Twickenham Riverside
Air Quality Assessment

LONDON BOROUGH OF
RICHMOND UPON THAMES

July 2021

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CONTENTS **PAGE**

1 INTRODUCTION

1.1 Entran Limited has been commissioned to undertake an assessment of air quality impacts associated with the re-development of land at Twickenham Riverside, to the south of King Street, Twickenham within the London Borough of Richmond-upon-Thames. The location of the Site is shown in Figure 1.

1.2 The Site is currently occupied by commercial buildings and a surface level car park. It is proposed to clear the Site and construct two new buildings providing commercial/retail premises at ground floor level and residential flats at 1st, 2nd and 3rd floor level.

1.3 The London Borough of Richmond upon Thames (LBRuT) has declared the whole borough as an Air Quality Management Area (AQMA) due to exceedences of the nitrogen dioxide (NO_2) and particulate matter (PM_{10}) objectives. The Site therefore falls within an AQMA.

1.4 This report presents the findings of a detailed air quality and odour assessment of the potential impacts associated with the proposed development on local air quality during both construction and operational phases. For both phases the type, source and significance of potential impacts are identified and the measures that should be employed to minimise these impacts are described.

1.5 A glossary of common air quality terminology is provided in **Appendix A.**

Figure 1: Site Location Plan

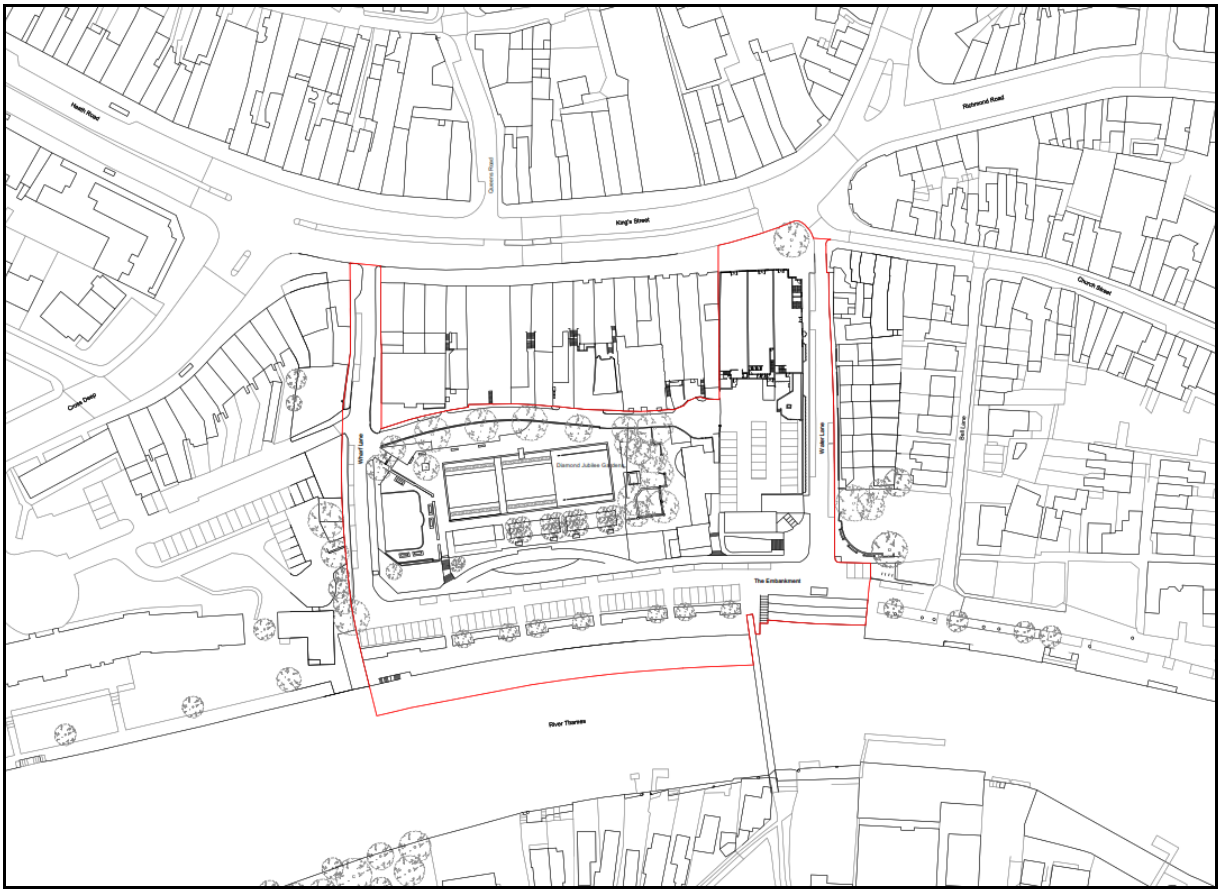
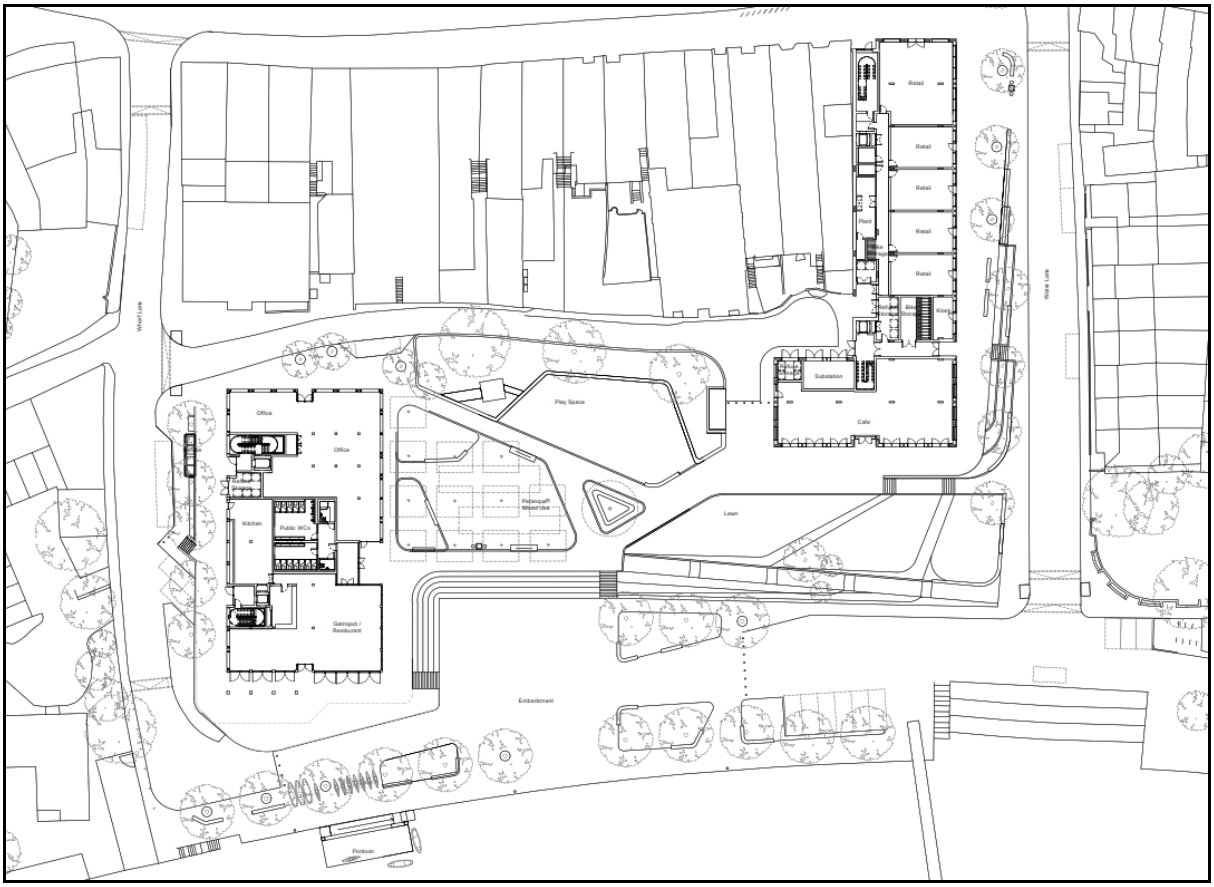


Figure 2: Proposed Development



2 LEGISLATION AND POLICY

Air Quality Strategy for England, Scotland, Wales & Northern Ireland

2.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[1], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.2 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

2.3 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.4 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

2.5 For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of nitrogen dioxide (NO_2), the short-term standard is for a 1-hour averaging period, whereas for fine particulates (PM_{10}) it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007.

2.6 The current statutory standards and objectives are set out in the table presented in **Appendix B**.

2.7 Of the pollutants included in the AQS, NO_2, PM_{10} and $PM_{2.5}$ will be particularly relevant to this project, as these are the primary pollutants associated with road traffic.

Local Air Quality Management (LAQM)

2.8 Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

2.9 Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate that part an Air Quality Management Area (AQMA).

2.10 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

2.11 The Department of Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their Review and Assessment work[2]. This guidance, referred to in this chapter as LAQM.TG(16), has been used where appropriate in the assessment.

National Planning Policy Framework

National Planning Policy Framework

2.12 The National Planning Policy Framework (NPPF)[3] sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with

[2] Department for Environment, Food and Rural Affairs (DEFRA), (2016): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16).

[3] Ministry of Housing, Communities and Local Government: *National Planning Policy Framework* (July 2021).

the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

2.13 The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to *'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.'*

2.14 Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 174) requires that *'planning policies and decisions should contribute to and enhance the natural and local environment by …preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as air and water quality'*

2.15 In dealing specifically with air quality the NPPF (paragraph 186) states that *'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan'.*

2.16 Paragraph 188 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively.'*

Control of dust and particulates associated with construction

2.17 Section 79 of the *Environmental Protection Act (1990*) states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

- ‘Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance’, and
- ‘any accumulation or deposit which is prejudicial to health or a nuisance’.

2.18 Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.19 In the context of the proposed development, the main potential for nuisance of this nature will arise during the construction phase – potential sources being the clearance, earthworks, construction and landscaping processes.

2.20 There are no statutory limit values for dust deposition above which ‘nuisance’ is deemed to exist – ‘nuisance’ is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates.

The Mayor’s Air Quality Strategy for London

2.21 In 2010 the GLA/Mayor of London published a new Mayor’s Air Quality Strategy for London[4]. This strategy is focused on improving London’s air quality. It also explains the current air quality experienced across London and gives predictions of future levels of pollution. The sources of pollution are outlined and a comprehensive set of policies and proposals are set out that will improve air quality in the London Boroughs.

2.22 The Strategy sets out a framework for delivering improvements to London’s air quality and includes measures aimed at reducing emissions from transport, homes, offices and new developments, promoting smarter more sustainable travel, as well as raising awareness of air quality issues.

2.23 The Strategy includes a policy which states: *“New developments in London shall as a minimum be ‘air quality neutral’ through the adoption of best practice in the management and mitigation of emissions”.*

The London Plan: The Spatial Development Strategy for Greater London (March 2021)

[4] Mayor of London: Cleaning London’s air, The Mayor’s Air Quality Strategy (December 2010)

2.24 Policy SI1 Improving air quality of the London Plan states:

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.

3) masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should propose methods of achieving an Air Quality Positive approach through the new development.

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.

Mayor of London Sustainable Design and Construction SPG

2.25 The Mayor's Sustainable Design and Construction Supplementary Planning Guidance (SPG)[5] sets out guidance on meeting the London Plan Policy on sustainable design and construction.

2.26 In relation to air quality the SPG sets out guidance on the following key areas:

- assessment requirements;
- construction and demolition;
- design and occupation;
- air quality neutral policy for buildings and transport; and
- emissions standards for combustion plant.

2.27 Reference has been made to the guidance set out within the SPG when undertaking this assessment.

The Mayor of London's Draft Supplementary Planning Guidance on the Control of Dust and Emissions during Construction and Demolition

2.28 The Mayor of London's Draft Supplementary Planning Guidance was published in July 2014. It replaces the Best Practice Guidance, published by the London Councils and Mayor of London in 2006[6].

The guidance describes the methodology for undertaking assessments of air quality impacts from construction and demolition in London.

Odour Guidance for Local Authorities

2.29 The Defra Odour Guidance for Local Authorities[7] provides guidance on preventing, investigating and managing odours. Guidance on odour assessment and control for facilities regulated under the Environmental Permitting Regulations 2010 is contained in the relevant Sector and Process Specific Guidance Notes and Horizontal Guidance documents. However, there are many other activities that fall outside these specific environmental regimes and 'odour' from these premises are 'regulated' by local authorities under the statutory nuisance provisions of Part III of the Environmental Protection Act (EPA) 1990. The aim of this guidance document is to provide a toolkit for local authorities to assist them in providing a consistent, effective and fair approach to their regulatory duties with regard to odours and therefore endeavours to:

- explain the basic properties of odour;
- explain the legal and regulatory framework for preventing and controlling odours;
- identify the most common sources of odour and the methods that can be used to investigate and assess them; and
- explain the administrative and practical control measures available to local authorities and to provide guidance on how best to implement the service.

Guidance on the Control of Odour from Commercial Kitchens Exhaust System

2.30 Problems associated with nuisance odour from commercial kitchen exhausts are a common problem, particularly in urban areas where housing may be adjacent to a catering premises. The Defra guidance on Control of Odour from Commercial Kitchens[8] provides best practice techniques to minimise odour from kitchen exhaust systems.

[5] Mayor of London (2014) Sustainable Design and Construction Supplementary Planning Guidance

[6] The control of dust and emissions from construction and demolition Best Practice Guidance, Greater London Authority and London Council's, November 2006.

[7] Defra (2010) Odour Guidance for Local Authorities

[8] Defra (2005) Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems

2.31 The guidance provides a background into odour, the potential sources and effects of odour from kitchens and the regulatory roles is assessing and controlling odour. Details of appropriate kitchen ventilation systems that can be installed to ensure odour is controlled to prevent statutory nuisance are also provided.

2.32 Appendix C of the Guidance sets out a risk assessment that can be used to identify the likelihood of odour nuisance occurring from a commercial kitchen facility and to assist in determining appropriate odour control requirements based on the operations carried out at the selected premises.

Richmond Local Plan

2.33 The Richmond Core Strategy[9].was adopted in July 2018 and sets out policies and guidance for the development of the borough until July 2033 or until it is superseded.

2.34 Policy LP 10 Local Environmental Impacts, Pollution and Land Contamination states:

> '*A. The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.*
>
> *Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.*
>
> *Air Quality*
>
> *B. 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:*

[9] London Borough of Richmond (2009) Local Development Framework, Core Strategy, Adopted April 2009

1. an air quality impact assessment, including where necessary, modelled data;

2. mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology;

3. measures to protect the occupiers of new developments from existing sources;

4. 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 sensitive receptors. […]

Odours and Fume Control

E. The Council will seek to ensure that any potential impacts relating to odour and fumes from commercial activities are adequately mitigated by requiring the following:

1. an impact assessment where necessary;

2. the type and nature of filtration to be used;

3. the height and position of any chimney or outlet;

4. promotion and use of new abatement technologies; […]'

EPUK & IAQM Land Use Planning and Development Control

2.35 Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) published the Land Use Planning and Development Control Air Quality guidance in January 2017[10] to provide guidance on the assessment of air quality in relation to planning proposals and ensure that air quality is adequately considered within the planning control process.

2.36 The main focus of the guidance is to ensure all developments apply good practice principles to ensure emissions and exposure are kept to a minimum. It also sets out criteria for identifying when a more detailed assessment of operational impacts is required, guidance on undertaking detailed assessments and criteria for assigning the significance of any identified impacts.

[10] EPUK & IAQM. Land-use Planning and Development Control: Planning for Air Quality, January 2017

2.37 This guidance has been used within this assessment.

Assessment of Dust from Demolition and Construction

2.38 The IAQM published guidance in 2014 on the assessment of emissions from demolition and construction activities[11]. The guidance sets out an approach to identifying the risk of impacts occurring at nearby sensitive receptors from dust generated during the construction process and sets out recommended mitigation measures based on the identified risk.

2.39 This guidance has been used within this assessment.

[11] Guidance on the assessment of dust from demolition and construction (version 1.1), IAQM, February 2014.

3 METHODOLOGY

Scope of Assessment

3.1 The scope of the assessment has been determined in the following way:

- Review of air quality data for the area surrounding the site and background pollutant maps; and
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

3.2 The proposed development is considered to be car-free. Impacts on local air quality as a result of the operational development have therefore been scoped out of this assessment. However, the Site is located adjacent to King Street and the northern façade falls within the King Street Air Quality Focus Area (AQFA) as designated by the Mayor of London and monitoring in the vicinity of the Site has recorded annual mean NO_2 concentrations above the relevant objective limit. An assessment of air quality at the Site in terms of exposure of new occupants has therefore been undertaken.

3.3 The proposals would provide commercial units at ground floor level. It is proposed to provide one café in the Water Lane building and one pub/restaurant in the Wharf Lane building. Any kitchen/café facility would be fitted with an extraction system which meets the requirements of the DEFRA guidance on the '*Control of Odour from Kitchens and Exhaust Systems'* including the location of any extract flue at least 1 m above the eaves of the roof of the building in which the kitchen facility is located and the incorporation of both a fine filtration system and active carbon filters. On this basis, it is concluded that any odour emissions would be adequately mitigated and no significant impacts would occur. The impact of odour has not therefore been considered any further within this report.

3.4 All developments within London are required to be Air Quality Neutral (AQN) in accordance with the London Plan and the 2010 Mayor of London's Air Quality Strategy. Based on criteria set out within the Mayor of London's Sustainable Design and Construction SPG the proposed development is classed as a 'major' development i.e. it would provide more than 10 residential units. The development proposal have therefore been assessed against the AQN polices. As detailed above the development would not generate a significant number of additional vehicle movements during the operational phase and therefore is considered to be air quality

neutral in terms of traffic emissions. Additionally, the Proposed Development will be heated by air source heat pumps. As such, the building emissions are considered to be air quality neutral.

3.5 During the demolition and construction phase there is the potential for dust emissions to result in nuisance and health impacts at nearby sensitive receptors. The assessment has therefore included an assessment of construction related impacts.

3.6 Due to the location of the Site in relation to the King Street AQFA mitigation has been identified based on the requirements for mitigating air quality within an AQFA.

3.7 Details of the assessment methodology and the specific issues considered are provided below.

Construction Phase Methodology

Construction Traffic

3.8 During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery may also work on site including generators and cranes. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

3.9 Based on the size of the development proposals, it is anticipated that there will be less than 25 additional HGV vehicles generated on the adjacent road network on any given day.

3.10 The criteria set out within the EPUK and IAQM guidance indicates that significant impacts on air quality are unlikely to occur where a development results in less than 25 HGV movements per day within an AQMA and 100 at locations outside of an AQMA. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment.

Construction Dust

3.11 To assess the potential impacts associated with dust and PM_{10} releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the Mayor of London[12] has been undertaken. The proposed approach to assessing the risk is based on the latest guidance produced by the IAQM[13] and follows the methodology set out below.

3.12 This approach divides construction activities into the following dust emission sources:

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

3.13 The risk of dust effects (low, medium or high) is determined by the scale (magnitude) and nature of the works and the proximity of sensitive human and ecological receptors.

[12] Mayor of London (2016) The Control of Dust and Emissions from Construction and Demolition Version 1.1, July 2016

3.14 The IAQM guidance recommends that an assessment be undertaken where there are sensitive human receptors:

- within 350 m of the Site boundary; or
- within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s).

3.15 An assessment should also be carried out where there are dust-sensitive ecological receptors:

- within 50 m of the Site boundary;
- or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s).

3.16 The significance of the dust effects is based on professional judgement, taking into account the sensitivity of receptors and existing air quality.

Dust Emission Magnitude

3.17 The magnitude of the dust impacts for each source is classified as Small, Medium or Large depending on the scale of the proposed works. Table 3.1 summarises the IAQM criteria that may be used to determine the magnitude of the dust emission. These criteria are used in combination with site specific information and professional judgement.

[13] Institute of Air Quality Management (2014) Guidance on the Assessment of Dust from Demolition and Construction

Table 3.1: Dust Emission Magnitude Criteria

Source	Large	Medium	Small
Demolition	• Total building volume >50,000m^3 • Potentially dusty material (e.g. concrete) • Onsite crushing and screening • Demolition activities >20m above ground level.	• Total building volume 20,000 - 50,000m^3 • Potentially dusty material • Demolition activities 10 - 20m above ground level.	• Total building volume <20,000m^3 • Construction material with low potential for dust release • Demolition activities <10m above ground level • Demolition during wetter months
Earthworks	• Total site area >10,000m^2 • Potentially dusty soil type (e.g. clay) • >10 heavy earth moving vehicles active at any one time • Formation of bunds >8m in height • Total material moved >100,000 tonnes	• Total site area 2,500 -10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 - 10 heavy earth moving vehicles active at any one time • Formation of bunds 4 - 8m in height • Total material moved 20,000 - 100,000 tonnes	• Total site area <2,500m^2 • Soil type with large grain size (e.g. sand) • <5 heavy earth moving vehicles active at any one time • Formation of bunds <4m in height • Total material moved <20,000 tonnes • Earthworks during wetter months
Construction	• Total building volume >100,000m^3 • On site concrete batching • Sandblasting	• Total building volume 25,000 - 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching	• Total building volume <25,000m^3 • Material with low potential for dust release (e.g. metal cladding or timber)
Trackout	• >50 HGV movements in any one day (a) • Potentially dusty surface material (e.g. high clay content) • Unpaved road length >100m	• 10 - 50 HGV movements in any one day (a) • Moderately dusty surface material (e.g. silt) • Unpaved road length 50 - 100m	• <10 HGV movements in any one day (a) • Surface material with low potential for dust release • Unpaved road length <50m
(a) HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes.			

Receptor Sensitivity

3.18 Factors defining the sensitivity of a receptor are presented in Table 3.2.

Table 3.2: Factors Defining the Sensitivity of a Receptor

Sensitivity	Human (health)	Human (dust soiling)	Ecological
High	• Locations where members of the public are exposed over a time period relevant to the air quality objectives for PM_{10} (a) • Examples include residential dwellings, hospitals, schools and residential care homes.	• Regular exposure • High level of amenity expected. • Appearance, aesthetics or value of the property would be affected by dust soiling. • Examples include residential dwellings, museums, medium and long-term car parks and car showrooms.	• Nationally or Internationally designated site with dust sensitive features (b) • locations with vascular species (c)
Medium	• Locations where workers are exposed over a time period relevant to the air quality objectives for PM_{10} (a) • Examples include office and shop workers (d)	• Short-term exposure • Moderate level of amenity expected • Possible diminished appearance or aesthetics of property due to dust soiling • Examples include parks and places of work	• Nationally designated site with dust sensitive features (b) • Nationally designated site with a particularly important plant species where dust sensitivity is unknown
Low	• Transient human exposure • Examples include public footpaths, playing fields, parks and shopping streets	• Transient exposure • Enjoyment of amenity not expected. • Appearance and aesthetics of property unaffected • Examples include playing fields, farmland (e), footpaths, short-term car parks and roads	• Locally designated site with dust sensitive features (b)

(a) In the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day.

(b) Ecosystems that are particularly sensitive to dust deposition include lichens and acid heathland (for alkaline dust, such as concrete).

(c) Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.

(d) Does not include workers exposure to PM_{10} as protection is covered by Health and Safety at Work legislation.

(e) Except commercially sensitive horticulture.

3.19 The sensitivity of a receptor will also depend on a number of additional factors including any history of dust generating activities in the area, likely cumulative dust impacts from nearby construction sites, any pre-existing screening such as trees or buildings and the likely duration of the impacts. In addition, the influence of the prevailing wind direction and local topography may be of relevance when determining the sensitivity of a receptor.

Area Sensitivity

3.20 The sensitivity of the *area* to dust soiling and health impacts is dependent on the number of receptors within each sensitivity class and their distance from the source. In addition, human health impacts are dependent on the existing PM_{10} concentrations in the area. Tables 3.3 and 3.4 summarise the criteria for determining the overall sensitivity of the area to dust soiling and health impacts respectively.

Table 3.3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the source (a)			
		<20m	<50m	<100m	<350m
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

(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

Table 3.4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} ($\mu g/m^3$)	Number of Receptors	Distance from the source (a)				
			<20m	<50m	<100m	<200m	<350m
High	> 32	> 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32	> 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28	> 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	< 24	> 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
		1 - 10	Medium	Low	Low	Low	Low
	28-32 $\mu g/m^3$	> 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	<28 $\mu g/m^3$	-	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

(a) For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

Table 3.5: Sensitivity of Area to Ecological Impacts

Sensitivity of Area	Distance from the Source	
	<20m	<50m
High	High Risk	Medium Risk
Medium	Medium Risk	Low Risk
Low	Low Risk	Low Risk

3.21 For each dust emission source (demolition, construction, earthworks and trackout), the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts.

Risk of Dust Impacts

3.22 The risk of dust impacts prior to mitigation for each emission source is presented in Tables 3.6 and 3.7.

Table 3.6: Risk of Dust Impacts – Demolition, Earthworks and Construction

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 3.7: 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

Mitigation and Significance

3.23 The IAQM guidance provides a range of mitigation measures which are dependent on the level of dust risk attributed to the site. Site specific mitigation measures are also included where appropriate.

3.24 The significance of the impacts following appropriate mitigation is determined by professional judgement.

Operational Phase Methodology

Traffic Emissions

3.25 The prediction of local air quality has been undertaken using the ADMS Roads dispersion model. This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

3.26 The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from Heathrow Airport Meteorological Station for 2019 has been used for the assessment.

3.27 The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) and Particulate Matter (PM_{10}) at selected receptors. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the DEFRA air quality website[14].

3.28 Traffic data for Kings Street, Wharf Lane and Water Lane have been obtained from ATC counts carried out in March 2020. Additional data for Richmond Road and London Road has been obtained from the Department of Transport (DfT) traffic data available on their website (http://www.dft.gov.uk/traffic-counts/).

3.29 A summary of the traffic data used in the assessment can be found in **Appendix C**. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage HGV for the assessment years considered.

[14] http://uk-air.defra.gov.uk

3.30 The emission factors released by DEFRA in August 2020, provided in the emissions factor toolkit EFT2020_10.1 have been used in the ADMS model (Version 5.0.0, released in April 2020) to predict existing NO_2, PM_{10} and $PM_{2.5}$ traffic emissions for 2019 (for verification purposes) and 2021.

3.31 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background NO_x, NO_2 and PM_{10} concentrations for use in the model have been taken from the DEFRA background maps for 2018. The data used in the assessment are set out in Table 4.5.

3.32 Background concentrations for 2019 have been used to predict concentrations in 2021 assuming no change in future years. This is considered to represent a conservative prediction of future concentrations.

3.33 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process aims to minimise modelling uncertainty and systematic error by correcting the modelled results by an adjustment factor to gain greater confidence in the final results. This process was undertaken using the methodology outlined in Chapter 7, Section 4 of LAQM.TG(16).

3.34 A verification factor of 2.92 was determined which indicates that the model is under-predicting in this area. This factor was applied to the modelled road-NO_x concentrations prior to conversion to annual mean NO_2 concentrations using the NO_x to NO_2 calculator. Further details of the determination of the verification factor are provided in **Appendix D**.

3.35 LAQM.TG(16) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[15] has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

3.36 Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in **Appendix B** for NO_2, PM_{10} and $PM_{2.5}$.

[15] D Laxen and B Marner: *Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites* (July 2003).

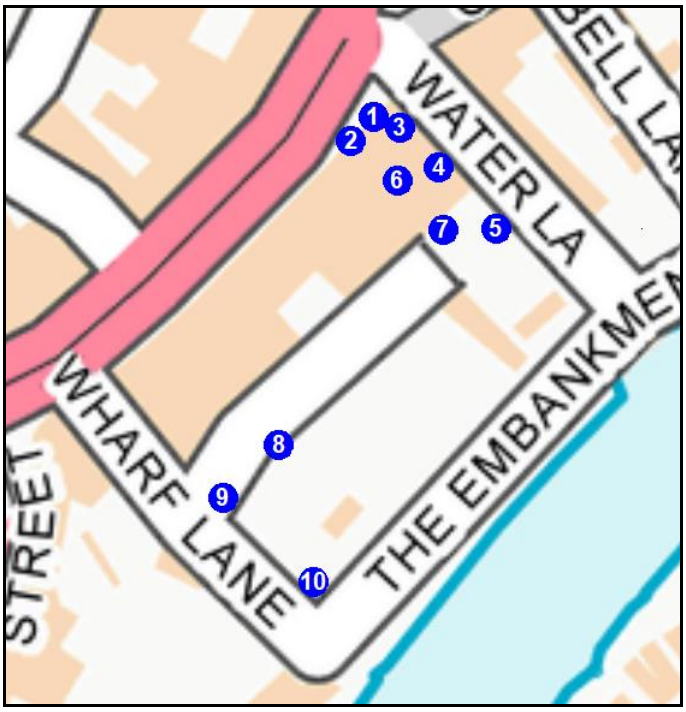
Sensitive Receptors

3.37 LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations '*where members of the public are regularly present'* should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

3.38 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term standards (such as 24 hour mean or annual mean) may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

3.39 To assess air quality at the Site, pollutant concentrations have been predicted at the facades of the new buildings, the locations of which are shown in Figure 3.1. Concentrations have been predicted at each floor of the new building at an equivalent height of 1.5 m above floor level.

Figure 3.1: Location of Receptors used in Modelling



4 BASELINE CONDITIONS

Richmond Review and Assessment of Air Quality

4.1 LBRuT has carried out detailed assessments of air quality and as a result has declared the whole borough an AQMA due to exceedences of the NO_2 and PM_{10} objectives. There is therefore the potential for pollutant concentrations at the Site to be exceeding the relevant air quality objectives.

Automatic Local Monitoring Data

4.2 LBRuT operate three static automatic monitoring sites and one mobile automatic site within the borough which record concentrations of both NO_2 and PM_{10}. As there are other monitoring sites in closer proximity to the Site monitoring NO_2 concentrations the automatic sites have not been used to assess baseline concentrations of this pollutant.

4.3 PM_{10} concentrations are measured at two of the automatic sites. Details of these are set out in Table 4.1 below and monitored concentrations of PM_{10} are set out in Table 4.2.

Table 4.1: Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	Relevant Exposure	Distance to Kerb of nearest road
RI1 Castelnau Library, Barnes	Roadside	522500, 177165	NO_2, PM_{10}	8 m	3 m
RI2 Wetlands Centre, Barnes	Suburban	522991, 176495	NO_2, PM_{10}	Children in adjacent play area	n/a

Table 4.2: PM_{10} automatic monitoring results

Monitoring Site	Objective	Year					
		2015	2016	2017	2018	2019	2020
RI1 Castelnau Library, Barnes	Annual Mean	22	20	18	19	15	15
	Hourly Exceedences of 200 µg/m^3	5	7	4	1	3	0
RI2 Wetlands Centre, Barnes	Annual Mean	17	16	15	15	16	16
	Hourly Exceedences of 200 µg/m^3	1	3	3	0	3	0

4.4 The data presented in Table 4.2 shows roadside and urban PM_{10} concentrations to be less than 75% of the annual mean objective of 40 µg/m^3. The data shows a downward trend in PM_{10} concentrations between 2015 and 2020.

4.5 Both sites have recorded exceedences of the 24-hour objective limit of 50 µg/m^3. The objective allows for up to 35 exceedences in any given year therefore the objective has been met at both locations during years.

4.6 Based on the data recorded at the two automatic sites it is expected that PM_{10} concentrations at the Site will meet the annual mean and 24-hour objectives.

Non-Automatic Monitoring

4.7 LBRuT operates an extensive network of diffusion tubes across the borough measuring concentrations of NO_2. Those closest to the development site are set out in Table 4.3 along with concentrations recorded between 2015 and 2020.

4.8 All the diffusion tube data has been bias corrected using bias adjustment factors derived from diffusion tubes collocated with the Councils automatic monitoring sites.

Table 4.3: Annual Mean NO_2 Concentrations Measured by Diffusion Tube (µg/m^3)[16]

Site Name	Site Type	OS Grid Reference	Annual mean concentrations (µg/m^3)					
			2015	2016	2017	2018	2019	2020
15 – Richmond Road	Kerbside	517197, 173939	37	41	38	34	32	26
32 – King Street	Kerbside	516226, 173195	62	64	59	56	47	40
65 – York Street	Kerbside	516356, 173365	-	75	68	55	50	40

4.9 The data presented in Table 4.3 shows annual mean NO_2 concentrations consistently above the 40 µg/m^3 objective limit at two of the three monitoring sites. The data shows a gradual decline in concentrations.

4.10 The Development Site is located to the south of King Street. Based on concentrations recorded at the King Street monitoring sites NO_2 concentrations are expected to exceed the annual mean objective across the development site.

4.11 Diffusion tubes cannot monitor short-term NO_2 concentrations, however, as previously discussed, research has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Based on annual mean concentrations recorded at the King Street monitoring sites there is the potential for the 1-hour objective to be exceeded in this location. There is therefore the risk that NO_2 concentrations are exceeding the 1-hour objective across the development site.

[16] London Borough of Richmond (2021) Air Quality Annual Status Report 2021

DEFRA Background Maps

4.12 Background concentrations have been obtained from the 2018 DEFRA background pollutant maps. The maps provide an estimate of background concentrations between 2018 and 2030. The average 2019 background concentrations for the grid square 516500, 173500, which includes the development site are presented in Table 4.4. These background concentrations have been used to assess air quality at the Site and at the King Street and York Street monitoring locations.

4.13 Additional background concentrations have been obtained for the grid square 517500, 173500 for the Richmond Road monitoring site.

Table 4.4: Estimated background concentrations from DEFRA maps (µg/m^3)

Pollutant	516500, 173500	517500, 173500
NO_2	21.6	18.7
PM_{10}	16.8	15.6
$PM_{2.5}$	11.4	10.7

4.14 The data presented in Table 4.4 shows that annual mean background concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the relevant objective limits.

5 ASSESSMENT OF IMPACT, MITIGATION AND RESIDUAL EFFECTS

IMPACT – CONSTRUCTION PHASE

Area Sensitivity

5.1 There are a number of commercial buildings currently located on the Site. These will need to be demolished as part of the development process. Impacts associated with demolition have therefore been considered within this assessment.

5.2 The assessment of dust impacts is dependent on the proximity of the most sensitive receptors to the site boundary. A summary of the receptors and area sensitivity to health and dust soiling impacts is presented in Table 5.1.

5.3 There are no dust-sensitive habitat sites within 50m of the proposed development, therefore the impact of dust emissions on ecologically sensitive receptors has not been considered further in this assessment.

Table 5.1: Sensitivity of Receptors and the Local Area to Dust Impacts

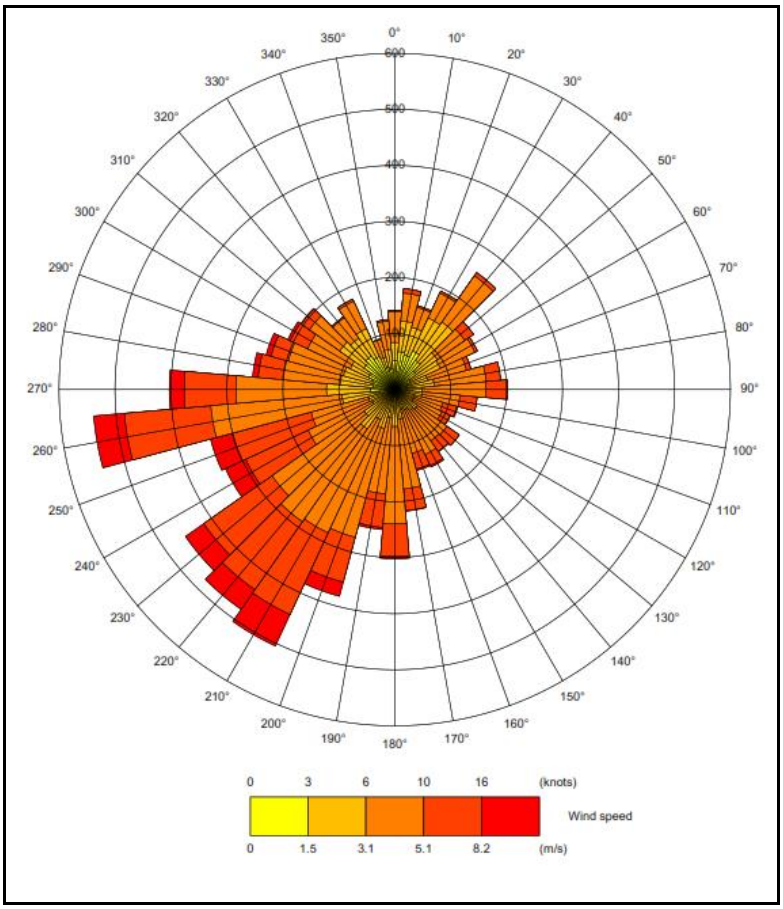
Receptor	Distance from Site Boundary (m)	Approx. Number of Receptors	Sensitivity to Health Impacts (a)		Sensitivity to Dust Soiling Impacts	
			Receptor	Area	Receptor	Area
Residential Properties	< 20 m	10-100	High	Low	High	High
Overall Sensitivity of the Area			**Low**		**High**	
(a) Estimated background PM_{10} concentration is 16.8 µg/m^3.						

5.4 The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited will depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

5.5 A wind rose from Heathrow Airport is provided below in Figure 5.1, which shows that the prevailing wind is from the southwest, therefore receptors to the northeast of the site are the most

likely to experience dust impacts from the site which includes flats located along King Street and houses along Water Lane.

Figure 5.1: Wind Rose for Heathrow Airport Meteorological Station (2019)



Dust Emission Magnitude

5.6 Dust emissions from demolition can arise from a number of activities including the de-construction of buildings, on-site crushing and screening and general disturbance of potentially dusty materials. The buildings that would be demolished are mainly constructed from bricks and concrete which are potentially dusty materials, however they have a total volume of less than 10,000 m^3 and are less than 10 m in height. The site is therefore determined as having a dust magnitude of *small* in relation to demolition activities.

5.7 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling of the site and landscaping. The area of the Site is approximately 4000 m^2 and it is expected that there will be between 3-5 earth moving vehicles on site at any one time which would stock pile material in bund which are likely to be no more than 4 m in height. Part of the earthworks would include the breaking up and clearing of the surface level

concrete which can create a significant amount of dust. The magnitude of the dust emission for the earthworks phase is therefore considered to be *medium*.

5.8 Dust emissions during construction will depend on the scale of the works, method of construction, construction materials and duration of build. The proposed residential buildings will be up to 3 storeys. Based on the size and construction materials the dust emission magnitude is considered to be *medium*.

5.9 Factors influencing the degree of trackout and associated magnitude of effect include vehicle size, vehicle speed, vehicle numbers, geology and duration. Construction traffic will travel along King Street onto Water Lane to gain access to the Site. There are a number of residential premises along Water Lane which would be sensitive to dust effects. The number of HGV movements (leaving the site) is unlikely to be more than 25 per day, therefore dust emission magnitude due to trackout is considered to be *medium.*

Dust Risk Effects

5.10 A summary of the potential risk of dust impacts, based on the low overall sensitivity of the area to human health impacts and high overall sensitivity to dust soiling impacts, is presented in Table 5.2.

Table 5.2: Risk of Dust Impacts Prior to Mitigation

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

IMPACT - OPERATIONAL PHASE

Traffic Emissions

NO_2 Concentrations

5.11 Annual mean NO_2 concentrations predicted at the facades of the new buildings up to 3rd floor level are set out in Table 5.3.

Table 5.3: Predicted Annual Mean NO_2 Concentrations (µg/m³)

Receptor Number	Floor	NO_2 Concentration (µg/m³)
1	Ground	36.3
	1st	30.5
	2nd	26.1
	3rd	24.0
2	Ground	37.7
	1st	30.9
	2nd	26.1
	3rd	23.9
3	Ground	31.9
	1st	28.9
	2nd	25.9
	3rd	24.0
4	Ground	28.1
	1st	26.8
	2nd	25.2
	3rd	23.9
5	Ground	25.7
	1st	25.1
	2nd	24.3
6	Ground	29.4
	1st	27.7
	2nd	25.5
	3rd	24.0
7	Ground	26.5
	1st	25.8
	2nd	24.7
8	Ground	25.2
	1st	24.7

Receptor Number	Floor	NO_2 Concentration (µg/m^3)
	2nd	24.0
9	Ground	25.0
	1st	24.4
	2nd	23.7
10	Ground	23.8
	1st	23.4
	2nd	23.1

5.12 The ADMS model is predicting annual mean NO_2 concentrations below the objective of 40 µg/m^3 at all proposed receptors.

5.13 As previously discussed, the ADMS model cannot predict short-term NO_2 concentrations. However, as the model is predicting annual mean NO_2 concentrations below 60 µg/m^3 at all locations across the Site it is considered unlikely that the 1-hour objective will be exceeded.

PM_{10} Concentrations

5.14 Predicted annual mean PM_{10} concentrations predicted at the facades of the building are provided in Table 5.4.

Table 5.4: Predicted Annual Mean PM_{10} Concentrations (µg/m^3)

Receptor Number	Floor	PM_{10} Concentration (µg/m^3)
1	Ground	20.4
	1st	18.9
	2nd	17.9
	3rd	17.4
2	Ground	20.8
	1st	19.0
	2nd	17.9
	3rd	17.4
3	Ground	19.3
	1st	18.5
	2nd	17.8
	3rd	17.4
4	Ground	18.3
	1st	18.0
	2nd	17.7

Receptor Number	Floor	PM_{10} Concentration (µg/m^3)
	3rd	17.4
5	Ground	17.8
	1st	17.6
	2nd	17.5
6	Ground	18.7
	1st	18.2
	2nd	17.7
	3rd	17.4
7	Ground	18.0
	1st	17.8
	2nd	17.6
8	Ground	17.7
	1st	17.5
	2nd	17.4
9	Ground	17.6
	1st	17.5
	2nd	17.3
10	Ground	17.3
	1st	17.3
	2nd	17.2

5.15 The ADMS model is predicting annual mean PM_{10} concentrations at less than 75% of the 40 µg/m^3 objective at all locations across the Site.

5.16 The number of exceedences of 50 µg/m^3, as a 24-hour mean PM_{10} concentration, has been calculated from the annual mean following the approach set out by DEFRA in LAQM.TG(16):

A = -18.5 + 0.00145 x annual mean3 + (206/annual mean)

where A is the number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration.

5.17 Based on the above approach, the maximum number of days >50 µg/m^3 PM_{10} is predicted to be between 1-4 at all locations within the Site. The objective allows for up to 35 exceedences of the 50 µg/m^3 limit therefore concentrations are not exceeding the 24-hour objective.

5.18 Future occupants of the Site would not be exposed to PM_{10} concentrations above the relevant air quality objectives therefore the impact of the development with regards new exposure to this pollutant is considered to be negligible.

$PM_{2.5}$ Concentrations

5.19 Predicted annual mean $PM_{2.5}$ concentrations predicted at the facades of the building are provided in Table 5.4.

Table 5.4: Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m^3)

Receptor Number	Floor	$PM_{2.5}$ Concentration (µg/m^3)
1	Ground	13.5
	1st	12.6
	2nd	12.0
	3rd	11.7
2	Ground	13.7
	1st	12.7
	2nd	12.0
	3rd	11.7
3	Ground	12.8
	1st	12.4
	2nd	12.0
	3rd	11.8
4	Ground	12.3
	1st	12.1
	2nd	11.9
	3rd	11.7
5	Ground	12.0
	1st	11.9
	2nd	11.8
6	Ground	12.5
	1st	12.2
	2nd	12.0
	3rd	11.7
7	Ground	12.1
	1st	12.0
	2nd	11.8
8	Ground	11.9
	1st	11.8
	2nd	11.7

Receptor Number	Floor	$PM_{2.5}$ Concentration (µg/m^3)
9	Ground	11.9
	1st	11.8
	2nd	11.7
10	Ground	11.7
	1st	11.7
	2nd	11.6

5.20 The ADMS model is predicting annual mean $PM_{2.5}$ concentrations at less than 75% of the 25 µg/m^3 objective at all locations across the Site.

5.21 Future occupants of the Site would not be exposed to $PM_{2.5}$ concentrations above the relevant air quality objectives therefore the impact of the development with regards new exposure to this pollutant is considered to be negligible.

MITIGATION

Construction Phase

5.22 The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

5.23 An overall medium risk of impacts is predicted at adjacent residential properties during construction of the proposed development. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Table 5.2. It is recommended that the 'highly recommended' measures set out in **Appendix E** are incorporated into a DMP and approved by LBRuT prior to commencement of any work on site.

5.24 In addition to the 'recommended' measures, the IAQM guidance also sets out a number of 'desirable' measures which should also be considered for inclusion within the DMP. These are also set out in **Appendix E**.

5.25 Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the proposed development would be negligible.

Operational Phase

5.26 The results of the detailed modelling assessment predict pollutant concentrations are below the relevant objectives at the Proposed Development. No mitigation measures during the operation of the Proposed Development are therefore considered necessary. The Proposed Development is also considered to be air quality neutral.

RESIDUAL EFFECTS

Construction phase

5.27 The greatest potential for dust nuisance problems to occur will generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

5.28 By following the mitigation measures outlined within this appraisal the impact will be substantially minimised. Residual impacts are therefore considered to be negligible.

Operational Phase

5.29 Residual impacts on local air quality are considered to be negligible.

6 CONCLUSIONS

6.1 An air quality impact assessment has been carried out to assess both construction and operational impacts of the proposed development.

6.2 An assessment of the potential impacts during the construction phase has been carried out. This has shown that during this phase of the proposed development releases of dust and PM_{10} are likely to occur during site activities. Through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases may be effectively mitigated and the resultant impacts are considered to be negligible.

6.3 ADMS Roads dispersion modelling has been carried out to the suitability of the Site for its proposed end use with regards to local air quality. Predicted pollutant concentrations at the Proposed Development are below the relevant objective levels. Therefore, the impact of the Proposed Development with regards new exposure to air quality is considered to be negligible. The Proposed Development is also considered to be air quality neutral.

6.4 Based on the above information, it is considered that air quality does not pose a constraint to redevelopment of the Site as proposed

APPENDIX A - AIR QUALITY TERMINOLOGY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m^3 micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

APPENDIX B - AIR QUALITY STANDARDS AND OBJECTIVES

Table B1: Air Quality Standards and Objectives

Pollutant	Standard (µg/m^3)	Averaging Period	No. of Permitted Exceedences
NO_2	200 (a)	1-Hour	18 per annum (99.8th percentile)
	40 (a)	Annual	-
PM_{10}	200 (a)	24-Hour	35 per annum (90.4th percentile)
	50 (a)	Annual	-
$PM_{2.5}$	25 (a)	Annual	-
(a) Air Quality Standards Regulations (2010) (b) EU Directive Limit Value			

APPENDIX C - SUMMARY OF TRAFFIC DATA

Traffic data utilised for the air quality assessment (AADT)

Road Link	Speed (kph)	2019 Base		2021 With Development	
		AADT	% HGV	AADT	% HGV
London Road	35	12901	4.0	12901	4.0
Richmond Road	35	16107	6.6	16107	6.6
Kings Street	35	31047	7.5	30970	7.5
Water Lane	35	1065	0.2	1053	0.3
Wharf Lane (assumed same along The Embankment)	35	779	1.5	802	1.1

APPENDIX D – VERIFICATION AND ADJUSTMENT OF MODELLED CONCENTRATIONS

Nitrogen Dioxide (NO_2)

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

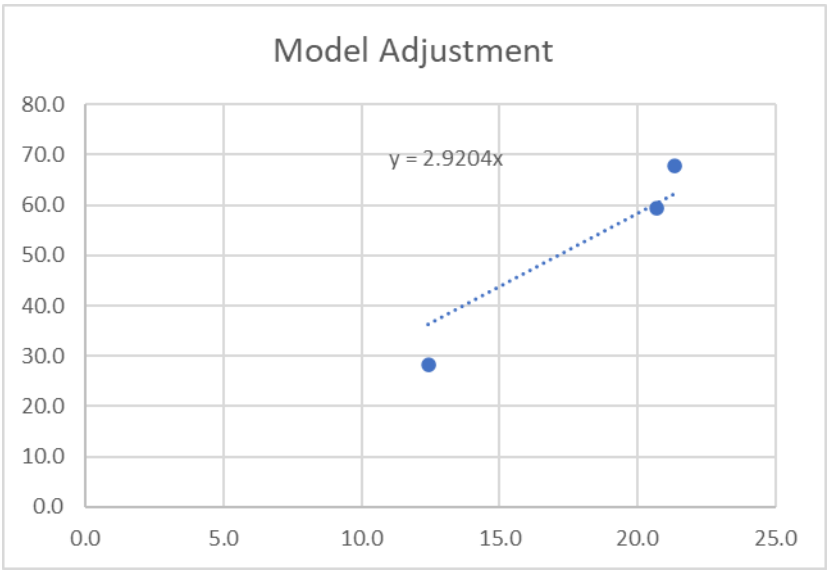
The model has been run to predict annual mean road-NO_x concentrations at three nearby monitoring sites.

The model output of road-NOx (i.e. the component of total NO_x coming from road traffic) has been compared to the 'measured' road-NO_x (Table D1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the Defra NO_x to NO_2 calculator available on the UK-AIR website.

Table D1: Comparison of Modelled and Monitored NOx concentrations

Monitoring Location	Total Monitored NO_2	Background NO2	Monitored Road NOx	Modelled Road NOx	Ratio
15	32.0	18.7	28.4	12.4	2.28
32	47.0	21.6	59.5	20.7	2.88
65	50.0	21.6	67.9	21.4	3.18

Figure D:1 Comparison of Modelled and Monitored Road NOx concentrations



The results in Table D1 and Figure D1 indicate that the ADMS model under-predicted the road NO_x concentrations at the selected monitoring sites. An adjustment factor was therefore determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution (2.92). This factor has then been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the Defra NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration.

Particulate Matter (PM_{10} and $PM_{2.5}$)

There was insufficient roadside monitoring data available against which the modelling could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance provided in LAQM.TG(16).

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG(16) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include root mean square error (RMSE); fractional bias (FB) and correlation coefficient (CC). These parameters estimate how the model results agree or diverge from the observations. The simplest parameter to calculate and to interpret is the RMSE, which has therefore been used in this assessment to understand the model uncertainty.

The RMSE value calculated after verification was 2.3. Guidance provided in LAQM.TG(16) indicates that for RMSE values higher than 25% of the objective level, that the model should be revisited. Ideally an RMSE value should be within 10% of the air quality objective level. For annual mean NO_2, which has an objective level of 40µg/m^3, this equates to 4µg/m^3. The RMSE value calculated for this assessment is therefore considered to fall within the acceptable limits, therefore the final predictions can be considered to be robust.

APPENDIX E – CONSTRUCTION MITIGATION MEASURES

It is recommended that the 'highly recommended' measures set out below are incorporated into a DMP and approved by LBRuT prior to commencement of any work on site:

- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to LBRuT when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary as necessary that are at least as high as any stockpiles;
- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If being re-used on site, cover as detailed below;
- soft strip inside buildings before demolition;
- avoid site runoff of water or mud;
- cover, seed or fence stockpiles to prevent wind whipping;
- 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;

- 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;
- keep site fencing, barriers and scaffolding clean using wet methods;
- avoid scabbling (roughening of concrete surfaces) if possible;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- record all inspections of haul routes and any subsequent action in a site log book;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- record all inspections of haul routes and any subsequent action in a site log book;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud) as required;
- ensure all vehicles switch off engines when stationary - no idling vehicles;
- the use of diesel or petrol powered generators will not be permitted and the use of mains electricity or battery powered equipment will instead be required;
- 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 effective water suppression is used during demolition operations;
- Avoid explosive blasting;
- Bag and remove biological debris or damp down such material before demolition;
- ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and 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;
- bonfires and burning of waste materials will not be permitted at the Site;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit
- the river will be used for deliveries to avoid peak hour delivery periods on the adjacent roads;

- all on-road vehicles will comply with the requirements of the London Low Emissions Zone and the London NRMM standards.