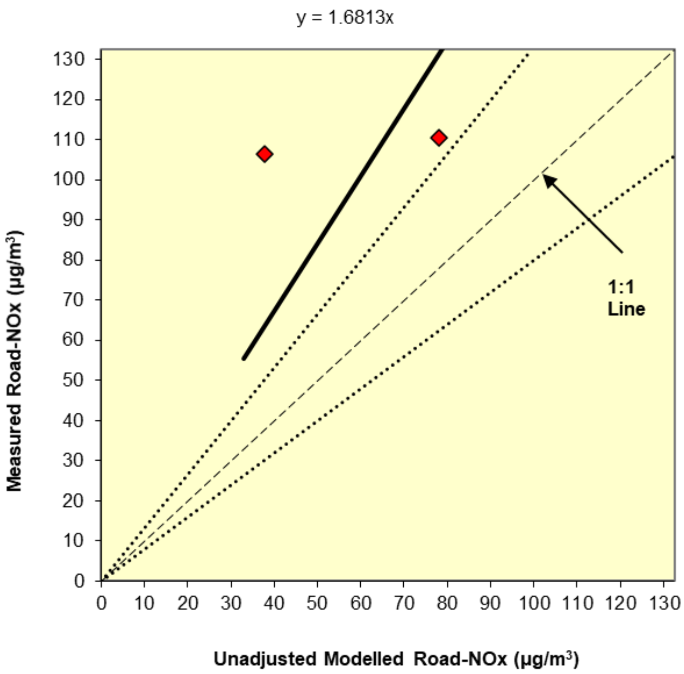

Figure A5.3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

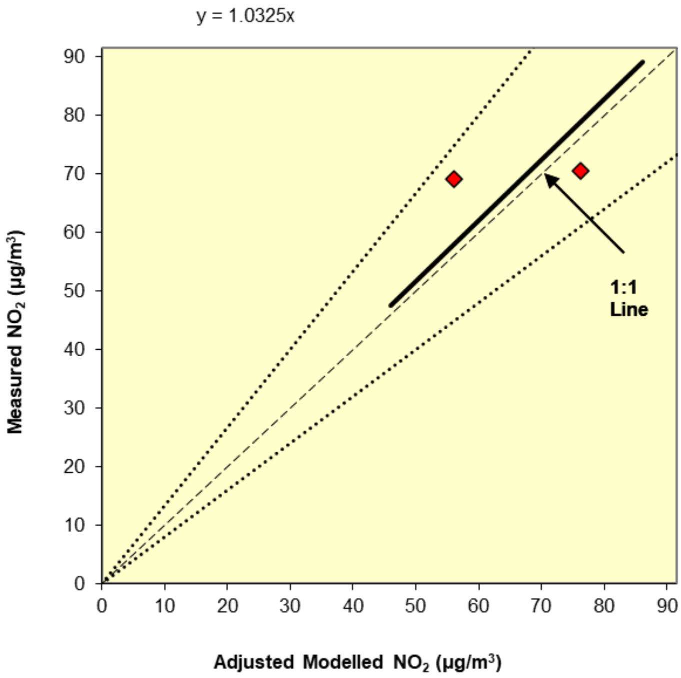

Figure A5.4: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

PM_{10} and $PM_{2.5}$

A5.22 The model outputs of road-PM_{10} and road-$PM_{2.5}$ have been adjusted by applying the adjustment factor calculated for road NOx.

Sensitivity Test

Nitrogen Dioxide

A5.23 The same model verification process has been carried out for the sensitivity test scenarios as for the 'official' predictions, but unadjusted background concentrations have instead been used in calculating the road-NOx and total NO_2 concentrations.

A5.24 An adjustment factor of 1.4054 was determined and applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A5.25 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A5.4 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

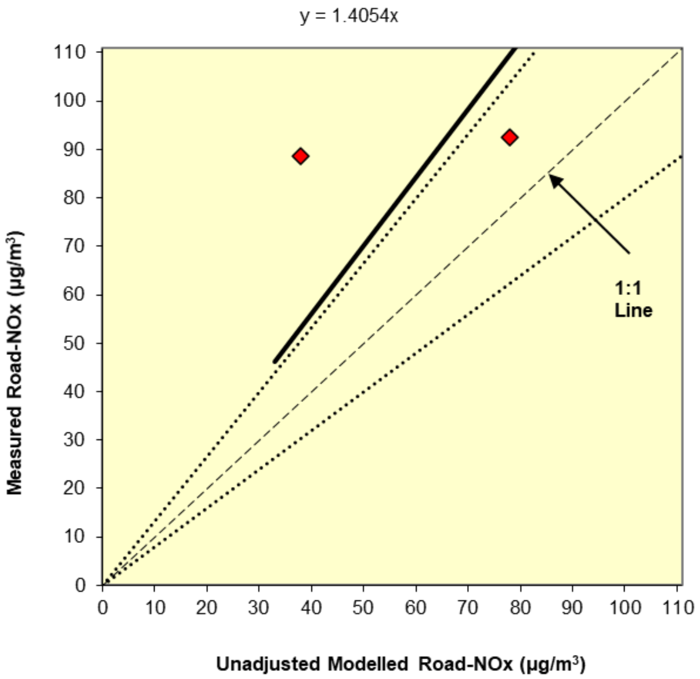

Figure A5.5: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

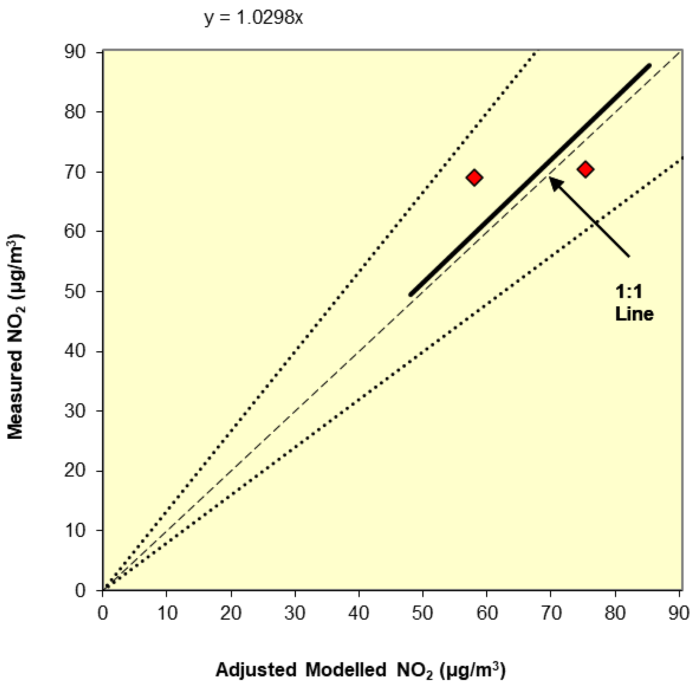

Figure A5.6: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

PM_{10} and $PM_{2.5}$

A5.26 The model outputs of road-PM_{10} and road-$PM_{2.5}$ have been adjusted by applying the adjustment factor calculated for road NOx, as this represented a more conservative approach compared to adjusting individually.

Model Post-processing

Road Traffic

A5.27 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factors set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2020b). The traffic mix within the calculator has been set to "All London traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

Point Sources

A5.28 Emissions from the generators will be predominantly in the form of nitrogen oxides (NOx) and PM_{10}. ADMS-5 has been run to predict the contribution of the proposed generator emissions to annual mean concentrations of nitrogen oxides and PM, and to the 99.79th percentile of 1-hour mean nitrogen oxides concentrations and the 90.4th percentile of 24-hour mean PM_{10} concentrations. For the initial screening of the process contributions, the approach recommended by the Environment Agency (2005) has been used to predict nitrogen dioxide concentrations, assuming that:

- annual mean NO_2 concentration = annual mean NOx concentration multiplied by 0.7; and
- 99.79th percentile of 1-hour mean NO_2 concentrations = 99.79th percentile of 1-hour mean NOx concentrations multiplied by 0.35.

A5.29 The PM output requires no further adjustment.

A6 London Vehicle Fleet Projections

A6.1 TfL has published an Integrated Impact Assessment (Jacobs, 2017) setting out the impacts of the changes to the LEZ and ULEZ described in Paragraphs A1.5 and A1.7. The assessment predicts that the changes will reduce overall NOx emissions from vehicles in London by 28% in 2021 (32% in Inner London and 27% in Outer London) and by 21% in 2025 (24% in Inner London and 21% in Outer London). The percentage reduction reduces with time due to the natural turnover of the fleet that would have occurred regardless of the introduction of the proposed changes. The proposed changes will not significantly affect emissions in Central London, where the ULEZ will already be implemented, but concentrations here will still reduce due to the lower emissions in surrounding areas.

A6.2 The report projects that the changes will reduce exposure to exceedances of the annual mean nitrogen dioxide objective by 40% and 21% in Central London in 2021 and 2025, respectively; by 4% and 0% in Inner London in 2021 and 2025, respectively; and by 23% and 27% in Outer London in 2021 and 2025, respectively, when compared to the baseline scenario.

A6.3 The changes are not projected to have a significant effect on PM_{10} and $PM_{2.5}$ concentrations, although a small reduction is predicted.

A6.4 AQC's report on the performance of Defra's EFT (AQC, 2020) also highlighted that the EFT's assumptions regarding future fleet composition in London and across the UK may be over-pessimistic in terms of NOx emissions. The future fleet projection derived from the EFT for Outer London, for example, shows a very small reduction in the proportion of diesel cars between 2016 and 2030, and a very limited uptake of electric cars. The AQC report highlights that this contrasts with the expectations of many observers, as well as the most recent trends publicised by the media. When considered alongside the future requirements of the LEZ and ULEZ, these future fleet projections seem all the more unrealistic (i.e. worst-case in terms of emissions), as the changes to the LEZ and ULEZ would reasonably be expected to significantly increase the uptake of lower emissions vehicles in London.

A6.5 As outlined in Paragraph 3.21, the changes to the LEZ and ULEZ announced by the Mayor of London in June 2018 are not reflected in Defra's latest EFT and thus have not been considered in this assessment. The potentially over-pessimistic fleet projections built in to the EFT have not been addressed in this report either. Paragraphs A6.1 and A6.2 highlight that the changes to the LEZ and ULEZ will result in significant reductions in vehicle nitrogen oxides emissions and resultant nitrogen dioxide concentrations. The changes might reasonably also be expected to expedite the uptake of cleaner vehicles well beyond that projected in the EFT's fleet projections for London. As such, while the results presented in this report represent a reasonably conservative reflection of likely concentrations and impacts in the absence of the changes to the LEZ and ULEZ, they almost certainly represent an unrealistically worst-case assessment of likely concentrations and impacts bearing in mind the implementation of these changes.

A7 'Air Quality Neutral'

A7.1 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a), and its accompanying Air Quality Neutral methodology report (AQC, 2014), provide an approach to assessing whether a development is air quality neutral. The approach is to compare the expected emissions from the building energy use and the car use associated with the proposed development against defined emissions benchmarks for buildings and transport in London.

A7.2 The benchmarks for heating and energy plant (termed 'Building Emissions Benchmarks' or 'BEBs') are set out in Table A7.1, while the 'Transport Emissions Benchmarks' ('TEBs') are set out in Table A7.2. In order to assess against the TEBs, it is necessary to combine the expected trip generation from the development with estimates of average trip length and average emission per vehicle. So as to ensure a consistent methodology, the report which accompanies the SPG (AQC, 2014) recommends that the information in Table A7.3 and Table A7.4 (upon which the TEBs are based) is used. Similarly, the information in Table A7.5 may be used if site-specific information are not available (AQC, 2014). For use classes other than A1, B1 and C3, trip lengths and average emissions per vehicle are not provided, thus the trip rates in Table A7.6 alone may be used to consider the air quality neutrality of a development. These have been derived from the Trip Rate Assessment Valid for London (TRAVL) database.

Table A7.1: Building Emissions Benchmarks (g/m[2] of Gross Internal Floor Area)

Land Use Class	NOx	PM_{10}
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

Table A7.2: Transport Emissions Benchmarks

Land use	CAZ [a]	Inner [b]	Outer [b]
NOx (g/m²/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m²/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

[a] Central Activity Zone.

[b] Inner London and Outer London as defined in the LAEI (GLA, 2019b).

Table A7.3: Average Distance Travelled by Car per Trip

Land use	Distance (km)		
	CAZ	Inner	Outer
Retail (A1)	9.3	5.9	5.4
Office (B1)	3.0	7.7	10.8
Residential (C3)	4.3	3.7	11.4

Table A7.4: Average Road Traffic Emission Factors in London in 2010

Pollutant	g/vehicle-km		
	CAZ	Inner	Outer
NO_x	0.4224	0.370	0.353
PM_{10}	0.0733	0.0665	0.0606

Table A7.5: Average Emissions from Heating and Cooling Plant in Buildings in London in 2010

	Gas (kg/kWh)		Oil (kg/kWh)	
	NO_x	PM_{10}	NO_x	PM_{10}
Domestic	0.0000785	0.00000181	0.000369	0.000080
Industrial/Commercial	0.000194	0.00000314	0.000369	0.000080

Table A7.6: Average Number of Trips per Annum for Different Development Categories

Land use	Number of Trips (trips/m^2/annum)		
	CAZ	Inner	Outer
A1	43	100	131
A3	153	137	170
A4	2.0	8.0	-
A5	-	32.4	590
B1	1	4	18
B2	-	15.6	18.3
B8	-	5.5	6.5
C1	1.9	5.0	6.9
C2	-	3.8	19.5
D1	0.07	65.1	46.1
D2	5.0	22.5	49.0
Number of Trips (trips/dwelling/annum)			
C3	129	407	386

A8 Construction Mitigation

A8.1 The following is a set of best-practice measures from the GLA guidance (GLA, 2014b) that should be incorporated into the specification for the works. These measures should be written into a Dust Management Plan. Some of the measures may only be necessary during specific phases of work, or during activities with a high potential to produce dust, and the list should be refined and expanded upon in liaison with the construction contractor when producing the Dust Management Plan.

Site Management

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- develop a Dust Management Plan (DMP);
- display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary;
- display the head or regional office contact information;
- record and respond to all dust and air quality pollutant emissions complaints;
- make a complaints 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 the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions are being carried out and during prolonged dry or windy conditions; and
- record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and ensure that the action taken to resolve the situation is recorded in the log book.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;

- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below;
- cover, seed, or fence stockpiles to prevent wind whipping;
- carry out regular dust soiling checks of buildings within 100 m of site boundary and provide cleaning if necessary;
- put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly;
- agree monitoring locations with the Local Authority; and
- where possible, commence baseline monitoring at least three months before work begins.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London LEZ (and ULEZ);
- ensure all Non-road Mobile Machinery (NRMM) comply with the standards set within the GLA’s Control of Dust and Emissions During Construction and Demolition SPG. This outlines that, from 1 September 2015, all NRMM of net power 37 kW to 560 kW used on the site of a major development in Greater London must meet Stage IIIA of EU Directive 97/68/EC (The European Parliament and the Council of the European Union, 1997) and its subsequent amendments as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum. From 1 September 2020 NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum, while NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum;
- ensure all vehicles switch off engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
- impose and signpost a maximum-speed-limit of 10 mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where appropriate);
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

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

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- ensure water suppression is used during demolition operations;
- avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- only remove the cover from small areas during work, not all at once.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible;

- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout

- Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- 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 gates should be located at least 10 m from receptors, where possible; and
- apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site.