Air Quality Assessment

Kneller Hall

For Radnor House School Limited

www.rpsgroup.com

Quality Management

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Executive Summary

The Kneller Hall Day School development involves the conversion of existing buildings and the construction of new buildings on the site, located within the London Borough of Richmond upon Thames. The entire borough is designated as an Air Quality Management Area (AQMA) due to elevated concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10}) attributable to road traffic emissions.

This Air Quality Assessment, undertaken to accompany the planning application, considers the air quality impacts from the construction phase and once the Proposed Development is operational.

The assessment has been undertaken based upon appropriate information on the Proposed Development provided by Radnor House School Limited and its project team. In undertaking this assessment, RPS experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour. These professional responsibilities are in accordance with the code of professional conduct set by the Institution of Environmental Sciences for members of the Institute of Air Quality Management (IAQM).

For the construction phase, the most important consideration is dust. Without appropriate mitigation, dust could cause temporary soiling of surfaces, particularly windows, cars and laundry. The mitigation measures provided within this report should ensure that the risk of adverse dust effects is kept to a minimum.

For the operational phase, arrivals at and departures from the Proposed Development may change the number, type and speed of vehicles using the local road network. Changes in road vehicle emissions are the most important consideration during this phase of the development.

Detailed atmospheric dispersion modelling has been undertaken. Pollutant concentrations are predicted to be well within the relevant health-based air quality objectives at the façades of both existing and proposed receptors. Therefore, air quality is acceptable at the development site, making it suitable for its proposed uses. The operational impact of the Proposed Development on existing receptors is predicted to be 'negligible' taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the operational air quality effects are considered to be 'not significant' overall.

The Kneller Hall development does not, in air quality terms, conflict with national or local policies, or with measures set out in the Council's Air Quality Action Plan. There are no constraints to the development in the context of air quality.

Contents

Tables, Figures and Appendices

Tables

Figures

Appendices

1 Introduction

1.1 This report details the air quality assessment undertaken for the Proposed Development in Twickenham, concerning the conversion of existing Kneller Hall buildings and construction of new buildings for a school. The report complements RPS' *'Air Quality Neutral Calculation: Kneller Hall'* report. That air quality neutral calculation report quantifies the emissions of atmospheric pollutants from the development at source (i.e. from vehicles and building plant) and compares the emissions with official benchmark levels that define neutrality. In contrast, this report considers the impacts of the development on ambient air quality at the point of exposure (i.e. at sensitive receptor locations) by comparing predicted levels with Air Quality Strategy objectives. The local authority, the London Borough of Richmond upon Thames, has currently designated the whole borough as an Air Quality Management Area (AQMA).

1.2 This air quality assessment covers the:

- Construction phase - an evaluation of the temporary effects from fugitive construction dust and construction-vehicle exhaust emissions; and the
- Operational phase – an evaluation of
  - the impacts of the development traffic on the local area including any effects on the AQMA
  - the impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

1.3 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects have then been described. The baseline air quality conditions have been established taking into account Defra estimates, local authority documents and the results of any local monitoring. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual construction-phase effects and the residual operational-phase effects.

2 Policy and Legislative Context

Ambient Air Quality Legislation and National Policy

Air Quality Standards Regulations

2.1 The Air Quality Standards Regulations 2010 [1], amended by The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 [2], sets limit values for ambient air concentrations for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene, certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs).

2.2 These limit values are legally binding on the Secretary of State. The Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

UK Air Quality Strategy

2.3 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 [3]. The Strategy sets UK air quality standards[♦] and objectives[#] for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. There is no legal requirement to meet objectives set within the UK AQS except where equivalent limit values are set within the Air Quality Standards Regulations.

2.4 The 1995 Environment Act also established the UK system of Local Air Quality Management (LAQM), that requires local authorities to go through a process of review and assessment of air quality in their areas, identifying places where objectives are not likely to be met, then declaring Air Quality Management Areas (AQMAs) and putting in place Air Quality Action Plans to improve air quality. These plans also contribute, at local level, to the achievement of the limit values in the Air Quality Standards Regulations.

♦ Standards are concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. Standards, as the benchmarks for setting objectives, are set purely with regard to scientific evidence and medical evidence on the effects of the particular pollutant on health, or on the wider environment, as minimum or zero risk levels.

Objectives are policy targets expressed as a concentration that should be achieved, all the time or for a percentage of time, by a certain date.

2.5 The limit values and objectives relevant to this assessment are summarised in Table 2.1. Where the limit values and the AQS objectives differ, the more stringent has been used.

Table 2.1 Summary of Relevant Air Quality Limit Values and Objectives

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than
Nitrogen Dioxide (NO_2)	1 hour	200 $\mu g.m^{-3}$	18 times per calendar year
	Annual	40 $\mu g.m^{-3}$	-
Particulate Matter (PM_{10})	24 Hour	50 $\mu g.m^{-3}$	35 times per calendar year
	Annual	40 $\mu g.m^{-3}$	-
Particulate Matter ($PM_{2.5}$)	Annual	20 $\mu g.m^{-3}$	-

2.6 On 14 January 2019, Defra published the *'Clean Air Strategy 2019'.* The report sets out actions that the Government intends to take to reduce emissions from transport, in the home, from farming and from industry.

National Planning Policy

National Planning Policy Framework

2.7 The National Planning Policy Framework (NPPF) [4] is a material consideration for local planning authorities and decision-takers in determining applications. At the heart of the NPPF, is a presumption in favour of sustainable development, subject to caveats where a plan or project affects a habitats site. For determining planning applications, this means approving development proposals if they accord with an up-to-date local development plan, unless material considerations indicate otherwise. If the development plan does not contain relevant policies, or the policies are out of date, then planning permission should be granted unless the application of policies in the NPPF that protect areas or assets of particular importance provides a clear reason for refusing the development, or any adverse impacts would significantly outweigh the benefits.

2.8 The NPPF sets out three overarching objectives to achieve sustainable development. The relevant objective in the context of this air quality assessment is:

*"**an environmental objective** – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural*

resources prudently, minimising waste and pollution and mitigating and adapting to climate change, including moving to a low carbon economy" (Paragraph 8c)

2.9 Under the heading 'Promoting sustainable transport', the NPPF states:

"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making." (Paragraph 105)

2.10 Under the heading 'Conserving and enhancing the natural environment', the NPPF states:

"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 and water quality, taking into account relevant information such as river basin management plans; …" (Paragraph 174)

"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." (Paragraph 186)

National Planning Practice Guidance

2.11 The National Planning Practice Guidance (NPPG) was issued on-line on 6 March 2014 and is updated periodically by government as a live document. The last major update was on 1 November 2019. The Air Quality section of the NPPG describes the circumstances when air quality, odour and dust can be a planning concern, requiring assessment.

2.12 The NPPG advises that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to 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. The NPPG states that when deciding whether air quality is relevant to a planning application, considerations could include whether the development would:

"Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the proposed development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;

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

Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality;

Give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations;

Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value."

2.13 The NPPG provides advice on how air quality impacts can be mitigated and notes *"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. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met."*

Regional Policy Guidance – The London Plan

2.14 The Mayor of London is responsible for all strategic planning in London. Amongst the Mayor's duties is the requirement to develop a Spatial Development Strategy for London, known as the London Plan. The London Plan [5] was published in March 2021. The Plan acts as an integrating framework for a set of strategies, including improvements to air quality.

2.15 The key policy relating to air quality is Policy SI 1: Improving Air Quality:

"A 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.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) 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

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development."

2.16 It continues by stating that: "*Where this policy refers to 'existing poor air quality' this should be taken to include areas where legal limits for any pollutant, or World Health Organisation targets for Particulate Matter, are already exceeded and areas where current pollution levels are within 5 per cent of these limits."*

2.17 The Mayor's London Environment Strategy [6] sets out the following policies seeking to improve London's air quality to the point where air pollution no longer poses a significant risk to human health:

"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

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

Policy 4.3.1 The Mayor will establish new targets for PM2.5 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"

2.18 In April 2014, the Greater London Authority (GLA) published Supplementary Planning Guidance (SPG) Sustainable Design and Construction [7]. The SPG reinforces the existing need for a *'conventional'* Air Quality Assessment where pollutant concentrations, at the point of human exposure, are compared with the relevant national objectives; however, the SPG also details how major developments must demonstrate they are achieving *'Air Quality Neutral'*. The Air Quality Neutral calculations have been undertaken for the Proposed Development and are provided in a separate report.

Local Planning Policy

2.19 The Borough of Richmond Upon Thames Local Plan was adopted in 2018, setting out policies up until 2033.

2.20 Policies relevant to air quality include

Policy LP10:

"The council promotes good air quality design and new technologies. Developers should secure at least 'Emissions Neutral' development. To consider the impact of introducing new developments in areas already subject to poor air quality, the following will be required:

- *An air quality impact assessment, including where necessary, modelled data;*
- *Mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology;*

- *Measures to protect the occupiers of new developments from existing sources;*
- *Strict mitigation for developments to be used by sensitive receptors such as schools, hospitals and care homes in areas of existing poor air quality; this also applies to proposals close to developments used by receptors.*

2.21 With respect to the AQMA, policies state:

"*The whole of the borough has been declared as an Air Quality Management Area (AQMA) and as such any new development and its impact upon air quality must be considered very carefully. Strict mitigation will be required for any developments proposed within or adjacent to 'Air Quality Focus Areas'. An 'Air Quality Focus Area' is a location that has been identified as having high levels of pollution and human exposure."*

3 Assessment Methodology

3.1 Neither the NPPF nor the NPPG is prescriptive on the methodology for assessing air quality effects or describing significance; practitioners continue to use guidance provided by Defra and non-governmental organisations, including Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM). However, the NPPG does advise 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. The scope and content of supporting information is best discussed and agreed between the local planning authority and applicant before it is commissioned.*" It lists a number of areas that might be usefully agreed at the outset.

3.2 This air quality assessment covers the elements recommended in the NPPG. The approach is consistent with the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [8], the Mayor of London's Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance [9]the IAQM Guidance on the assessment of dust from demolition and construction [10], the Mayor of London's Local Air Quality Management Technical Guidance: LLAQM.TG19 [11] and, where relevant, Defra's Local Air Quality Management Technical Guidance: LAQM.TG22 [12]. It includes the key elements listed below:

- assessment of the existing air quality in the study area (existing baseline) and prediction of the future air quality without the development in place (future baseline), using official government estimates from Defra, publicly available air quality monitoring data for the area, and relevant Air Quality Review and Assessment (R&A) documents;
- a qualitative assessment of likely construction-phase impacts with mitigation and controls in place; and
- a quantitative prediction of the future operational-phase air quality impact with the development in place (with any necessary mitigation), encompassing
  - the impacts of the development traffic on the local area
  - the impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

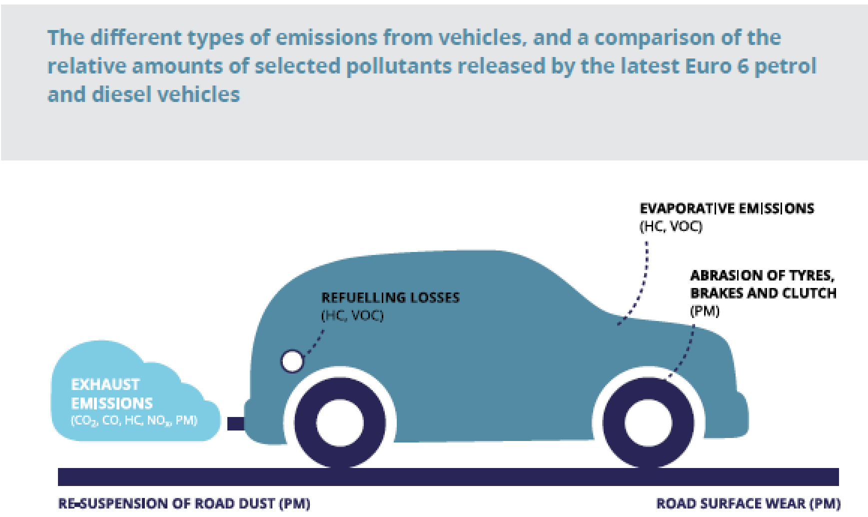
3.3 In line with the guidance set out in the NPPG, the Environmental Health Department at Richmond Borough Council was consulted to agree the scope and methodology for this assessment. No response was received.

3.4 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management and Chartered Environmentalist and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 18 years' experience.

Summary of Key Pollutants Considered

3.5 For the operational phase of the Proposed Development, the main pollutants from road traffic with potential for local air quality impacts are nitrogen oxides (NO_x) and particulate matter (PM_{10}). Regarding the building emissions, the main pollutants from the with potential for local impacts are also NO_x. Emissions of total NO_x from combustion sources comprise nitric oxide (NO) and NO_2. The NO oxidises in the atmosphere to form NO_2. The assessment of operational impacts therefore focuses on changes in NO_2 and PM_{10} concentrations. The impact from fine particulate matter, known as $PM_{2.5}$ (a subset of PM_{10}) concentrations has also been considered.

Figure 3.1 Types of Vehicle Emissions



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide

3.6 For the construction phase of the Proposed Development the key pollutant is dust, covering both the PM_{10} fraction that is suspended in the air that can be breathed, and the deposited dust that has fallen out of the air onto surfaces and which can potentially cause temporary annoyance effects.

3.7 Regarding exhaust emissions from construction-related vehicles (contractors' vehicles and Heavy Goods Vehicles (HGVs), diggers, and other diesel-powered vehicles), these are unlikely to have a significant impact on local air quality [10] except for large, long-term construction sites: the EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [8] indicates that air quality assessments should include developments increasing annual average daily Heavy Duty Vehicle (HDV) traffic flows by more than 25 within or adjacent to an AQMA and more than 100 elsewhere. The results of the Highways and Access assessment indicates that the aforementioned EPUK & IAQM thresholds are not expected to be exceeded for any individual road during the construction phase of this project; therefore, construction-vehicle exhaust emissions have not been assessed specifically.

Construction Phase - Methodology

3.8 Dust is the generic term used to describe particulate matter in the size range 1-75 µm in diameter [13]. Particles greater than 75 µm in diameter are termed grit rather than dust. Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density; together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

3.9 The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry). Additionally, dust can potentially have adverse effects on vegetation and fauna at sensitive habitat sites.

3.10 The IAQM Guidance on the assessment of dust from demolition and construction sets out 350 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 500 m of the entrance, within which there could potentially be nuisance dust and PM_{10} effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases. (In this particular application, there are no ecological receptors within the distances and ecological effects have been scoped out). These distances are set to be deliberately conservative.

3.11 Concentration-based limit values and objectives have been set for the PM_{10} suspended particle fraction, but no statutory or official numerical air quality criterion for dust annoyance has been set at a UK, European or World Health Organisation (WHO) level. Construction dust assessments have tended to be risk based, focusing on the appropriate measures to be used to keep dust impacts at an acceptable level.

3.12 The Mayor of London's Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance [9] (hereafter referred to as the Construction and Demolition SPG) provides information relating to the approach to the assessment, recommended mitigation measures and appropriate monitoring strategies. In particular, the Construction and Demolition SPG states that the assessment methodology provided in the current version of the Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction should be used.

3.13 The IAQM dust guidance aims to estimate the impacts of both PM_{10} and dust through a risk-based assessment procedure. The IAQM dust guidance document states: "*The impacts depend on the mitigation measures adopted. Therefore the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified.*"

3.14 The IAQM dust guidance provides a methodological framework, but notes that professional judgement is required to assess effects: *"This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified."*

3.15 Consistent with the recommendations in the IAQM dust guidance, a risk-based assessment has been undertaken for the development, using the well-established source-pathway-receptor approach:

- The dust impact (the change in dust levels attributable to the development activity) at a particular receptor will depend on the magnitude of the dust source and the effectiveness of the pathway (i.e. the route through the air) from source to receptor.
- The effects of the dust are the results of these changes in dust levels on the exposed receptors, for example annoyance or adverse health effects. The effect experienced for a given exposure depends on the sensitivity of the particular receptor to dust. An assessment of the overall dust effect for the area as a whole has been made using professional judgement taking into account both the change in dust levels (as indicated by the Dust Impact Risk for individual receptors) and the absolute dust levels, together with the sensitivities of local receptors and other relevant factors for the area.

3.16 The detail of the dust assessment methodology is provided in Appendix A.

3.17 The dust risk categories that have been determined for each of the four activities (demolition, earthworks, construction and trackout) have been used to define the appropriate site-specific mitigation measures based on those described in the Mayor of London's SPG. The Mayor of London's SPG states that with the recommended dust mitigation measures in place the residual impact will be "minimised".

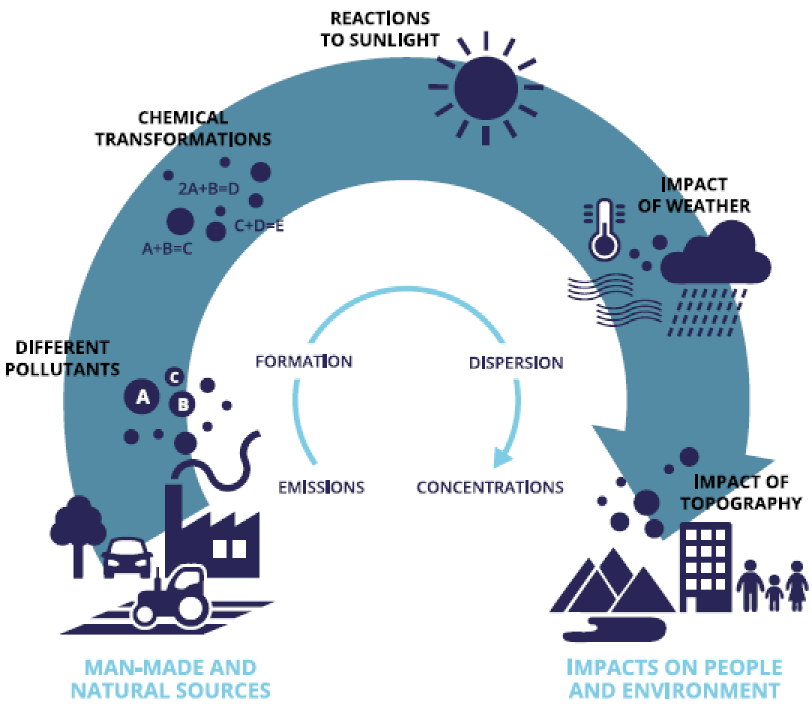
3.18 This assessment does not consider the air quality impacts of dust from any contaminated land or buildings. If contaminated land is identified on the Application Site, the impacts will be assessed in other technical discipline reports.

Operational Phase - Methodology

Atmospheric Dispersion Modelling of Pollutant Concentrations

3.19 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

Figure 3.2 Air Pollution: From Emissions to Exposure



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide

3.20 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.

3.21 The ADMS-Roads model has been used in this assessment to predict the air quality impacts from changes in traffic on the local road network. This is a version of the Atmospheric Dispersion Modelling System (ADMS), a formally validated model developed in the UK by Cambridge Environmental Research Consultants Ltd (CERC) and widely used in the UK and internationally for regulatory purposes.

Modelled Scenarios

3.22 Modelling has been undertaken with and without the Proposed Development.

3.23 It is expected that the school will open in September 2023, with circa 500 pupils. The school will then grow annually, with additional form groups being introduced, up to a maximum of 1,000 pupils. The earliest that the school is expected to reach capacity is 2029.

3.24 Traffic data was provided for the first year the development is operational, 2023, and the year the development will be fully operational, 2029. To ensure the most conservative emissions, the traffic data for 2029 have been used in the modelling alongside the emissions data for 2023. As emission factors decrease over time, this is a conservative assumption.

Model Input Data

Traffic Flow Data

3.25 Traffic data used in the assessment have been provided by the project's transport consultants, Caneparo Associates. The traffic flow data provided for this assessment are summarised in Table 3.1. The modelled road links are illustrated in Figure 1.

Table 3.1 Traffic Data Used Within the Assessment

Road Link ID	Road Link Name	Speed ($km.hr^{-1}$)	Daily Two-Way Vehicle Flow			
			Without Development		With Development	
			Total Vehicles	HDV	Total Vehicles	HDV
1	Kneller Road S	32	9447	1242	9676	1266
2	Warren Road	32	9407	1235	9600	1253
3	Kneller Road E	32	1340	171	1419	177
4	Whitton Dene	32	5249	575	5365	587
5	Nelson Road	32	3251	336	3288	342
6	Kneller Road W	32	658	68	658	68
7	Kneller Hall N	32	0	0	82	12
8	Kneller Hall S	32	0	0	428	36

Notes:
HDV = Heavy Duty Vehicle - vehicles greater than 3.5 t gross vehicle weight including buses

3.26 The average speed on each road has been reduced by 10 $km.hr^{-1}$ to take into account the possibility of slow-moving traffic near junctions and at roundabouts in accordance with LAQM.TG22.

Vehicle Emission Factors

3.27 The modelling has been undertaken using Defra's 2021 emission factor toolkit (version 11) which draws on emissions generated by the European Environment Agency (EEA) COPERT 5.3 emission calculation tool.

Meteorological Data

3.28 ADMS-Roads requires detailed meteorological data as an input. The most representative observing station for the region of the study area that supplies all the data in the required format is Heathrow Airport, approximately 7.5 km west of the Application Site. Meteorological data from that station for 2020 have been used within the dispersion model. The wind rose is presented in Figure 2.

Receptors

3.29 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LLAQM.TG19 [11] provides examples of exposure locations and these are summarised in Table 3.2.

Table 3.2 Examples of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades and gardens of residential properties, schools (including all of playgrounds), hospitals (and their grounds), care homes (and their grounds) etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Kerbside sites (as opposed to locations at the building's façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels.	Kerbside sites (as opposed to locations at the building's façade), or any other location where public exposure is expected to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.30 Representative sensitive receptors for this assessment have been selected at properties where pollutant concentrations and/or changes in pollutant concentrations are anticipated to be greatest, as listed in Table 3.3.

Table 3.3 Modelled Sensitive Receptors

ID	Description	Receptor Type	x	y
1	Kneller Road / Kendrey Gardens Junction	Residential	515045	174041

ID	Description	Receptor Type	x	y
2	Kneller Road / Warren Road Junction	Residential	514791	174041
3	Kneller Road / The Ridge Junction	Residential	514581	174039
4	Nelson Rd / Warren Rd Junction	Residential	514431	174064
5	Nelson Road	Residential	514456	174203
6	Duke of Cambridge Pub	Non-Residential	514625	174171
7	Kneller Rd / Nelson Road Junction	Residential	514483	174231
8	Whitton Dene / Kneller Road Junction	Residential	514514	174250
9	Whitton Dene	Residential	514533	174347
10	Proposed Development 1	School	514555	174340
11	Proposed Development 2	School	514538	174248
12	Proposed Development 3	School	514656	174179
13	Proposed Development 4	School	514722	174143
14	Proposed Development 5	School	514840	174065
15	Proposed Development 6	School	514951	174060

3.31 The annual, daily and hourly-mean AQS objectives apply at the front and rear façades of all residential properties and at the proposed development. The daily and hourly-mean AQS objectives only, apply at the modelled pub. The approaches used to predict the concentrations for these different averaging periods are described below.

Long-Term Pollutant Predictions

3.32 Annual-mean NO_x and PM_{10} concentrations have been predicted at representative sensitive receptors using ADMS-Roads, then added to relevant background concentrations. Primary NO in the NO_X emissions is converted to NO_2 to a degree determined by the availability of atmospheric oxidants locally and the strength of sunlight. For road traffic sources, annual-mean NO_2 concentrations have been derived from the modelled road-related annual-mean NO_x concentration using Defra's calculator [14].

Short-Term Pollutant Predictions

3.33 In order to predict the likelihood of exceedances of the hourly-mean AQS objectives for NO_2 and the daily-mean AQS objective for PM_{10}, the following relationships between the short-term and the annual-mean values at each receptor have been considered.

Hourly-Mean AQS Objective for NO_2

3.34 Research undertaken in support of LLAQM.TG19 has indicated that the hourly-mean limit value and objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60 $\mu g.m^{-3}$. The threshold of 60 $\mu g.m^{-3}$ NO_2 has been used as the guideline for considering a likely exceedance of the hourly-mean nitrogen dioxide objective.

Daily-Mean AQS Objective for PM_{10}

3.35 The number of exceedances of the daily-mean AQS objective for PM_{10} of 50 µg.m^{-3} may be estimated using the relationship set out in LAQM.TG22:

*Number of Exceedances of Daily Mean of 50 µg.m^{-3} = -18.5 + 0.00145 * (Predicted Annual-mean PM_{10})^3 + 206 / (Predicted Annual-mean PM_{10} Concentration)*

3.36 This relationship indicates that the daily-mean AQS objective for PM_{10} is likely to be met if the predicted annual-mean PM_{10} concentration is 31.8 µg.m^{-3} or less.

3.37 The daily mean objective is therefore not considered further within this assessment if the annual-mean PM_{10} concentration is predicted to be less than 31.5 µg.m^{-3}.

Fugitive PM_{10} Emissions

3.38 Transport PM_{10} emissions arise from both the tailpipe exhausts and from fugitive sources such as brake and tyre wear and re-suspended road dust. Improvements in vehicle technologies are reducing PM_{10} exhaust emissions; therefore, the relative importance of fugitive PM_{10} emissions is increasing. Current official vehicle emission factors for particulate matter include brake dust and tyre wear which studies suggest may account for approximately one-third of the total particulate emissions from road transport; but not re-suspended road dust (which remains unquantified.)

Significance Criteria for Development Impacts on the Local Area

3.39 The EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document [8] advises that:

"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."

3.40 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 3.4 provides the EPUK & IAQM approach for describing the long-term air quality impacts at sensitive human-health receptors in the surrounding area.

Table 3.4 Impact Descriptors for Individual Sensitive Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, limit value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.
3. The table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

3.41 The human-health impact descriptors above apply at individual receptors. The EPUK & IAQM guidance states that the impact descriptors *"are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."*

3.42 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

Significance Criteria for New Population Exposure (Site Suitability)

3.43 The London Councils' Air Quality and Planning Guidance [15] provides Air Pollution Exposure Criteria (APEC) for assessing the significance on exposure to air pollution and the levels of mitigation required when considering site suitability. Table 3.5 provides a summary of the criteria.

Table 3.5 Summary of Air Pollution Exposure Criteria (APEC)

Criteria	Applicable Range NO_2 Annual-Mean	Applicable Range PM_{10}	Recommendation
APEC-A	> 5% below national objective	Annual-Mean >5% below national objective 24-Hour >1-day less than national objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
APEC-B	Between 5% below or above national objective	Annual-Mean Between 5% above or below national objective 24-Hour Between 1-day above or below national objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered, e.g. maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised.
APEC-C	>5% above national objective	Annual-Mean >5% above national objective 24-Hour >1-day more than national objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures.

3.44 Concentrations have been predicted at proposed receptors to determine the APEC category that would apply.

3.45 The EPUK & IAQM guidance considers an exceedance of an air quality objective at a building façade to be significant adverse effect unless provision is made to reduce the resident's or occupant's exposure by some means.

Uncertainty

3.46 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.47 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.48 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the uncertainty range informed by an analysis of relevant, available data.

3.49 The atmospheric dispersion model used for this assessment, ADMS Roads, has been validated by its supplier and is widely used by professionals in the UK and overseas. A site-specific verification (calibration) provides additional certainty and is particularly important when air quality levels are close to exceeding the objectives/limit values.

3.50 LAQM.TG22 requires that local authorities verify the results of any detailed modelling undertaken for the purposes of fulfilling their R&A duties. Model verification refers to the checks that are carried out on model performance at a local level. Modelled concentrations are compared with the results of monitoring. Where there is a disparity between modelled and monitored concentrations, the first step is to review the appropriateness of the data inputs to determine whether the performance of the model can be improved. Once reasonable efforts have been made to reduce the uncertainties in the data inputs, an adjustment may be established and applied to reduce any remaining disparity between modelled and monitored concentrations. No adjustment factor is deemed necessary where the modelled concentrations are within 25% of the monitored concentrations.

3.51 For the verification and adjustment of NOx/NO_2 concentrations for R&A purposes, it is recommended that the comparison involves a combination of automatic and diffusion monitoring, rather than a single automatic monitor. This is to ensure any adjustment factor derived is representative of all locations modelled and not unduly weighted towards the characteristics at a single site. Where only diffusion tubes are used for the model verification, the study should consider a broad spread of monitoring locations across the study area to provide sufficient information relating to the spatial variation in pollutant concentrations.

3.52 Local Authorities generally implement a broad spread of monitoring, particularly in areas that are known to be sensitive to changes in air quality. Consequently, Local Authorities are usually able to verify the models they use for R&A purposes; however for individual developments, there is less likely to be a broad range of monitoring locations within the relevant study area. Notwithstanding this, a small number of monitoring locations have been identified within the study area and a model verification study has been undertaken for the proposed development and is included at Appendix B.

3.53 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 3.6.

Table 3.6 Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of current baseline air quality conditions	The background concentration used within the assessment is the most conservative value from a comparison of measured and Defra mapped concentration estimate.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes to the result being towards the top of the uncertainty range, rather than a central estimate.
	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	
Fraction from Modelled Sources	Traffic flow estimates	Traffic flows provided have all been based on traffic counts, rather than flows derived from a traffic model. High growth assumptions have been used to develop the traffic dataset used within the model.	The modelled fraction is a minor proportion of the total predicted concentration. The modelled fraction is likely to contribute to the result being between a central estimate and the top of the uncertainty range.
	Traffic speed estimates	Traffic speed estimates have been used within the model. The average speed has been reduced in congested areas to take account of slow-moving and queuing traffic.	
	Road-related emission factors – projection to future years	The most recently published emission factors have been used within the modelling and these are based on the current and best understanding of the variation in emission factors in future years. Modelling has been undertaken using traffic flows in 2029, with emission factors in 2023. As emission factors decrease over time, this is a conservative approach.	
	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the	

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
		development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for a full year of meteorological conditions. This means that the conditions in 8,760 hours have been considered in the assessment.	
	Receptors	Receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	

3.54 The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

4 Baseline Air Quality Conditions

Overview

4.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. National Planning Practice Guidance and EPUK & IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality. LAQM.TG22 recommends that Defra mapped concentration estimates are used to inform background concentrations in air quality modelling and states that: "*Where appropriate these data can be supplemented by and compared with local measurements of background, although care should be exercised to ensure that the monitoring site is representative of background air quality*".

4.2 For this assessment, the background air quality has been characterised by drawing on information from the following public sources:

- Defra maps [16], which show estimated pollutant concentrations across the UK in 1 km grid squares; and
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies.

4.3 A detailed description of how the baseline air quality has been derived for this Proposed Development site is summarised in the following paragraphs.

Review and Assessment Process

4.4 The Council has designated the whole of the borough as an AQMA due to high levels of NO_2 and PM_{10} attributable to road traffic.

4.5 LLAQM.TG22 includes Air Quality Focus Areas (AQFAs) which are pollution hotspots where there is the potential for high human exposure and where the GLA believes air quality issues are the most acute. The proposed development and study area are not within an AQFA.

Local Urban Background Monitoring

4.6 Monitors at urban background locations measure concentrations away from the local influence of emission sources and are therefore broadly representative of residential areas within large conurbations. Monitoring at local urban background locations is considered an appropriate source of data for the purposes of describing baseline air quality for this Proposed Development site.

4.7 There are no automatic monitors classified as urban background within the London Borough of Richmond upon Thames. There are two nearby local monitoring stations where urban background concentrations are measured using continuous automatic instruments in Hounslow. Hounslow Council monitors NO_2 and PM_{10} at the Cranford and Hatton Cross urban background locations. The most recently measured annual-mean concentrations are presented in Table 4.1.

Table 4.1 Automatically Monitored Urban Background Annual-Mean Concentrations

Monitor Name	Approximate Distance from the Application Site (km)	Pollutant	Concentration ($\mu g.m^{-3}$)		
			2017	2018	2019
Cranford	5	NO_2	30	26	27.2
Cranford		PM_{10}	18	15	18
Hatton Cross	5	NO_2	33	28	27.3
Hatton Cross		PM_{10}	18	21	20

4.8 In addition, Hounslow and Richmond manually monitor NO_2 concentrations at several urban background locations using passive diffusion tubes and the most recently measured annual-mean concentrations are presented in Table 4.2.

Table 4.2 Passively Monitored Urban Background Annual-Mean NO_2 Concentrations

Borough	Monitor Code	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)		
			2017	2018	2019
Hounslow	HS76	3	26.8	27	29
	HS83	3.6	24.8	19.9	18.4
	HS88	8.3	23.4	20.7	22
Richmond	Holly Lodge	4.4	17	18	17

All concentrations have been adjusted for bias

Defra Mapped Concentration Estimates

4.9 Defra's total annual-mean NO_2 concentration estimates have been collected for the 1 km grid squares of the monitoring sites and the Proposed Development and are summarised in Table 4.3.

Table 4.3 Defra Mapped Annual-Mean Background NO_2 Concentration Estimates

Monitor Code	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)	
		Range of Monitored	Estimated Defra Mapped
Cranford	5	26 – 30	28.0
Hatton Cross	5	27.3 – 33	26.5
HS76	3	26.8 - 29	23.3
HS83	3.6	18.4 - 24.8	26.0
HS88	8.3	20.7 - 23.4	23.3
Holly Lodge	4.4	17 - 18	17.7
Application Site	-	-	21.1

4.10 Similarly, the Defra total annual-mean PM_{10} concentration estimates have been collected for the grid square of the monitoring sites and the Proposed Development and are summarised in Table 4.4.

Table 4.4 Defra Mapped Annual-Mean Background PM_{10} Concentration Estimates

Monitor Code	Approximate Distance from the Application Site (km)	Concentration ($\mu g.m^{-3}$)	
		Range of Monitored	Estimated Defra Mapped
Cranford	5	15 - 18	17.2
Hatton Cross	5	18 - 21	16.3
Application Site	-	-	17.1

Appropriate Background Concentrations for the Development Site

4.11 For NO_2, the Defra mapped background concentration estimates are not consistently within the range of the results from monitoring. The HS76 monitor is the closest monitoring location to the Application Site. Monitored annual-mean NO_2 concentrations at the HS76 range from 26.8 to 29 $\mu g.m^{-3}$. To ensure the assessment is conservative, the background annual-mean NO_2 concentration has been derived from the average measured data at HS76, giving a value of 27.6 $\mu g.m^{-3}$.

4.12 For PM_{10}, the Defra mapped background concentration estimate is smaller than or within the range of results from monitoring. To ensure the assessment is conservative, the background annual-mean PM_{10} concentration has been derived from the average measured data at Hatton Cross, giving a value of 19.7 µg.m^{-3}.

4.13 In the absence of $PM_{2.5}$ monitoring at this site, the background annual-mean concentration at the Application Site has been derived from the Defra mapped background concentration estimate.

4.14 Historically the view has been that background traffic-related NO_2 concentrations in the UK would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on emissions. After a prolonged period through the last decade where background annual-mean NO_2 concentrations did not generally decrease in line with expectations, the most recent monitoring studies indicate ambient traffic-related NO_2 concentrations are now falling. To ensure that the assessment presents conservative results, no reduction in the background has been applied for future years.

4.15 Table 4.5 summarises the annual-mean background concentrations for NO_2, PM_{10} and $PM_{2.5}$ used in this assessment.

Table 4.5 Summary of Background Annual-Mean (Long-term) Concentrations used in the Assessment

Pollutant	Data Source	Concentration (µg.m^{-3})
NO_2	Average Measured HS67(2017-2019)	27.6
PM_{10}	Average Measured Hatton Cross (2017-2019)	19.7
$PM_{2.5}$	Defra Mapped	11.7

5 Assessment of Construction-Phase Air Quality Impacts

Construction Dust

5.1 Whilst no detailed construction phase information is currently available, the type of activities that could cause fugitive dust emissions are: demolition; earthworks; handling and disposal of spoil; wind-blown particulate material from stockpiles; handling of loose construction materials; and movement of vehicles, both on and off site.

5.2 The level and distribution of construction dust emissions will vary according to factors such as the type of dust, duration and location of dust-generating activity, weather conditions and the effectiveness of suppression methods.

5.3 The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows, cars and laundry. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse effects, although short-term events may occur (for example, due to technical failure or exceptional weather conditions). The following assessment, using the IAQM methodology, predicts the risk of dust impacts and the level of mitigation to minimise air quality impacts.

Risk of Dust Impacts

Source

5.4 The volume of the buildings on site that would be demolished has been estimated to be below 20,000 m^3. Therefore, the dust emission magnitude for the demolition phase is classified, using the IAQM dust guidance, as small.

5.5 The site area is over 10,000 m^2, therefore, the dust emission magnitude for the earthworks phase is classified as large.

5.6 The total volume of the buildings to be constructed would be between 25,000m^3 and 100,000 m^3 so the dust emission magnitude for the construction phase is classified as medium.

5.7 The maximum number of outwards movements in any one day is between 10 and 50 HDVs, the dust emission magnitude for trackout would be classified as medium.

Table 5.1 Dust Emission Magnitude for Demolition, Earthworks, Construction and Trackout

Demolition	Earthworks	Construction	Trackout
Small	Large	Medium	Medium

Pathway and Receptor - Sensitivity of the Area

5.8 All demolition, earthworks and construction activities are assumed to occur within the site boundary. As such, receptors at distances within 20 m, 50 m, 100 m, 200 m and 350 m of the site boundary have been identified and are illustrated in Figure 3. The sensitivity of the area has been classified and the results are provided in Table 5.2 below.

Table 5.2 Sensitivity of the Surrounding Area for Demolition, Earthworks and Construction

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	Medium	Approx. 30 residential properties to the south and west of site. 10-100 high sensitivity receptors located within 50 m of the site boundary (Table A.4)
Human Health	Low	Approx. 30 residential properties to the south and west of site. Background PM_{10} concentrations for the assessment = 19.7 µg.m^{-3} 10 – 100 high sensitivity receptors located within 50 m of the site boundary and PM_{10} concentrations below 24 µg.m^{-3} (Table A.5)

5.9 The Dust Emission Magnitude for trackout is classified as medium and trackout may occur on roads up to 200 m from the site. The major routes within 200 m of the site are Kneller Road and Warren Road. The sensitivity of the area has been classified and the results are provided in Table 5.3

Table 5.3 Sensitivity of the Surrounding Area for Trackout

Potential Impact	Sensitivity of the Surrounding Area	Reason for Sensitivity Classification
Dust Soiling	High	Between 10 and 100 residential properties aligning Kneller Road and Warren Road. 10 – 100 high sensitivity receptors located within 20 m of the roads (Table A.5)
Human Health	Low	Between 10 and 100 residential properties aligning Kneller Road and Warren Road. Background PM_{10} concentrations for the assessment = 19.7 µg.m^{-3} 10 – 100 high sensitivity receptors located within 20 m of the roads and PM_{10} concentrations below 24 µg.m^{-3} (Table A.6)

Overall Dust Risk

5.10 The Dust Emission Magnitude has been considered in the context of the Sensitivity of the Area (Tables A.5 and A.6) to give the Dust Impact Risk. Table 5.4 summarises the Dust Impact Risk for the four activities.

Table 5.4 Dust Impact Risk for Demolition, Earthworks, Construction and Trackout

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

5.11 Taking the site as a whole, the overall risk is deemed to be medium. The mitigation measures appropriate to a level of risk for the site as a whole and for each of the phases are set out in Section 7.

5.12 Provided this package of mitigation measures is implemented, the residual construction dust effects will not be significant. The IAQM dust guidance states that "*For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally* *be 'not significant'."* The IAQM dust guidance recommends that significance is only assigned to the effect after the activities are considered with mitigation in place.

6 Assessment of Operational-Phase Air Quality Impacts

Assessment of Air Quality Impacts on Surrounding Area

6.1 This section of the report summarises the future operational-phase air quality impacts of the key pollutants associated with the development traffic of the proposed scheme.

Nitrogen Dioxide (NO_2)

6.2 Table 6.1 presents the annual-mean NO_2 concentrations predicted at the façades of existing receptors.

Table 6.1 Predicted Annual-Mean NO_2 Impacts at Existing Receptors

Receptor ID	Concentration ($\mu g.m^{-3}$)		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
Kneller Road / Kendrey Gardens Junction	30.9	31.2	1	Negligible
Kneller Road / Warren Road Junction	30.8	31.0	1	Negligible
Kneller Road / The Ridge Junction	30.8	31.1	1	Negligible
Nelson Rd / Warren Rd Junction	30.6	30.8	1	Negligible
Nelson Road	29.0	29.1	0	Negligible
Duke of Cambridge Pub	28.3	28.4	0	Negligible
Kneller Rd / Nelson Road Junction	29.3	29.4	0	Negligible
Whitton Dene / Kneller Road Junction	30.1	30.3	0	Negligible
Whitton Dene	29.1	29.2	0	Negligible
Maximum	**30.9**	**31.2**	**1**	**-**
Minimum	**28.3**	**28.4**	**0**	**-**

6.3 Predicted annual-mean NO_2 concentrations at the façades of the existing receptors are below the AQS objective for NO_2. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptors are 'negligible'.

6.4 As all predicted annual-mean NO_2 concentrations are below 60 µg.m^{-3}, the hourly-mean objective for NO_2 is likely to be met at all receptors. The short-term NO_2 impact can be considered 'negligible' and is not considered further within this assessment.

6.5 Overall, the impact on the surrounding area from NO_2 is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Particulate Matter (PM_{10})

6.6 Table 6.2 presents the annual-mean PM_{10} concentrations predicted at the façades of existing receptors.

Table 6.2 Predicted Annual-Mean PM_{10} Impacts at Existing Receptors

Receptor ID	Concentration (µg.m^{-3})		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
Kneller Road / Kendrey Gardens Junction	20.6	20.6	0	Negligible
Kneller Road / Warren Road Junction	20.6	20.6	0	Negligible
Kneller Road / The Ridge Junction	20.6	20.6	0	Negligible
Nelson Rd / Warren Rd Junction	20.5	20.5	0	Negligible
Nelson Road	20.1	20.1	0	Negligible
Duke of Cambridge Pub	19.9	19.9	0	Negligible
Kneller Rd / Nelson Road Junction	20.1	20.1	0	Negligible
Whitton Dene / Kneller Road Junction	20.3	20.3	0	Negligible
Whitton Dene	20.1	20.1	0	Negligible
Maximum	**20.6**	**20.6**	**0**	**-**
Minimum	**19.9**	**19.9**	**0**	**-**

6.7 Predicted annual-mean PM_{10} concentrations at the façades of the existing receptors are well below the AQS objective for PM_{10}. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

6.8 As all predicted annual mean PM_{10} concentrations are below 31.5 µg.m^{-3}, the daily-mean PM_{10} objective is expected to be met at all receptors and the short-term PM_{10} impact is not considered further within this assessment.

6.9 Overall, the impact on the surrounding area from PM_{10} is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Fine Particulate Matter ($PM_{2.5}$)

6.10 Table 6.3 presents the annual-mean $PM_{2.5}$ concentrations predicted at the façades of existing receptors.

Table 6.3 Predicted Annual-Mean $PM_{2.5}$ Impacts at Existing Receptors

Receptor ID	Concentration ($\mu g.m^{-3}$)		With - Without Dev as % of the AQS Objective	Impact Descriptor
	Without Development	With Development		
Kneller Road / Kendrey Gardens Junction	12.2	12.2	0	Negligible
Kneller Road / Warren Road Junction	12.2	12.2	0	Negligible
Kneller Road / The Ridge Junction	12.2	12.2	0	Negligible
Nelson Rd / Warren Rd Junction	12.2	12.2	0	Negligible
Nelson Road	11.9	11.9	0	Negligible
Duke of Cambridge Pub	11.8	11.8	0	Negligible
Kneller Rd / Nelson Road Junction	11.9	11.9	0	Negligible
Whitton Dene / Kneller Road Junction	12.0	12.0	0	Negligible
Whitton Dene	11.9	11.9	0	Negligible
Maximum	**12.2**	**12.2**	**0**	-
Minimum	**11.8**	**11.8**	**0**	-

AQS objective = $20\mu g.m^{-3}$

6.11 Predicted annual-mean $PM_{2.5}$ concentrations at the façades of the existing receptors are below the AQS objective for $PM_{2.5}$ at all receptors. When the magnitude of change is considered in the context of the absolute concentrations, the impact descriptor is categorised as 'negligible' at all receptors.

6.12 Overall, the impact on the surrounding area from $PM_{2.5}$ is considered to be 'negligible', using the criteria adopted for this assessment and based on professional judgement.

Assessment of New Population Exposure (Site Suitability)

6.13 This section of the report summarises the operational-phase air quality impacts on future occupants of the development from their exposure to the prevailing levels of air pollution, which can be a factor in the suitability of the site for its proposed uses.

6.14 Table 6.4 presents the annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations predicted at the façades of proposed receptors.

Table 6.4 Predicted NO_2, PM_{10} and $PM_{2.5}$ Concentrations (µg.m^{-3}) at Proposed Receptors

Receptor ID	Annual-mean NO_2	Annual-mean PM_{10}	Annual-mean $PM_{2.5}$	No. of days where daily-mean PM_{10} > 50 µg.m^{-3}
Proposed Development 1	30.2	20.4	12.1	4
Proposed Development 2	30.9	20.4	12.1	4
Proposed Development 3	28.7	20.0	11.9	3
Proposed Development 4	28.9	20.0	11.9	3
Proposed Development 5	31.8	20.8	12.3	4
Proposed Development 6	31.4	20.7	12.3	4
Maximum	**31.8**	**20.8**	**12.3**	**4**
Minimum	**28.7**	**20.0**	**11.9**	**3**

6.15 The long-term and short-term objectives apply at the Proposed Development.

6.16 The predicted annual-mean NO_2 concentrations range between 28.7 and 31.8 µg.m^{-3}, well below the annual-mean AQS objective of 40 µg.m^{-3} at all receptors. Furthermore, as the annual-mean NO_2 concentration is predicted to be less than 60 µg.m^{-3}, the hourly-mean AQS objective is expected to be met.

6.17 The predicted annual-mean PM_{10} concentrations range between 20.0 and 20.8 µg.m^{-3}, well below the annual-mean AQS objective of 40 µg.m^{-3} at all receptors. The highest number of daily-mean PM_{10} concentrations predicted to be over 50 µg.m^{-3} is 4. As such, the short-term AQS objective for this pollutant is expected to be met.

6.18 Predicted annual-mean $PM_{2.5}$ concentrations range between 11.9 and 12.3 µg.m^{-3}. Predicted concentrations at all receptors are below the annual-mean AQS objective of 20 µg.m^{-3}.

World Health Organisation Guidelines

6.19 As set out in paragraph 2.16, the London Plan refers to World Health Organisation (WHO) targets in relation to existing air quality. The WHO sets guidelines and interim targets which serve as incremental steps in the progressive reduction of air pollution towards the air quality guideline levels and are intended for use in areas where air pollution is high. The WHO states that interim targets *"are air pollutant levels that are higher than the air quality guideline levels, but which authorities in highly polluted areas can use to develop pollution reduction policies that are achievable within realistic time frames. The interim targets should be regarded as steps towards ultimately achieving air quality guideline levels, rather than as end targets."* [17]. For PM_{10} and

$PM_{2.5}$, the WHO sets four interim targets: Interim target 1 being the highest and interim target 4 being the lowest and closest to the guideline level. For this development:

- The maximum predicted annual-mean PM_{10} concentration exceeds the WHO guideline of 15 $\mu g.m^{-3}$ but is well below the WHO interim target 3 of 30 $\mu g.m^{-3}$.
- The maximum predicted annual-mean $PM_{2.5}$ concentration exceeds the WHO guideline of 5 $\mu g.m^{-3}$ but is also well below the WHO interim target 3 of 15 $\mu g.m^{-3}$.

6.20 As set out above, concentrations of both pollutants are below the relevant limit values set in legislation for England.

Significance of Effects

6.21 It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

6.22 The impacts predicted at individual receptors and the geographical extent over which such impacts occur, can be used to inform the judgement on the impact on the surrounding area as a whole, and whether the resulting overall effect is significant or not. The IAQM guidance states, *"Whilst it may be that there are 'slight', 'moderate', or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."* and *"…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."*

6.23 The results of the modelling indicate that with the development, the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at existing receptors are below the relevant long and short-term AQS objectives. When the magnitude of change in annual-mean NO_2, PM_{10} and $PM_{2.5}$ concentrations is considered in the context of the absolute predictions, the air quality impacts of the development on existing receptors are categorised as 'negligible'. Taking into account the geographical extent of the impacts predicted in this study, the overall impact of the development on the surrounding area as a whole is considered to be 'negligible', using the descriptors adopted for this assessment.

6.24 The AQS objectives for NO_2, PM_{10} and $PM_{2.5}$ are likely to be met at the facades of the Proposed Development. On that basis, future occupants of the development should be exposed to acceptable air quality and the site is deemed suitable for its proposed future in this respect.

6.25 Using professional judgement, the resulting air quality effect is considered to be 'not significant' overall.

Sensitivity and Uncertainty

6.26 Section 3 provided an analysis of the sources of uncertainty in the results of the assessment. The conclusion of that analysis was that, overall, the predicted total concentration is likely to be towards the top of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

6.27 The impacts at existing receptors are shown to be not significant even for this conservative scenario. Similarly, the predicted pollutant concentrations at proposed receptors are below the relevant AQS objectives. Consequently, further sensitivity analysis has not been undertaken and, in practice, the impacts at sensitive receptors are likely to be lower than those reported in this conservative assessment.

7 Mitigation

Mitigation During Construction

7.1 The Mayor of London's Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance lists mitigation measures for low, medium and high dust risks.

7.2 As summarised in Table 5.4, the predicted Dust Impact Risk is classified as low for Demolition and, medium for Earthworks, Construction and Trackout. The general site measures described as 'highly recommended' for medium risk sites are listed below. The 'highly recommended' measures for low risk demolition sites, medium risk construction sites and medium risk trackout are also listed. There are no 'highly recommended' measures for medium risk earthworks.

Site Management

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Develop a Dust Management Plan.
- 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 and dust (sic) are being carried out, and during prolonged dry or windy conditions.

- Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.

Preparing and maintaining the site

- Plan site layout: machinery and dust causing activities should be located away from receptors.
- Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site.
- Fully enclosure site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Agree monitoring locations with the Local Authority.
- Where possible, commence baseline monitoring at least three months before phase begins.
- Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly.

Operating vehicle/machinery and sustainable travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone.
- Ensure all non-road mobile machinery (NRMM) comply with the standards set within this guidance.
- 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 possible.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible).
- 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.
- 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.
- Avoid bonfires and burning of waste materials.

Measures specific to demolition

- Ensure effective water suppression is used during demolition operations.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition

Measures specific to construction

- 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.

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 securely covered to prevent escape of materials during transport.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems and regularly cleaned.
- Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Implement a wheel washing system (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 to be located at least 10m from receptors where possible.

7.3 The Mayor of London's SPG states that with the recommended dust mitigation measures in place the residual impact will be *"minimised"*, and recommends the mitigation is secured by for a condition or Section 106 agreement as appropriate.

Mitigation for the Operational Impact of the Development on the Surrounding Area

7.4 When the change in concentration at existing sensitive receptors is considered in the context of the absolute concentration, the overall air quality impact on the surrounding area as a whole is categorised as "negligible" and the resulting effect is considered to be "not significant". On that basis, no mitigation measures are considered necessary.

Mitigation for New Population Exposure (Site Suitability)

7.5 The development site is within an AQMA, declared by the London Borough of Richmond upon Thames due to high levels of NO_2 and PM_{10} attributable to road traffic emissions. The NO_2, PM_{10} and $PM_{2.5}$ pollutant concentrations at the facades of the proposed development are predicted to be more than 5% below their respective AQS objectives and therefore fall into the London Councils' APEC-A banding for which no mitigation is required.

8 Conclusions

8.1 This assessment has considered dust effects during the construction phase and the air quality impacts during the operational phase of the Kneller Hall development.

8.2 The Kneller Hall development, such as dust generation and plant vehicle emissions, are predicted to be of short duration and only relevant during the construction phase. The results of the risk assessment of construction dust impacts undertaken using the Mayor of London's guidance indicates that before the implementation of mitigation and controls, the risk of dust impacts will be medium. Implementation of the highly-recommended mitigation measures described in the Mayor of London's Supplementary Planning Guidance *"should ensure the air quality impacts of construction and demolition are minimised and any mitigation measures employed are effective"*.

8.3 Regarding the operational impact of the Kneller Hall development on the surrounding area, detailed atmospheric dispersion modelling has been undertaken. The operational impact of the development on existing receptors in the local area is predicted to be 'negligible' taking into account the changes in pollutant concentrations and absolute levels. Using the criteria adopted for this assessment together with professional judgement, the overall impact on the area as a whole is described as 'negligible'.

8.4 Regarding suitability of air quality at the site for introducing new occupants, pollutant concentrations at the façades of proposed residential receptors are predicted to be well within the relevant health-based air quality objectives. On that basis, future occupants of the development should be exposed to acceptable air quality and the site is deemed suitable for its proposed future use in this respect.

8.5 Using professional judgement, the resulting air quality effect of the Kneller Hall development is considered to be 'not significant' overall.

8.6 At the heart of the NPPF is a presumption in favour of sustainable development, subject to caveats where a plan or project affects a habitats site. For determining planning applications, this means approving development proposals if they accord with the local development plan, unless material considerations indicate otherwise. If the development plan is absent, silent or the policies are out of date, then planning permission should be granted unless any adverse impacts would significantly outweigh the benefits, or specific policies in the NPPF indicate development should be restricted.

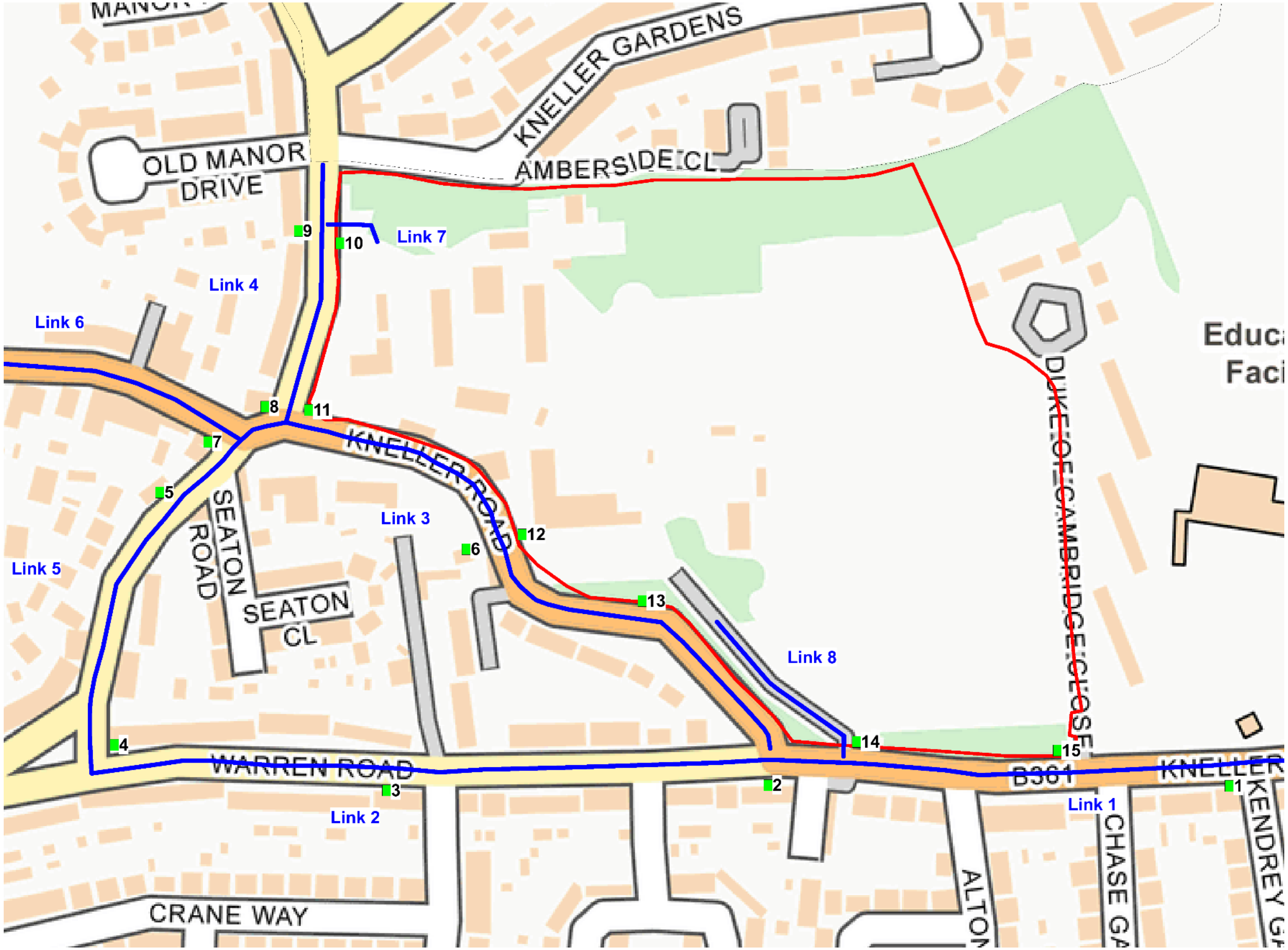
8.7 The NPPG advises that in considering planning permission, the relevant question for air quality is "*will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations or other environmental policies* *and duties, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas?"* The proposed development will not.

8.8 The Kneller Hall development does not, in air quality terms, conflict with national or local policies, or with measures set out in the Council's Air Quality Action Plan. There are no constraints to the development in the context of air quality.

Glossary

AADT	Annual Average Daily Traffic Flow
ADMS	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
Deposited Dust	Dust that has settled out onto a surface after having been suspended in air
DMP	Dust Management Plan
Dust	Solid particles suspended in air or settled out onto a surface after having been suspended in air
Effect	The consequences of an impact, experienced by a receptor
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
Impact	The change in atmospheric pollutant concentration and/or dust deposition. A scheme can have an ‘impact’ on atmospheric pollutant concentration but no effect, for instance if there are no receptors to experience the impact
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
R&A	Review and Assessment
Receptor	A person, their land or property and ecologically sensitive sites that may be affected by air quality
Risk	The likelihood of an adverse event occurring
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network

Figures



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Project: Kneller Hall	
Job Ref: JAR2925	
File location:	
Date: 02/09/2022	Rev: 0
Drawn:KB	Checked:FP

Figure 1: Road Links and Receptor Locations

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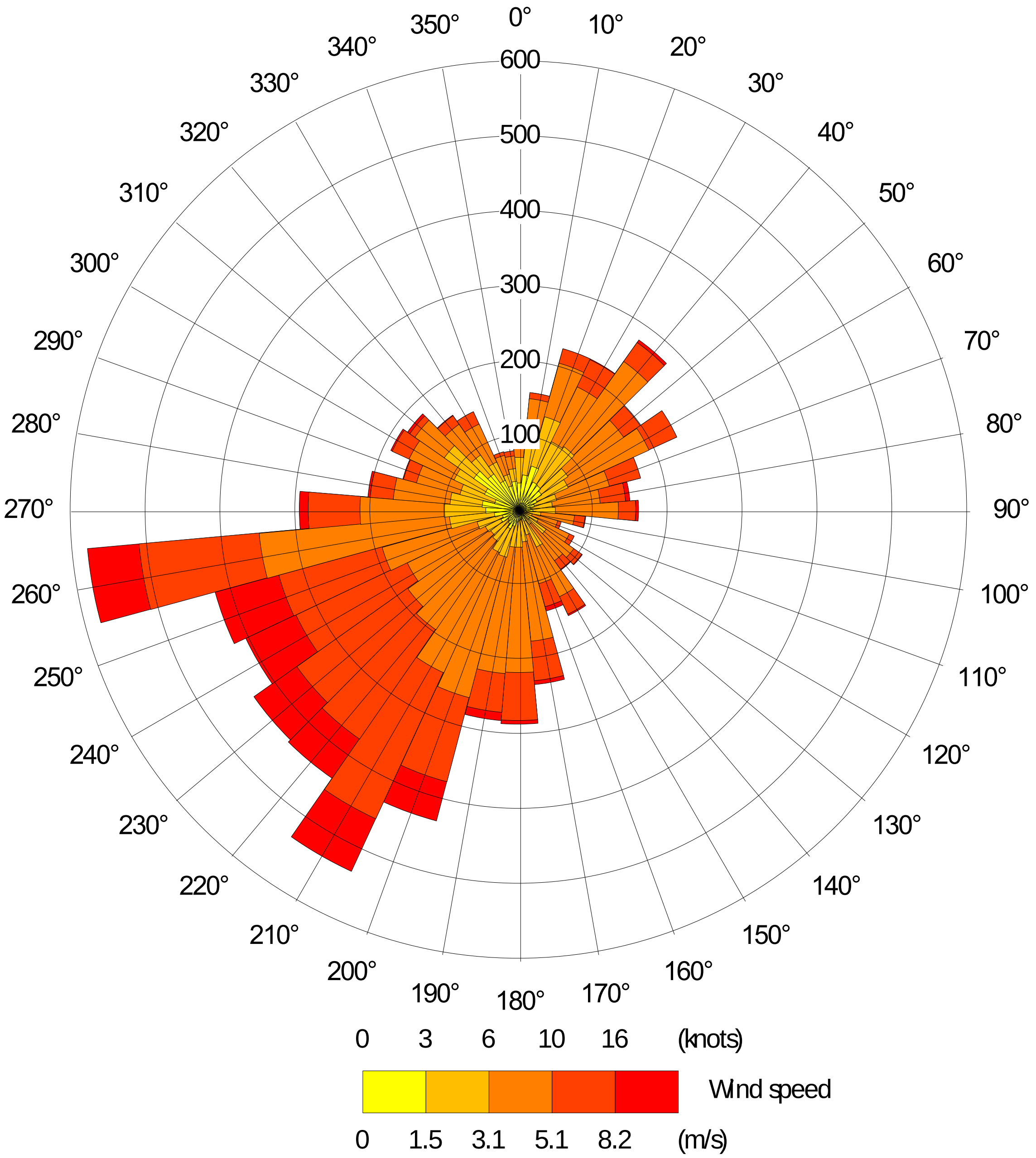

Figure 2: Wind Rose – Heathrow, 2020

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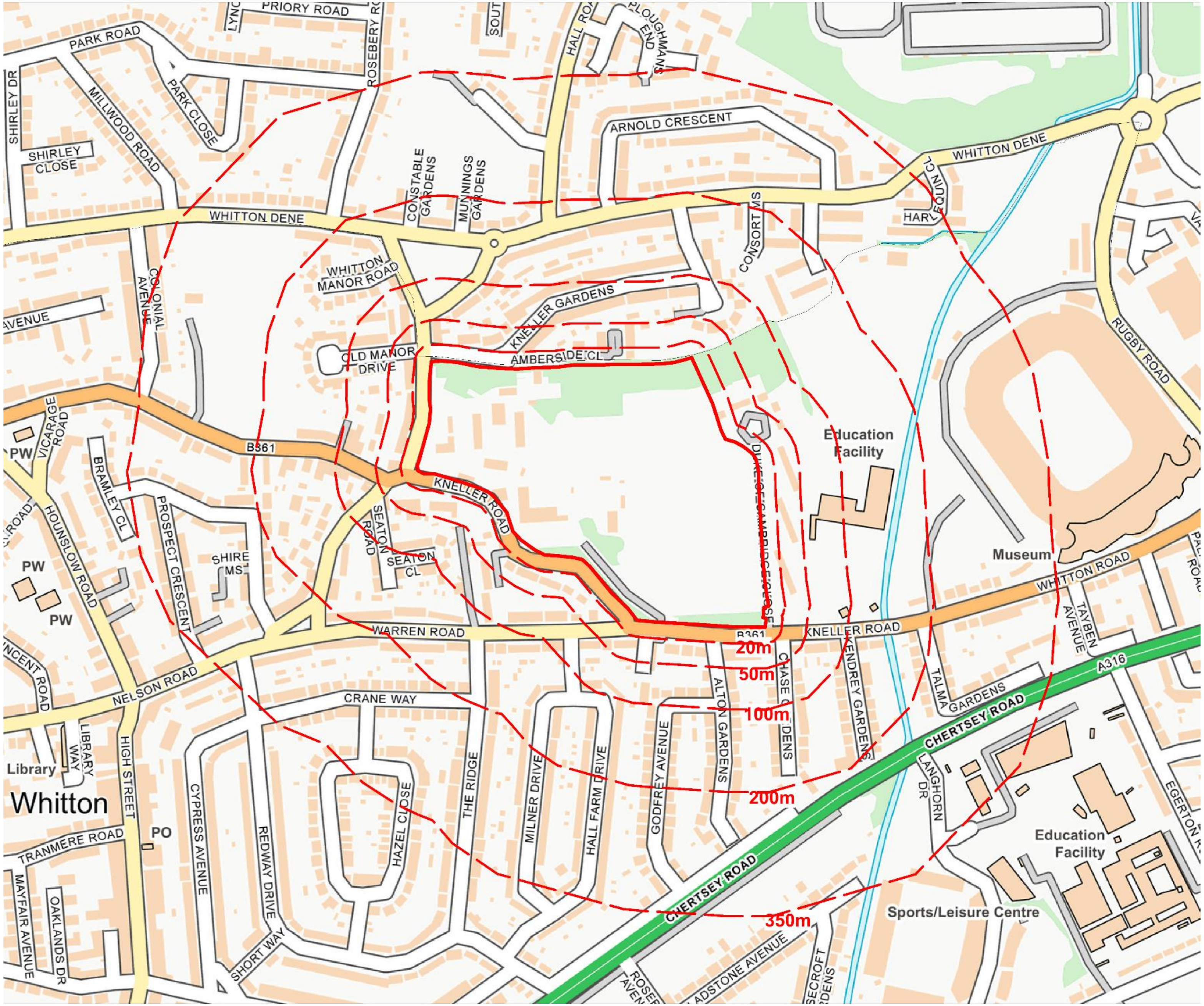

Boundary

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Figure 3: Construction Dust Boundaries

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Appendices

Appendix A: Detailed Construction Dust Assessment Methodology

Source

A.1 The IAQM dust guidance gives examples of the dust emission magnitudes for demolition, earthworks and construction activities and trackout. These example dust emission magnitudes are based on the site area, building volume, number of HDV movements generated by the activities and the materials used. These example magnitudes have been combined with details of the period of construction activities to provide the ranking for the source magnitude that is set out in Table A.1.

Table A.1 Risk Allocation – Source (Dust Emission Magnitude)

Features of the Source of Dust Emissions	Dust Emission Magnitude
Demolition - building over 50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities > 20 m above ground level. **Earthworks** – total site area over 10,000 m^2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved > 100,000 tonnes. **Construction** - total building volume over 100,000 m^3, activities include piling, on-site concrete batching, sand blasting. Period of activities more than two years. **Trackout** – 50 HDV outwards movements in any one day, potentially dusty surface material (e.g. High clay content), unpaved road length > 100 m.	Large
Demolition - building between 20,000 to 50,000 m^3, potentially dusty construction material and demolition activities 10 - 20 m above ground level. **Earthworks** – total site area between 2,500 to 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 - 8 m in height, total material moved 20,000 to 100,000 tonnes. **Construction** - total building volume between 25,000 and 100,000 m^3, use of construction materials with high potential for dust release (e.g. concrete), activities include piling, on-site concrete batching. Period of construction activities between one and two years. **Trackout** – 10 - 50 HDV outwards movements in any one day, moderately dusty surface material (e.g. High clay content), unpaved road length 50 – 100 m.	Medium
Demolition - building less than 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 winter months. **Earthworks** – total site area less than 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 < 20,000 tonnes earthworks during winter months. **Construction** - total building volume below 25,000 m^3, use of construction materials with low potential for dust release (e.g. metal cladding or timber). Period of construction activities less than one year.	Small

Features of the Source of Dust Emissions	Dust Emission Magnitude
Trackout – < 10 HDV outwards movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.	

Pathway and Receptor - Sensitivity of the Area

A.2 Pathway means the route by which dust and particulate matter may be carried from the source to a receptor. The main factor affecting the pathway effectiveness is the distance from the receptor to the source. The orientation of the receptors to the source compared to the prevailing wind direction is a relevant risk factor for long-duration construction projects; however, short-term construction projects may be limited to a few months when the most frequent wind direction might be quite different, so adverse effects can potentially occur in any direction from the site.

A.3 As set out in the IAQM dust guidance, a number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

A.4 Table A.2 and Table A.3 sets out the IAQM basis for categorising the sensitivity of people and property to dust and PM_{10} respectively.

Table A.2 Sensitivities of People and Property Receptors to Dust

Receptor	Sensitivity
Principles:- • 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 to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. Indicative Examples:- • Dwellings. • Museums and other culturally important collections. • Medium and long-term car parks and car showrooms.	High
Principles:- • 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. Indicative Examples:- • Parks. • Places of work.	Medium

Receptor	Sensitivity
Principles:- • 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. Indicative Examples:- • Playing fields, farmland (unless commercially-sensitive horticultural). • Footpaths and roads. • Short-term car parks.	Low

Table A.3 Sensitivities of People and Property Receptors to PM_{10}

Receptor	Sensitivity
Principles:- • Locations where members of the public are exposed over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- ▪ Residential properties. ▪ Schools, hospitals and residential care homes.	High
Principles:- • Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM_{10}, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- ▪ Office and shop workers (but generally excludes workers occupationally exposed to PM_{10} as protection is covered by Health and Safety at Work legislation).	Medium
Principles:- • Locations where human exposure is transient exposure. Indicative Examples:- • Public footpaths. • Playing fields, parks. • Shopping streets.	Low

A.5 The IAQM methodology combines consideration of the pathway and receptor to derive the ‘sensitivity of the area’. Table A.4 and Table A.5 show how the sensitivity of the area has been derived for this assessment.

Table A.4 Sensitivity of the Area to Dust Soiling Effects on People and Property

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

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

b For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table A.5 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d]				
			<20	<50	<100	<200	<350
High	> 32 $\mu g.m^{-3}$	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 $\mu g.m^{-3}$	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 - 28 $\mu g.m^{-3}$	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	< 24 $\mu g.m^{-3}$	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	> 32 $\mu g.m^{-3}$	>10	High	Medium	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d] <20	<50	<100	<200	<350
		1 – 10	Medium	Low	Low	Low	Low
	28 – 32 µg.m^{-3}	> 10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	< 28 µg.m^{-3}	>1	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a This refers to the background concentration derived from the assessment of baseline conditions later in this report. The concentration categories listed in this column apply to England, Wales and Northern Ireland but not to Scotland.

b The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

c For high sensitivity receptors with high occupancy (such as schools or hospitals), the approximate number of occupants has been used to derive an equivalent number of receptors.

d For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

The IAQM dust guidance lists the following additional factors that can potentially affect the sensitivity of the area and, where necessary, professional judgement has been used to adjust the sensitivity allocated to a particular area:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which are considered go beyond the classifications given in the table above.

A.6 The matrices in Table A.6, Table A.7, Table A.8 and Table A.9 have been used to assign the risk for each activity to determine the level of mitigation that should be applied. For those cases where the risk category is ‘negligible’, no mitigation measures are required beyond those mandated by legislation.

Table A.6 Risk of Dust Impacts – Demolition

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

Table A.7 Risk of Dust Impacts – Earthworks

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

Table A.8 Risk of Dust Impacts – Construction

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

Table A.9 Risk of Dust Impacts – Trackout

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

Appendix B: Model Verification

B.1 The approach to model verification that LAQM.TG22 recommends for local authorities when they carry out their LAQM duties is summarised in Section 3. For the verification and adjustment of NO_x /NO_2 concentrations, the guidance recommends that the comparison considers a broad spread of automatic and diffusion-tube monitoring. Richmond and Hounslow councils monitor roadside NO_2 concentrations passively using diffusion tubes at four locations in the vicinity of the Application Site.

B.2 The concentrations monitored over recent years are provided in Table B.1.

Table B.1 Measured Annual-mean NO_2 Concentrations (µg.m^{-3})

Monitoring Site	Measured Annual-mean NO_2 Concentrations (µg.m^{-3})			
	2016	2017	2018	2019
HS89 - Whitton Dene	42	32.1	28.8	27.4
31 - A316	54	52	49	45
HS64 - A3063	35.3	33.2	28.7	27.1
71 - Chertsey Road	-	-	-	52
56 – A316	51	50	43	39

B.3 Monitored concentrations from 2019 have been used in the model verification for monitors 31, 71 and 56. For monitors HS89 and HS64 the 2019 measured concentrations are lower than the background concentration of 27.6 µg.m^{-3} used in the assessment. For HS89 and HS64 measured concentrations in 2018 have ben used instead.

B.4 The monitored annual-mean NO_x road contributions have been derived from the monitored annual-mean NO_2 concentrations using the LAQM.TG22 calculator. The monitored annual-mean NO_X road contributions have then been compared with the modelled annual-mean NO_x road contributions. This comparison is provided in Table B.2 below.

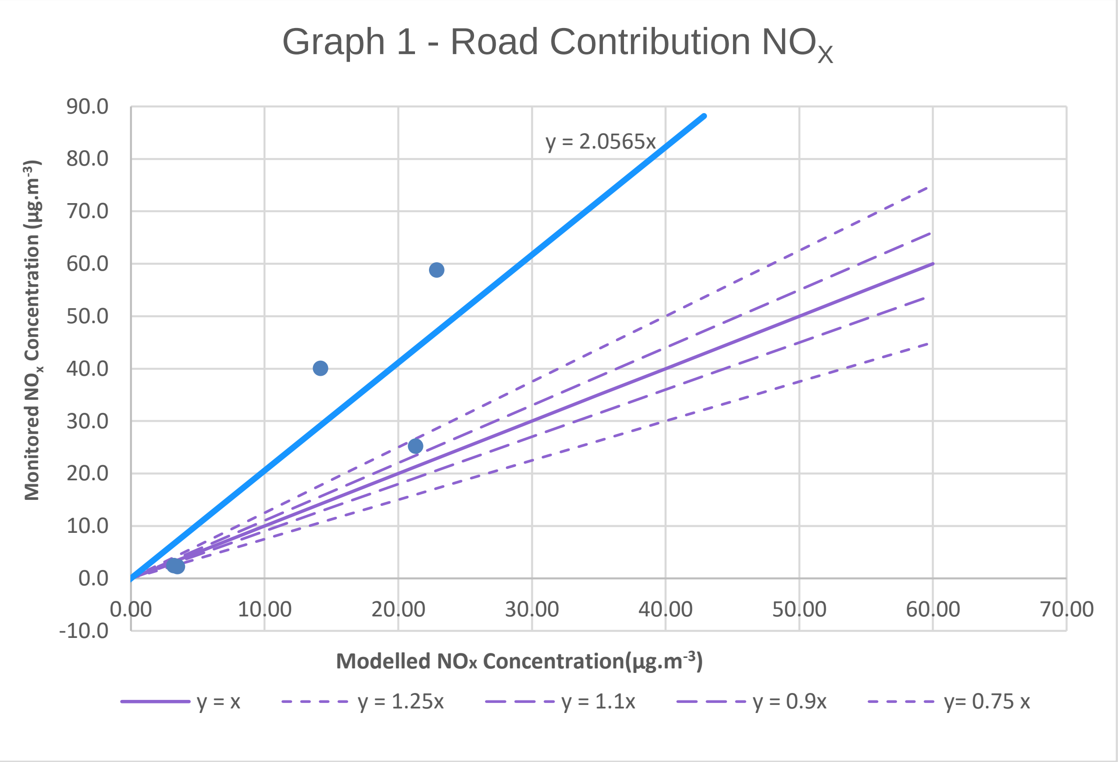
Table B.2 Comparison of Monitored and Modelled Annual-mean Road NO_x Contribution (µg.m^{-3})

Monitoring Site	Annual-mean Road NO_X Contribution (µg.m^{-3})	
	Monitored	Modelled
HS89 - Whitton Dene	2.5	3.21
31 - A316	40.07	14.19
HS64 - A3063	2.29	3.48
71 - Chertsey Road	58.87	22.87

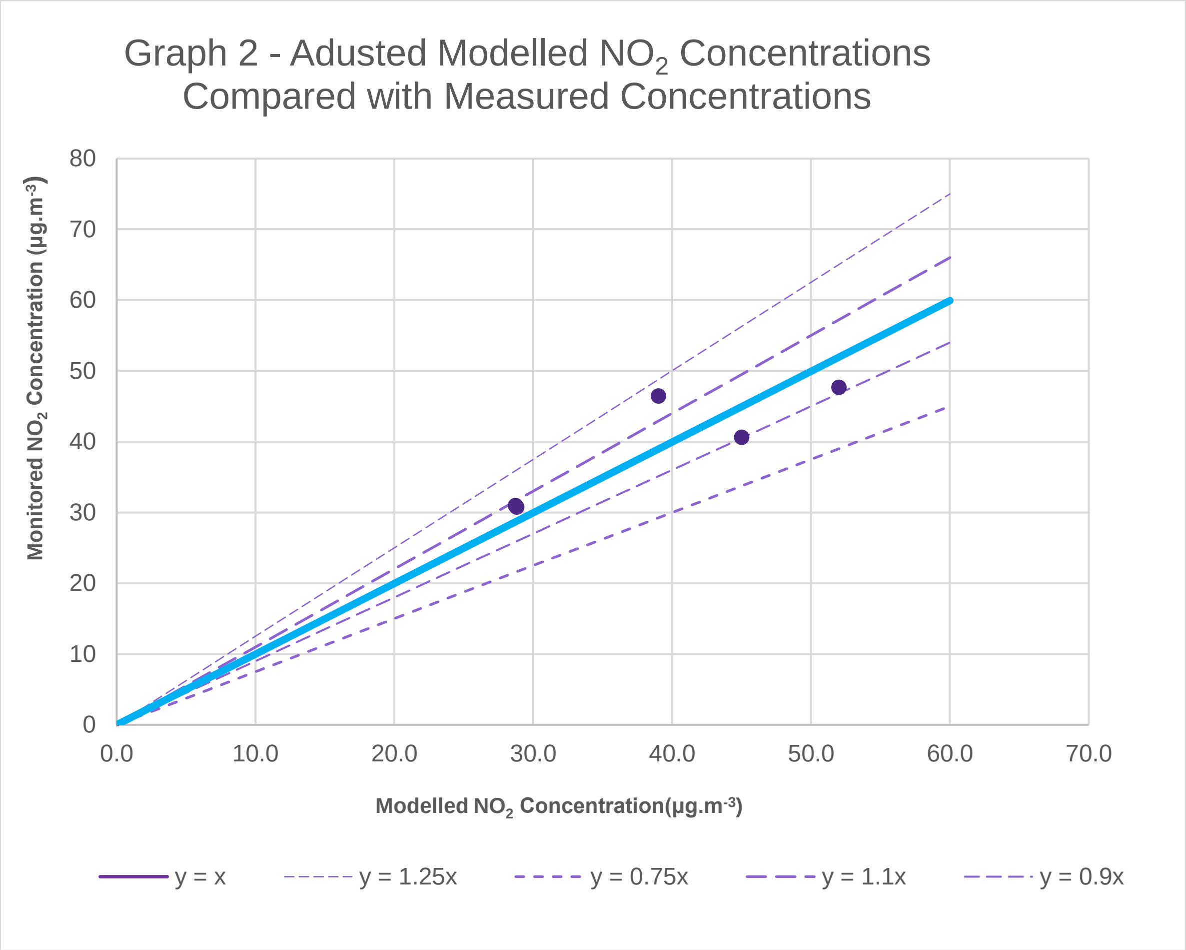
Monitoring Site	Annual-mean Road NO_x Contribution (µg.m^{-3})	
	Monitored	Modelled
56 – A316	25.25	21.30

B.5 It should be borne in mind that the monitored concentrations are themselves only estimates to the true concentrations at each point; the EU Directive on air quality [18] designates passive NO_2 samplers indicative measures with a potential uncertainty of +/-30 %. Ignoring any uncertainty errors in the monitoring results, Table B.2 above indicates that the model is under-predicting on average.

B.6 The modelled annual-mean NO_x road contributions have been plotted against the monitored annual-mean NO_x road contributions in Graph 1.



B.7 The modelled NO_x contributions have been multiplied by the gradient of the trend line (2.0565) to determine the corrected NO_x contributions. Modelled annual-mean NO_2 concentrations have been derived from the corrected modelled annual-mean NO_x road contributions. The corrected modelled annual-mean NO_2 concentrations have been plotted against the monitored annual-mean NO_2 concentrations in Graph 2.



B.8 The corrected modelled annual-mean NO_2 concentrations are all within 25% of the monitored annual-mean NO_2 concentrations. The correction factor therefore improves the modelled concentrations and has been applied to all predictions used within the assessment.

B.9 The fractional bias can also be used to determine whether the corrected model has a tendency to over or under-predict. The fractional bias is calculated as:

(Average Monitored NO_X Concentration – Average Predicted NO_x Concentration) / 0.5 x (Average Monitored NO_X + Average Predicted NOx Concentration)

B.10 Fractional bias values vary between +2 and -2 and has an ideal value of zero. A negative value suggests a model over-prediction and a positive value suggests a model under-prediction.

B.11 Table B.3 sets out the average monitored concentration and the average predicted concentration.

Table B.3 Comparison of Monitored and Adjusted Modelled Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)

Monitoring Site	Annual-mean Road NO_X Contribution ($\mu g.m^{-3}$)	
	Monitored	Corrected Modelled
HS89 - Whitton Dene	2.5	6.6
31 - A316	40.1	29.2
HS64 - A3063	2.3	7.2
71 - Chertsey Road	58.9	47.0
56 – A316	25.3	43.8
Average	25.3	26.8

B.12 The fractional bias for this study is therefore (25.8 – 26.8) / (0.5 x (25.8 +26.8)) = -0.04. As the fractional bias is negative, the adjusted model is overpredicting.

References

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5 GLA, March 2021, The London Plan – The Spatial Development Strategy for Greater London.

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9 Mayor of London, July 2014, The Control of Dust and Emissions During Construction and Demolition

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11 Mayor of London, 2019 London Local Air Quality Management Technical Guidance, 2019 (LLAQM.TG19)

12 Defra, 2022 Local Air Quality Management Technical Guidance, 2022 (LAQM.TG22)

13 British Standard Institute, 1983, BS 6069:Part 2:1983, ISO 4225-1980 Characterization of air quality. Glossary

14 http://laqm.defra.gov.uk/review-and-assessment/tools/tools.html

15 London Councils' Air Quality and Planning Guidance, Revised Version January 2007

16 Drawn from Defra Maps at http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

17 World Health Organisation, 2021, WHO global air quality guidelines

18 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe