RUGBY FOOTBALL UNION

Air Quality Assessment

Twickenham Stadium – East Stand Extension

July 2016

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RFU

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Contents

1 Introduction

1.1 Overview

Mott MacDonald Ltd has been commissioned by the Rugby Football Union (RFU) to assess the potential impacts on ambient air quality from the proposed extension of the East Stand of Twickenham Stadium, London (hereafter referred to as the 'proposed development'). This report presents the air quality assessment to accompany the planning application for the proposed development.

The proposed development is located in the London Borough of Richmond upon Thames (LBRUT), which was declared an Air Quality Management Area (AQMA) in 2000. This AQMA encompasses the entirety of the LBRUT and was declared due to exceedences of the nitrogen dioxide (NO_2) and particulate matter (PM_{10}) air quality objectives [Ref 1]. The location of the proposed development within the AQMA is presented in Appendix A.

The proposed development comprises minor demolition work/structural alterations at the East Stand of the stadium and construction of a new five storey extension to enhance the corporate and general admission hospitality facilities, comprising new bars, restaurants and other facilities. The capacity of the stadium will not increase and no new car parking spaces will be created. The energy needs of the proposed development will be met by additional capacity at the stadium's existing energy plant and a new combined heat and power (CHP) engine.

In accordance with guidance from the Institute of Air Quality Management (2015) [Ref 2], an air quality assessment is recommended as the proposed development will consist of more than 1,000m^2 of floor space and will have a centralised energy facility. This assessment considers the following key aspects:

- Baseline conditions and whether concentrations of pollutants at the proposed development are likely to be above or below relevant air quality objectives
- Construction phase impacts
- Operational phase impacts

The approach undertaken for this assessment has been agreed with the air quality officer at LBRUT following consultation.

1.2 Key Pollutants

This assessment focusses on nitrogen oxides (NO_x) and particulate matter as these are the pollutants that may be affected by the proposed development. Descriptions of these pollutants are presented in the following subsections.

1.2.1 Nitrogen oxides

Nitrogen oxides is a term used to describe a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2), referred to collectively as NO_x. These are primarily formed from atmospheric and fuel nitrogen as a result of high temperature combustion. The main sources in the UK are road traffic and power generation.

During the process of combustion, atmospheric and fuel nitrogen is partially oxidised via a series of complex reactions to NO. The process is dependent on the temperature, pressure, oxygen concentration

and residence time of the combustion gases in the combustion zone. Most NO_x exhausting from a combustion process is in the form of NO, which is a colourless and tasteless gas. It is readily oxidised to NO_2, a more harmful form of NO_x, by chemical reaction with ozone and other chemicals in the atmosphere. NO_2 is a yellowish-orange to reddish-brown gas with a pungent, irritating odour and is a strong oxidant.

1.2.2 Particulate matter

Particulate matter (PM) is a complex mixture of organic and inorganic substances present in the atmosphere. Sources are numerous and include power stations, other industrial processes, road transport, domestic coal burning and trans-boundary pollution. Secondary particulates, in the form of aerosols, attrition of natural materials and, in coastal areas, the constituents of sea spray, are significant contributors to the overall atmospheric loading of particulates. In urban areas, road traffic is generally the greatest source of fine particulate matter, although localised effects are also associated with construction and demolition activity.

Fine particles are of greatest concern to human health as they can penetrate deeper into the respiratory system. Fine PM is often described in terms of particle size: PM_{10} (particulate matter with a mean aerodynamic diameter of less than 10 microns) and $PM_{2.5}$ (with a diameter less than 2.5 microns). Construction activities can result in temporary effects from dust. ‘Dust’ is a generic term which usually refers to particulate matter in the size range 1-75 microns in diameter; the most common impacts from dust emissions are soiling and increased ambient PM_{10} concentrations [Ref 18].

2 Legislation and Policy

2.1 Introduction

This section summarises the relevant international and national legislation, policy and planning guidance in relation to air quality for the proposed development. In addition, UK regional and local planning policy guidance has been reviewed in order to identify relevant air quality policy implications.

2.2 Legislation

2.2.1 European Union

EU Framework Directive 96/62/EEC [Ref 3] on ambient air quality assessment and management came into force in November 1996 and had to be implemented by Member States by May 1998. This Directive aimed to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants. As a Framework Directive, it required the European Commission to propose 'Daughter' Directives which set air quality limit and target values, alert thresholds and guidance on monitoring and measurement for individual pollutants. The four Daughter Directives are as follows:

- Council Directive 1999/30/EC (the first Daughter Directive) relating to limit values for sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and nitrogen oxides (NO_x), particulate matter (PM_{10}) and lead in ambient air
- Directive 2000/69/EC (the second Daughter Directive) relating to limit values for benzene and carbon monoxide (CO) in ambient air
- Directive 2002/3/EC (the third Daughter Directive) relating to ozone (O_3) in ambient air
- Directive 2004/107/EC (the fourth Daughter Directive) relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Directive 2008/50/EC on ambient air quality and cleaner air for Europe [Ref 4] was adopted in May 2008. This Directive merged the first three existing Daughter Directives and one Council Decision into a single Directive on air quality (it is anticipated that the fourth Daughter Directive will be brought within the new Directive at a later date). It also set new standards and target dates for reducing concentrations of fine particles.

2.2.2 England

2.2.2.1 Air quality

The Air Quality Standards Regulations 2010 [Ref 5] came into force in June 2010; they implement EU Directive 2008/50/EC on ambient air quality.

Part IV of the Environment Act 1995 [Ref 6] requires that every local authority shall periodically carry out a review of air quality within its area, including likely future air quality. As part of this review, the authority must assess whether air quality objectives are being achieved, or likely to be achieved within the relevant periods. Any parts of an authority's area where the objectives are not being achieved, or are not likely to be achieved within the relevant period must be identified and declared as an 'air quality management area'

(AQMA). Once such a declaration has been made, authorities are under a duty to prepare an action plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.

The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in the Air Quality (England) Regulations 2000 [Ref 7] and the Air Quality (England) (Amendment) Regulations 2002 [Ref 8]. In most cases, the air quality objectives are numerically synonymous with the limit values specified in the EU directives although compliance definitions and compliance dates differ.

The Environment Act also requires that the UK Government produces a national 'air quality strategy' (AQS) containing standards, objectives and measures for improving ambient air quality and to keep these policies under review. Further details of the AQS are presented in Section 2.4.

2.2.2.2 Statutory nuisance

Section 79(1)(d) of the Environmental Protection Act 1990 [Ref 9] defines one type of 'statutory nuisance' as "*any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*". Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. However, it is a defence if an operator employs the best practicable means to prevent or to counteract the effects of the nuisance.

2.3 Policy

2.3.1 National policy

2.3.1.1 UK Air Quality Strategy

As described above, the Environment Act 1995 requires the UK Government to produce a national AQS. The AQS establishes the UK framework for air quality improvements. Measures agreed at the national and international level are the foundations on which the strategy is based. The first Air Quality Strategy was adopted in 1997 [Ref 9] and replaced by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000 [Ref 10]. The 2000 Strategy was replaced by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 [Ref 12].

The Environment Act 1995 requires that the Environment Agency has regard to the AQS in exercising its pollution control functions. Local authorities are also required to work towards the strategy's objectives prescribed in regulations for that purpose.

The air quality objectives in the AQS are a statement of policy intentions and policy targets. As such, there is no legal requirement to meet these objectives except in as far as they mirror any equivalent legally binding limit values in EU directives and English regulations.

2.3.1.2 National Planning Policy Framework

The National Planning Policy Framework [Ref 13] sets out government planning policies for England. With regard to air quality it states that:

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

And:

"Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.3.1.3 National Planning Practice Guidance

On 6 March 2014, the Department for Communities and Local Government (DCLG) published a national planning practice guidance web-based resource [Ref 14].

The National Planning Practice Guidance includes a dedicated section on air quality. It notes that, for new planning applications, the local planning authority may want to know about:

- "*The 'baseline' local air quality;*
- *Whether the proposed development could significantly change air quality during the construction and operational phases; and/or*
- *Whether there is likely to be a significant increase in the number of people exposed to a problem with air quality, such as when new residential properties are proposed in an area known to experience poor air quality.*"

It also states the following in relation to determining whether air quality is relevant to a planning decision:

"*Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).*" [Ref 15]

2.3.2 Regional planning policy

2.3.2.1 The Mayor of London's Air Quality Strategy

The Mayor of London's Air Quality Strategy [Ref 16] was published in December 2010, the aim of which is to "*reduce air pollution in London so that the health of Londoners is improved*". The strategy proposes a number of new measures to help achieve EU and national air quality objectives by:

- Reducing emissions from transport – by encouraging smarter choices and sustainable travel behaviour, using emission control schemes, promoting technological change and cleaner vehicles, and reducing emissions from public transport.

- Targeting air quality priority locations – by adopting local measures and trialling new processes e.g. using dust suppressants.
- Reducing emissions from homes, business and industry – through energy efficiency schemes, use of the planning system and updating and implementing best practice on construction and demolition.
- Increasing awareness of air quality issues – by improving access to information on poor air quality and directing information to those most at risk.

The strategy also details measures to improve air quality that are already underway, such as the London Low Emission Zone (LEZ), the London Permit Scheme, London Congestion Charging and implementation of Best Practice Guidance for construction and demolition.

2.3.2.2 The London Plan

The spatial development strategy for London, known as the London Plan, addresses the spatial implications of the Mayor's Air Quality Strategy. In 2011, the Greater London Authority (GLA) and Mayor of London published the London Plan 2011, which replaces the previous London Plan of 2008. In March 2015, the London Plan was updated to include alterations to the London Plan since 2011 [Ref 17] and in March 2016, two Minor Alterations to the London Plan (MALPs) were published on Housing and Parking Standards. This is the overarching strategic plan for London, providing an integrated framework for economic, environmental, social and transport development up to the year 2036. It forms part of the wider development context for Greater London and provides the framework to which local authorities' planning policies and decisions must conform.

Policy 7.14 ("Improving Air Quality") of the London Plan 2011 states that development proposals should:

- 'Minimise increased exposure to existing poor air quality and make provision to address local problems of air quality...such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans.
- Promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' "The control of dust and emissions from construction and demolition".
- Be at least "air quality neutral" and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)).
- Ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches.

2.3.2.3 Supplementary Planning Guidance

To help meet the policies stated within the London Plan, various Supplementary Planning Guidance documents (SPGs) have been produced by the Mayor of London. These guidance documents provide additional guidance to support statutory development plans. From an air quality perspective, the two most relevant SPGs are:

- The Control of Dust and Emissions during Construction and Demolition (July 2014), and;

- Sustainable Design and Construction (April 2014).
  The SPG on Control of Dust and Emissions during Construction and Demolition [Ref 17] provides guidance on preparing an Air Quality Statement for construction and demolition activities, including air quality (dust) risk assessments;

The SPG on Sustainable Construction and Design [Ref 19] contains a section which provides guidance on the management of air pollution, including:

- Requirements for air quality assessments
- Location and transport measures to minimise emissions to air
- Emission standards for combustion plants
- Off-setting provisions.

2.3.2.4 The Mayor's Transport Strategy

The Mayor's Transport Strategy (MTS) was developed jointly with the London Plan and sets out policies and measures for the development of London's transport infrastructure [Ref 20]. As part of the strategy to enhance the quality of life for all Londoners, it aims to promote improvements in air quality, by "*reducing air pollutant emissions from ground-based transport, contributing to EU air quality targets*" while enabling economic, social and environmental development. The MTS recognises that air quality in London is the worst in the country and supports many of the policies included in the Air Quality Strategy, such as the expansion of Low Emission Zones and improvements to bus and taxi fleets.

2.3.3 Local planning policy

1.2.2.1 Second Local Implementation Plan (2011-2014)

The Second Local Implementation Plan (LIP2) details how the MTS will be implemented in LBRUT and outlines specific transport objectives and a programme of investment for the Borough. The LIP2 focuses on the period between 2011 and 2014 and beyond to 2031 to reflect the timeframe of the MTS [Ref 21]. The Plan also sets out current LBRUT Council thinking on transport priorities, policies and programmes. The desire to reduce air pollution in the Borough underpins several objectives and interventions detailed within the strategy, with Local, Regional and National Policy (as detailed above) feeding into LIP2. Specifically, Objective 2 of LIP2 is "*to improve the local environment and quality life for all residents of the Borough*". Within this Objective, LBRUT Council has identified the importance of improving air quality within the Borough to "*enhance quality of life in Richmond and London as a whole*". As such, several interventions related to air quality have been suggested to help achieve the objectives detailed in LIP2, such as:

- "*Opportunities … to improve accessibility and permeability of public spaces for walking, cycling and public transport*
- *Support Cycle Hire schemes*
- *Ongoing programme of Borough wide pollution monitoring*"

2.3.3.1 LBRUT Local Development Framework

The LBRUT Local Development Framework sets out the development priorities for the Borough. Within this Framework, the Core Strategy (published in 2009) details the vision and spatial strategy for the Borough over the next 15 years [Ref 22]. Specifically, one of the key objectives within the Core Strategy is to reduce "*levels of air pollution, particularly from road traffic along major roads and aircraft noise from Heathrow*" which feeds into Borough wide environmental objectives. The Core Strategy is currently undergoing a process of review to draft a Local Plan which is planned to be available for formal consultation in late spring/early summer 2016.

The LBRUT Development Management Plan (DMP) is a Development Plan Document within the Local Development Framework which builds upon the Core Strategy and provides more detailed policies for the control of development. The DMP policies, adopted in November 2011, follow the themes of "For a Sustainable Future; Protecting Local Character; and Meeting People's Needs". Within this are several policies aimed at reducing air pollution, such Policy DM DC 4 (the protection and enhancement of trees and landscapes in the borough) and Policy DM SD 5 (incorporation of living roofs into new developments).

The Local Development Framework also includes the Twickenham Area Action Plan, which was adopted July 2013 [Ref 23]. This Action Plan, which focusses on the commercial town centre of Twickenham, provides a framework to revitalise the town centre, in part through environmental improvements. In addition to Twickenham complying with the policies outlined in the Core Strategy, the Twickenham Area Action Plan outlines principles for environmental improvements, including ensuring "*that all new developments, environmental and transport improvements are designed to be sustainable*".

2.3.3.2 LBRUT Community Plan 2007-2017

The LBRUT Community Plan presents the vision of the Borough between 2007 and 2017, as developed through local public consultation [Ref 24]. The plan highlights seven priorities for the Borough, Priority two of which is to be "*the greenest borough in London*". As such, the Plan details a number of aims which, if achieved, will meet the priority of becoming the greenest borough in London. One of these aims is "to promote sustainable forms of transport and to reduce the levels of air pollution and other environmental impacts resulting from road transport".

2.3.3.3 LBRUT Air Quality Action Plan

The 2002 Air Quality Action Plan for LBRUT outlines policy context, key actions to improve air quality in the Borough, air pollution hotspots and actions to help implement the Action Plan [Ref 25]. The updated 2012-2013 AQAP progress report [Ref 26] identified 33 Action Plan measures, divided into London-wide, Borough-wide and local measures which will help the Borough to comply with EU and National Air Quality Objectives. These recommended Action Plan measures are based upon a set of eleven guiding principles, as identified in the 2002 AQAP. The most important of these guiding principles in the context of this air quality assessment are highlighted below:

- "*Richmond upon Thames Council will discourage new activity where there is clear evidence that the activity will lead to a significant increase in air pollution*

- *Richmond upon Thames Council will act in partnership with others in the delivery of actions set out in this plan*"

In accordance with meeting these guiding principles, the LBRUT Council encourages building contractors to sign up to the 'The Considerate Constructors Scheme'. This national initiative seeks "to improve the image of the construction industry by striving to promote and achieve best practice". By signing up to the Scheme's Code of Considerate Practice, constructors should, among other things, protect and enhance the environment by minimising the impact of air pollution [Ref 27].

2.4 Summary

This Section has identified the legislation and policy framework relevant to the assessment. On the basis of the above, applicable numerical objectives are summarised in Table 2.1. It should be noted that the air quality objectives only apply in locations of relevant exposure i.e. where members of the public might reasonably be exposed to pollutants for the respective averaging periods. Table 2.2 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment.

Table 2.1: Relevant air quality objectives

Pollutant	Averaging period	Air quality objectives		Attainment date
		Concentration	Allowance	
Nitrogen dioxide (NO_2)	1 hour	200µg/m^3	18 per calendar year[e]	31 December 2005[a][b] 1 January 2010[c]
	Annual	40µg/m^3	-	31 December 2005[a][b] 1 January 2010[c][d]
Particulates (PM_{10})	24 hour	50µg/m^3	35 per calendar year[f]	31 December 2004[a][b] 1 January 2005[c]
	Annual	40µg/m^3	-	31 December 2004[a][b] 1 January 2005[c][d]
Particulates ($PM_{2.5}$)	Annual	25µg/m^3	-	2020[b][g]2010[c][h]

Notes:
[a] Air Quality (England) Regulations 2000 as amended.
[b] Air Quality Strategy 2007.
[c] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010.
[d] Derogations (time extensions) to 1 January 2015 were agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations. In March 2011, the Commission agreed the UK's revised application for a time extension for meeting the daily PM_{10} limit value, granting a "temporary and conditional exemption" for the Greater London urban area.
[e] Can be expressed as the 99.79th percentile of 1 hour means.
[f] Can be expressed as the 90.41st percentile of 24 hour means.
[g] Also a 'Target' of 15% reduction in annual mean concentrations at urban background between 2010 and 2020.
[h] Also a 'Target' of 20% reduction in annual mean concentrations at urban background between 2010 and 2020.

Table 2.2: Locations where the air quality objectives apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes 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. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24 hour	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
1 hour	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, 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 expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: [Ref 28]

3 Methodology

3.1 Introduction

This section summarises the methods used to determine the impact of the proposed development on local air quality during the construction and operational phases.

3.2 Construction phase

3.2.1 Construction dust

Guidance from the Institute of Air Quality Management (IAQM) [Ref 29] and Mayor of London SPG [Ref 17] recommends splitting the construction phase into four separate source categories and determining the dust risk associated with each of those sources individually. This assessment has determined the risk of each of the following source categories:

- Demolition[1]
- Earthworks
- Construction
- Trackout (the transport of dust and dirt onto the public road network).

The risk of each source for dust effects is described as 'negligible', 'low risk', 'medium risk' or 'high risk' depending on the nature and scale of the construction activities and the proximity of sensitive receptors to the construction site boundary. The assessment is used to define appropriate mitigation measures to reduce the level of effects such that they are not significant.

The assessment considers three separate effects from dust:

- Annoyance due to dust soiling
- Harm to ecological receptors/the natural environment
- The risk of health effects due to significant increase in exposure to PM_{10} and $PM_{2.5}$.

Step 1 of the assessment applies screening criteria to the proposed development which states that an assessment will normally be required where there is:

- A ‘human receptor’ within:
  - 350m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- An ‘ecological receptor’ within:
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

No further assessment is required if there are no receptors within the defined boundaries.

[1] As defined in the IAQM Construction Dust Guidance as “Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time.”

Step 2A of the assessment is to determine the overall dust-raising magnitude (small, medium or large) from each of the dust sources identified (demolition, earthworks, construction and trackout) in accordance with the criteria outlined in Table B.1 in Appendix B.

Step 2B of the assessment is to define the sensitivity of the area (as high, medium or low) in accordance with the criteria presented within Table B.2 in Appendix B.

The sensitivity takes account of a number of factors:

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

The receptor sensitivity has been based on the highest of any of the criteria being met and therefore the assessment is considered robust. The sensitivity of the area is further determined for dust soiling, human health and ecosystem impacts by considering the criteria in Table B.3, Table B.4 and Table B.5 in Appendix B respectively. Criteria presented in these tables are based on the distance of the source to the closest receptors.

The final step of the assessment (Step 2C) takes the dust raising magnitude identified for each of the dust sources and the sensitivity of the area to determine the overall risk category of effects on annoyance due to dust soiling, harm to ecological receptors and the risk of health effects due to an increase in exposure to PM_{10}. The criteria for each of the dust sources have been presented within Table B.6, Table B.7, Table B.8 and Table B.9 in Appendix B respectively, determining the mitigation measures appropriate for the assessment.

3.2.2 Construction plant

Construction work requires the use of a range of site plant, such as cranes and on site generators. All of these plants have an energy demand and some may result in direct emissions to air from exhausts.

Guidance from the IAQM [Ref 29] notes that impacts from exhaust emissions from on-site plant are unlikely to be significant. Given the local and temporary nature of site plant, effects of plant emissions on local air quality are considered to be of negligible significance relative to the surrounding road traffic contributions on the local road network. Construction plant emissions have therefore not been assessed further. Nevertheless, mitigation measures to reduce the effect of site plant on local air quality are discussed in Section 6.

3.2.3 Construction traffic

The latest IAQM/ Environmental Protection UK (EPUK) Land Use Planning & Development Control document [Ref 2] does not provide guidance on when emissions from construction vehicles should be considered. However the IAQM guidance on assessing impacts from construction and demolition [Ref 29] recommends that the EPUK 2010 guidance on ‘Development Control: Planning for Air Quality’ [Ref 30]

should be adopted to assess construction traffic emissions. According to the EPUK 2010 guidance, an assessment of construction traffic emissions is only likely to be required for large, long-term construction sites that will generate Heavy Goods Vehicle (HGV) movements of over 200 per day over a period of a year or more.

Construction traffic flows are predicted to be well below 200 movements per day and have therefore not been considered further.

3.3 Operational phase

3.3.1 Traffic impacts

Guidance from IAQM [Ref 2] indicates that a change in the annual average daily traffic (AADT) of 100 light duty vehicles (LDVs) or 25 heavy duty vehicles (HDVs) within an AQMA could be considered a significant change and should be assessed. Following consultation with the transport planning consultant for the proposed development, Momentum Transport Planning, it is understood that the East Stand extension will not result in a material increase in the number of trips by car on match-days as the capacity of the stadium will not increase and no new car parking facilities will be created. The creation of vehicle trips associated with non-match day events (such as conferences) was determined based on the capacity of the new facilities and assumptions on the likely modal split of those arriving at the stadium; the potential traffic impacts were shown to be well below the IAQM criteria. On this basis, operational traffic increases from the proposed development are unlikely to have an impact on local air quality and have not been assessed further. This approach was discussed and agreed with LBRUT's air quality officer in May 2016.

3.3.2 Energy plant

The East Stand extension's energy requirements will be met by a new CHP engine and the use of additional capacity at the stadium's existing energy plant.

The CHP engine will have a thermal output of approximately 80kW and will be gas-fired with an ultra-low NO_x design. The CHP will be installed at roof level in the south plant room of the East Stand extension; the CHP flue will be approximately 1m high above roof level and 250mm in diameter2.

The CHP will comply with the emission limits set out by the IAQM/EPUK [Ref2] and the Mayor of London's Sustainable Design and Construction Supplementary Planning Guidance [Ref 19] as well as any additional requirements that LBRUT may recommend. The location of the CHP and in particular the height and location of the flue with respect to surrounding buildings will be situated appropriately to avoid adverse effects on dispersion. On this basis, the impact of the CHP on ambient air quality at the proposed development site is expected to be negligible and therefore not significant. These impacts have therefore not been considered further although appropriate mitigation is presented in Section 6.

[2] Refer to architect's elevation drawing and roof plans for further details.

4 Baseline conditions

1.3 Introduction

Information on air quality in the UK is available from a variety of sources including Local Authorities, national network monitoring sites and other published sources. The key sources reviewed in this assessment are from LBRUT Council and Defra.

This baseline analysis examines the existing conditions at the proposed development based on available automatic and non-automatic data of roadside and background monitoring sites as well as the average background concentration for the site according to the Defra background maps [Ref 30].

For the purposes of this assessment, only concentrations of NO_2 and PM_{10} and are considered as these are the key pollutants of relevance to the proposed development.

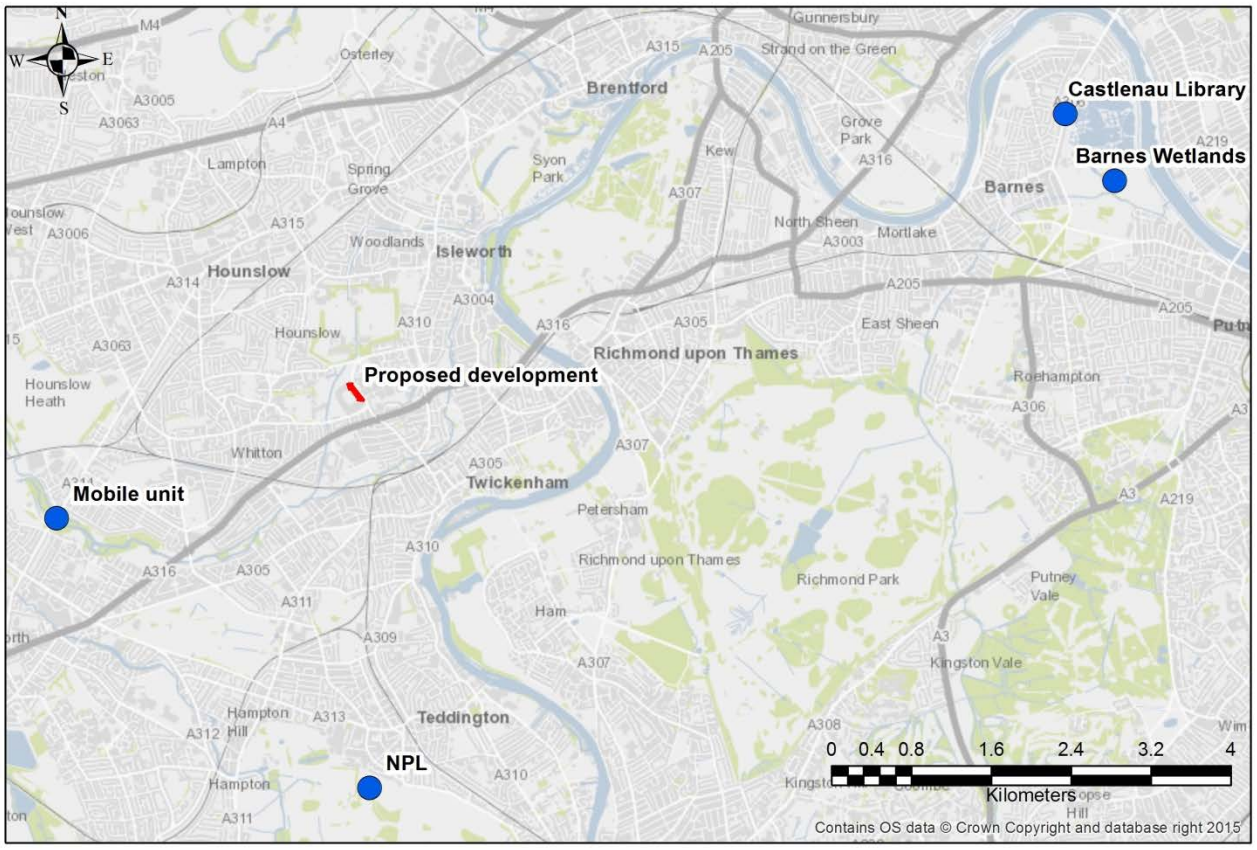
1.4 Monitoring Data

1.4.1 Automatic monitoring

Air quality in LBRUT is monitored at three stationary automatic monitoring sites: Castelnau Library (roadside), Barnes Wetlands Centre (suburban) and the National Physical Laboratory (NPL) Teddington (suburban). The monitoring site at NPL is part of the UK Automatic Urban and Rural Network (AURN). All these sites monitor NO_2, while PM_{10} is also measured at Castelnau Library and Barnes Wetlands Centre. There is an additional automatic monitoring site in the form of a Mobile Air Quality Unit which measures NO_2 and PM_{10}, predominately at roadside locations across Richmond upon Thames. Between March 2012 and March 2015, this unit resided at Hanworth Road, Whitton (a roadside site). Since then, the monitoring site has been moved to three different sites. Consequently, no annual monitoring data is available for 2015 for this station.

The specific locations of these automatic monitoring sites in relation to the proposed development site are shown in Figure 4.1 while the recorded pollutant concentrations from the past three years are provided in Table 4.1.

Figure 4.1: Locations of automatic monitoring sites in LBRUT



The Hanworth Road mobile monitoring site is located approximately 3.2 kilometres west of the proposed development. Prior to this site moving in 2015, this site reported exceedences of the annual NO_2 air quality objective of 40µg/m^3 in both 2013 and 2014 although the one hour NO_2 objective was met. PM_{10} concentrations at this site were well below the respective annual and 24-hour PM_{10} air quality objective.

The Castlenau Library roadside monitoring site is located approximately 7.6 kilometres north east of the proposed development. For the past three years, the annual mean PM_{10} and NO_2 concentrations at this site have been below their associated annual air quality objectives, although annual mean NO_2 concentrations in 2013 and 2014 were close to the limit value of 40µg/m^3. In the past three years relevant short term objectives at these locations have been met.

The suburban automatic monitoring sites at Barnes Wetlands Centre and NPL Teddington are located 7.8 kilometres northeast and 3.9 kilometres south of the proposed development respectively. Both these sites have recorded mean PM_{10} and NO_2 concentrations which are either below or well below their respective annual and short term air quality objectives.

Table 4.1: Annual automatic monitoring sites results

Site name	Site type	X	Y	Pollutant	Annual mean concentration (µg/m^3)[a]			Distance from site (km)
					2013	2014	2015	
Castelnau Library	Roadside	522500	177165	NO_2	39	37	34	7.6
				PM_{10}	22	20	21	
Barnes Wetlands Centre	Suburban	522991	176495	NO_2	25	24	23	7.8
				PM_{10}	20	18	17	
NPL Teddington	Suburban	515542	170420	NO_2	21	27	19	3.9
Mobile Air Quality Unit (Hanworth Road)	Roadside	512600	173404	NO_2	**43**	**42**	**-**	3.2
				PM_{10}	25	23	-	

Source: LBRUT Council, 2015 [Ref 32], LAQN [Ref 33], UK-AIR [Ref 34]
All locations achieved a data capture rate >75%

Table 4.2: Hourly automatic NO_2 monitoring sites results

Site name	Site type	X	Y	Pollutant	Number of hours NO_2 concentrations were >200 µg/m^3			Distance from site (km)
					2013	2014	2015	
Castelnau Library	Roadside	522500	177165	NO_2	2	0	0	7.6
Barnes Wetlands Centre	Suburban	522991	176495	NO_2	0	0	0	7.8
NPL Teddington	Suburban	515542	170420	NO_2	0	0	0	3.9
Mobile Air Quality Unit (Hanworth Road)	Roadside	512600	173404	NO_2	2	0	**-**	3.2

Source: LBRUT Council, 2015 [Ref 32], LAQN [Ref 33], UK-AIR [Ref 34]
All locations achieved a data capture rate >75%
Number of hourly mean NO_2 concentrations greater than 200 µg/m^3 (allowed per year = 18)

Table 4.3: Daily automatic PM_{10} monitoring sites results

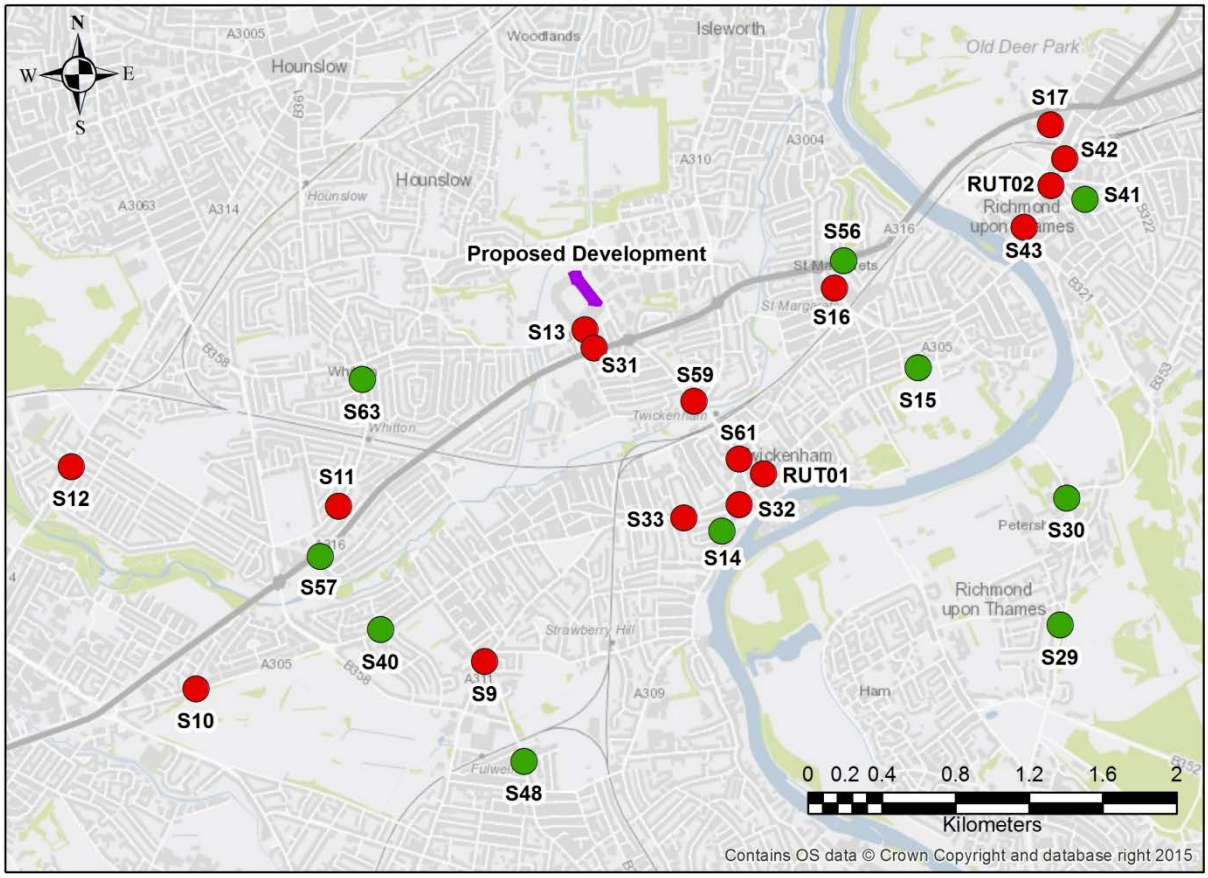
Site name	Site type	X	Y	Pollutant	Number of days PM_{10} concentrations were >50 µg/m^3			Distance from site (km)
					2013	2014	2015	
Castelnau Library	Roadside	522500	177165	PM_{10}	10	4	7	7.6
Barnes Wetlands Centre	Suburban	522991	176495	PM_{10}	6	3	3	7.8
Mobile Air Quality Unit (Hanworth Road)	Roadside	512600	173404	PM_{10}	8	6	-	3.2

Source: LBRUT Council, 2015 [Ref 32], LAQN [Ref 33], UK-AIR [Ref 34]
All locations achieved a data capture rate >75%
Number of 24 hour mean PM_{10} concentrations greater than 50µg/m^3(allowed per year = 35)

1.4.2 Non-automatic monitoring

LBRUT Council conducts extensive non-automatic monitoring for NO_2 using diffusion tubes. In 2015, there was a total of 62 diffusion tube sites across the city, the majority of which are at kerbside locations. For the purpose of this assessment, only monitoring locations within three kilometres of the proposed development were considered to represent baseline NO_2 concentrations at the proposed development and it should be noted that none of these locations are described as representative of background locations. The locations of these monitoring sites in relation to the proposed development are shown in Figure 4.2, while the non-automatic monitoring data collected by LBRUT council is presented in Table 4.2.

Figure 4.2: Non-automatic monitoring locations



N.B. Monitoring sites exceeding the annual NO_2 objective in 2015 are highlighted in red, those complying with the annual objective in 2015 are in green

Between 2013 and 2015, the majority of monitoring locations in LBRUT within three kilometres of the proposed development experienced declines in annual mean NO_2 concentrations, yet the concentrations for 2015 are below average so may not reflect long term NO_2 trends for the Borough. Nonetheless, in 2015 sixteen out of the twenty-six non-automatic monitoring sites within three kilometres of the proposed development recorded annual mean NO_2 concentrations which exceeded the annual air quality objective of 40µg/m^3. Of these sixteen sites, two recorded annual mean NO_2 concentrations which were double that of

the annual NO_2 air quality objective of 40µg/m^3. The monitoring sites closest to the proposed development, S13 and S31, recorded mean NO_2 concentrations which exceeded the annual air quality objective in all three years.

Table 4.2: Non-automatic monitoring sites results

Site Name	Site type	X	Y	Annual mean NO_2 concentration (µg/m^3)			Distance from site (km)
				2013 (bias adjustment factor = 0.96)	2014 (bias adjustment factor = 0.97)	2015 (bias adjustment factor = 0.92)	
S9	Kerbside	514842	172346	**49**	**48**	**42**	2.0 (SW)
S10	Kerbside	513278	172199	**46**	**47**	**43**	3.0 (SW)
S11	Kerbside	514050	173189	**49**	**48**	**44**	1.7 (SW)
S12	Kerbside	512600	173404	**49**	**46**	**41**	3.0(SW)
S13	Kerbside	515387	174146	**48**	**47**	**42**	0.1 (SW)
S14	Kerbside	516133	173051	**46**	**45**	39	1.4 (SE)
S15	Kerbside	517197	173939	**40**	**40**	37	1.9 (SE)
S16	Kerbside	516742	174373	**44**	**43**	**41**	1.3 (E)
S17	Kerbside	517916	175257	**68**	**68**	**63**	2.7 (NE)
S29	Kerbside	517967	172543	39	36	30	3.0 (SE)
S30	Roadside	518003	173233	38	34	29	2.7 (SE)
S31	Roadside	515438	174048	**61**	**62**	**54**	0.2 (S)
S32	Kerbside	516226	173195	**74**	**73**	**62**	1.3 (SE)
S33	Kerbside	515927	173129	**62**	**69**	**61**	1.2 (S)
S40	Kerbside	514278	172521	**41**	**40**	36	2.1 (SW)
S41	Kerbside	518102	174854	**42**	**41**	38	2.7 (E)
S42	Kerbside	517991	175075	**58**	**54**	**47**	2.7 (NE)
S43	Kerbside	517771	174701	**87**	**80**	**80**	2.3 (E)
S48	Kerbside	515059	171805	**45**	**45**	39	2.5 (S)
S56	Roadside	516791	174521	**46**	38	37	1.3 (E)
S57	Kerbside	513953	172915	39	36	33	2.0 (SW)
S59	Kerbside	515980	173758	**46**	**42**	**40**	0.7 (SE)
S61	Roadside	516224	173444	**58**	**54**	**48**	1.1 (SE)
S63	Kerbside	514181	173875	**43**	**42**	38	1.3 (W)
RUT01	Roadside	516356	173365	**60**	**62**	**45**	1.3 (SE)
RUT02	Kerbside	517917	174928	**94**	**96**	**88**	2.6 (NE)

Source: LBRUT, 2015 [Ref 32]

1.5 Defra background maps

Defra provides estimates of background pollutant concentrations for NO_X, NO_2, PM_{10} and $PM_{2.5}$ across the UK for each one kilometre grid square for every year from 2011 to 2030. Future year projections have been developed on the base year for the background maps, which is currently the year 2011. The maps

include a breakdown of background concentrations by emission source, including road and industrial sources which have been calibrated against 2011 UK monitoring data.

The 2011 reference year background maps are based on monitoring and meteorological data for 2011 which have been produced to include the most current information available on emissions from Euro 5 and Euro 6 Light Duty Vehicles (LDV) [Ref 30].

Background concentrations attributed to the grid square of the proposed development for 2016 are presented in Table 4.3. Overall, the background NO_2, PM_{10} and $PM_{2.5}$ concentrations at the proposed development for 2016 are well below their respective annual air quality objectives.

Table 4.3: Projected background concentrations at proposed development site

Pollutant	Concentration (µg/m^3) 2016
NO_2	24.6
NO_x	37.3
PM_{10}	29.6
$PM_{2.5}$	13.7

Source: Defra AIR [Ref 30]

Notes: Derived from data relating to Ordinance Survey Grid Square 514500, 173500

1.6 Summary

Recorded concentrations of PM_{10} across LBRUT comply with the PM_{10} short and long term air quality objectives. Hourly NO_2 concentrations recorded in LBRUT are also below the respective short term air quality. However, a large number of exceedences of the annual NO_2 objective were recorded at non-automatic monitoring locations. Exceedences of this air quality objective were also recorded at the automatic NO_2 monitoring site closest to the proposed development in 2013 and 2014. The baseline monitoring indicates that pollutant concentrations are generally elevated at roadside locations and are above the annual mean NO_2 air quality objectives.

5 Predicted impacts

5.1 Introduction

This Section provides details of the likely impacts predicted to occur as a result of construction and operation of the proposed development.

5.2 Construction phase impacts

Potential significant dust emissions from the proposed development will only occur during the construction phase; therefore, all impacts from construction dust emissions are described as being temporary and pre construction conditions will be returned when the construction phase is complete.

Magnitude and sensitivity descriptors that have been applied to assess the overall impact of the construction phase are presented in Appendix B.

For the purpose of this assessment, the construction site has been split into two different zones – the East Stand construction zone and the contractor's compound zone. The construction phase impacts for these two zones have been examined separately as each zone will have different construction activities associated with them and different proximities to receptors. This is in accordance with IAQM guidance [Ref 29] which states that "the site can be divided into 'zones' for the dust risk assessment… where different parts of a large site are different distances from the nearest receptors".

5.2.1 East stand construction zone

Table 5.1 presents the overall dust emission magnitude of the East stand construction zone. A 'medium' dust emission magnitude is predicted for construction. Demolition and earthworks are predicted to have a 'small' magnitude. Construction dust emissions associated with trackout have been scoped out of this section of the dust assessment as none of the haulage roads from the East stand construction zone entrance will be on a public highway (as the HDVs will travel through the Contractor's compound zone) and all roads will be paved. The effect of track out has therefore been deemed as 'not applicable' as the IAQM and Mayor of London guidance only applies to trackout from unpaved roads on a public highway.

Table 5.1: Dust emission magnitude

Activity	Dust emission magnitude	Justification
Demolition[3]	Small	Total building volume to be demolished <20,000m^3, demolition activities <10m above ground level.
Earthworks	Small	Total site area <2,500m^2, <5 heavy earth moving vehicles at a time, material moved <20,000 tonnes.
Construction	Medium	Total building volume 25,000m^3-100,000m^3.
Trackout	N/A	Paved roads (asphalt site surface material) through the contractors' compound zone (which is off the public highway)

3 As defined in the IAQM Construction Dust Guidance as "Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time."

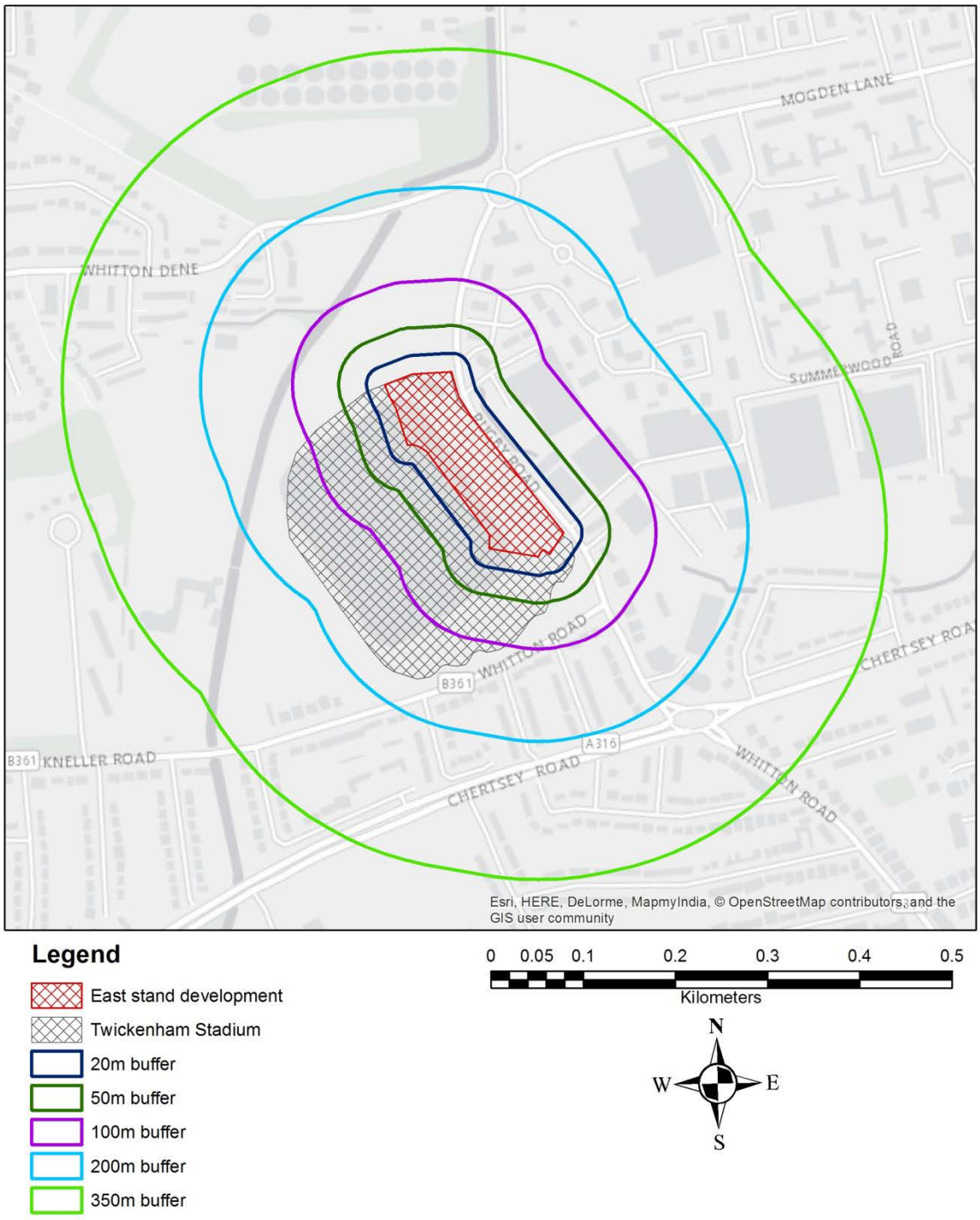
Figure 5.1 and Table 5.2 present the sensitivity of this zone to effects caused by construction activities, which is based on the criteria presented in Table B.1, Table B.2 and Table B.3 within Appendix B. As there are no international, national or local ecological designations (e.g. Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSI) or Local Nature Reserves) or dust-sensitive vegetation within 50m of the site boundary, the sensitivity of ecological receptors to construction dust is 'not applicable'. The nearest ecologically sensitive receptor to the site, the Duke of Northumberland's River, is approximately 90m north-west of the proposed site boundary.

Table 5.2: Area sensitivity

Effect	Area sensitivity	Comment
Dust soiling	Medium	There are 10-100 residential properties within 50 metres of the site boundary.
PM_{10} effects	Medium	Background PM_{10} concentrations between 28-32µg/m^3. 10-100 residential properties within 50 metres of the site boundary.
Ecological effects	N/A	No ecological receptors within 50m of the site boundary.

Notes: The area sensitivities stated above apply to demolition, earthworks and construction activities

Figure 5.1: Dust assessment buffers for the East stand construction zone



The overall risk of receptors to dust soiling effects and PM_{10} effects from the East stand construction zone are presented in Table 5.3. Risk is based on the criteria presented in Table B.4 to Table B.9 within Appendix B.

Table 5.3: Summary of the risk of construction effects

Activity	Dust soiling effects	PM_{10} health effects
Demolition	Low risk	Low risk
Earthworks	Low risk	Low risk
Construction	Medium risk	Medium risk
Trackout	N/a	N/a

As Table 5.3 shows, the greatest risk from dust soiling and PM_{10} effects in the East stand construction zone is during construction, where the risk for both effects is 'medium'. Dust soiling and PM_{10} effects for demolition and earthworks are 'low risk'.

5.2.2 Contractors' compound zone

The contractors' compound zone will be located to the north of the stadium in an area currently used for car parking by RFU. This zone will comprise an RFU staffing area, contractors' compound and a delivery holding area in which HDVs can wait prior to accessing the East Stand construction zone or exiting the site onto the public highway, in order to reduce congestion on access roads. When events are held at the stadium during the East Stand extension construction phase, construction plant may be relocated from the East Stand construction zone to the delivery holding area for temporary storage. Further details are provided in the Construction Management Plan.

Table 5.4 presents the overall dust emission magnitude of the contractors' compound zone. Dust emitting activities are only expected to occur within the delivery holding area and on-site access roads, as shown in Figure 5.2 and Figure 5.3. Earthworks and trackout are predicted to have a 'small' magnitude. Dust emissions associated with construction and demolition have been scoped out of this section of the dust assessment as these activities will not occur within this zone.

Table 5.4: Dust emission magnitude

Activity	Dust emission magnitude	Justification
Demolition	N/A	No demolition to take place in this zone.
Earthworks	Small	<5 heavy earth moving vehicles at a time, material moved <20,000 tonnes along the site roads within this zone
Construction	N/A	No construction to take place in this zone.
Trackout	Small	Asphalt road surface, <10 HDV movements a day, <50m unpaved road length

Figure 5.2, Figure 5.3 and Table 5.5 present the sensitivity of this zone to effects caused by earthworks and trackout, which is based on the criteria presented in Table B.1, Table B.2 and Table B.3 within Appendix B.

Table 5.5: Area sensitivity

Activity	Effect	Area sensitivity	Comment
Earthworks	Dust soiling	Medium	There are 10-100 residential properties within 50 metres of the site boundary.
	PM_{10} effects	Medium	Background PM_{10} concentrations between 28-32µg/m^3. 10-100 residential properties within 50 metres of the site boundary.
	Ecological effects	Low	The Duke of Northumberland's River (a sensitive ecological receptor) is located less than 20m from the site boundary.
Trackout	Dust soiling	High	There are 10-100 residential properties within 20 metres of the routes used by construction vehicles on the public highway.
	PM_{10} effects	High	Background PM_{10} concentrations between 28-32µg/m^3. 10-100 residential properties within 20 metres of the routes used by construction vehicles on the public highway
	Ecological effects	Low	The Duke of Northumberland's River (a sensitive ecological receptor) is located less than 20m from the site boundary.

Figure 5.2: Dust assessment boundaries for the contractors' compound zone (earthworks buffers only)

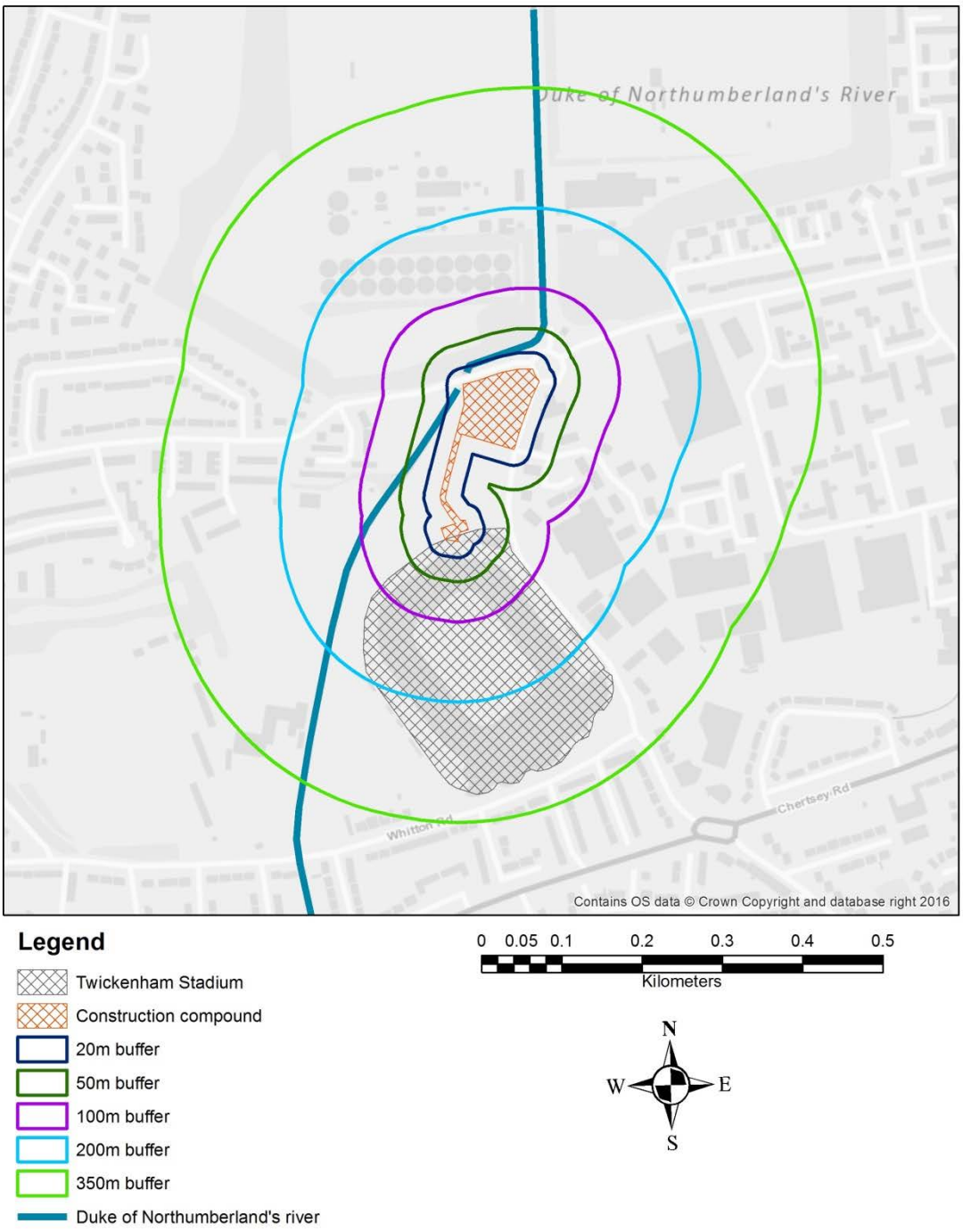
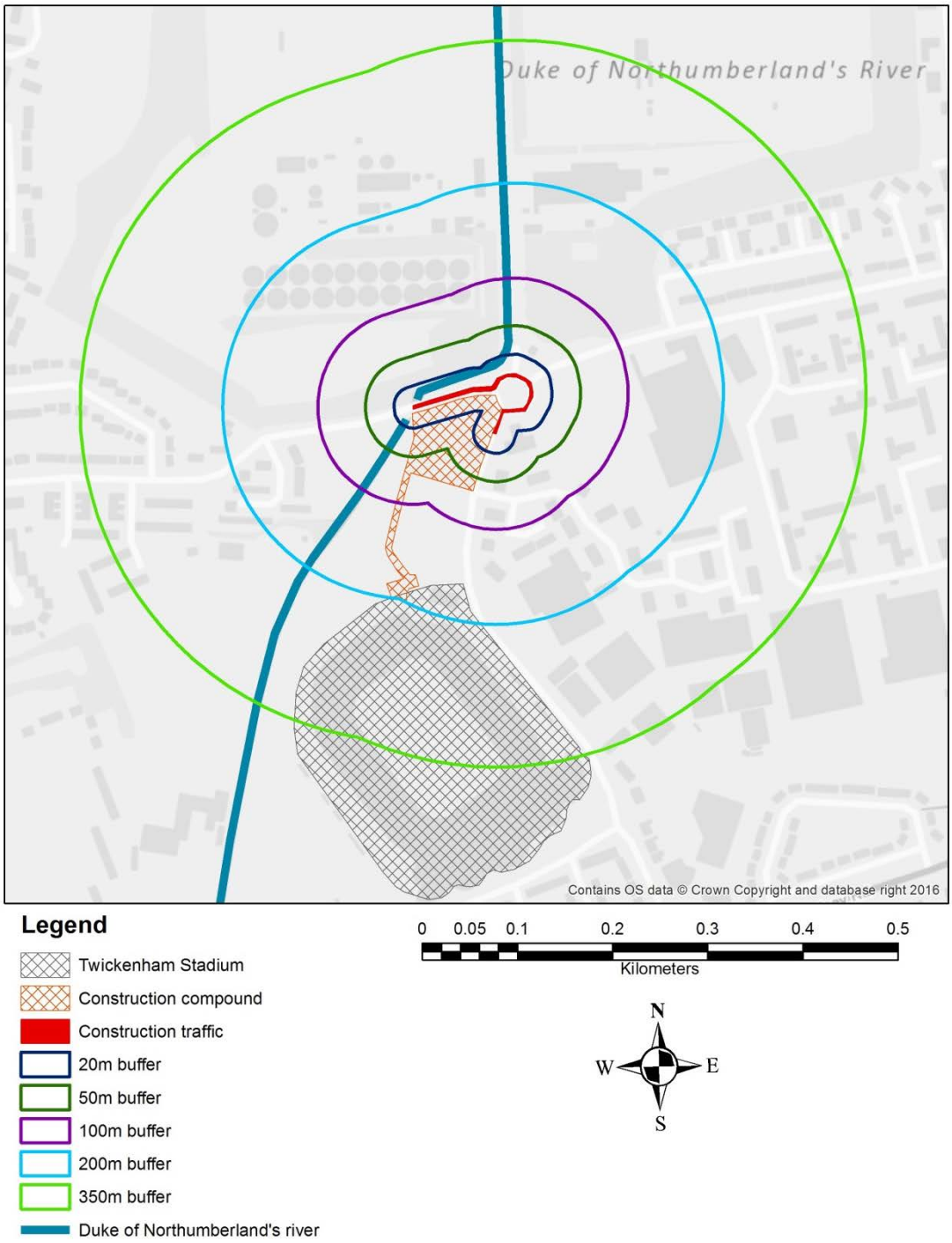


Figure 5.3: Dust assessment boundaries for the contractors' compound zone (trackout buffers only)



The overall risk of receptors to dust soiling effects, PM_{10} effects and ecological impacts from the contractors' compound zone are presented in Table 5.6. Risk is based on the criteria presented in Table B.4 to Table B.9 within Appendix B.

Table 5.6: Summary of the risk of construction effects

Activity	Dust soiling effects	PM_{10} health effects	Ecological impacts
Demolition	N/a	N/a	N/a
Earthworks	Low risk	Low risk	Low risk
Construction	N/a	N/a	N/a
Trackout	Low risk	Low risk	Low risk

As Table 5.6 shows, there is a 'low risk' of dust soiling, PM_{10} effects and ecological impacts from earthworks and trackout in the contractors' compound zone.

5.2.3 Summary

Based on the above, the overall effect of dust nuisance and/or loss of amenity from the construction phase in the East stand construction zone is described as 'medium risk' at worst without mitigation while the overall effect in the contractors' compound zone is described as 'low risk' at worst without mitigation. Possible mitigation for a 'medium risk' development, as recommended by the IAQM [Ref 29] and the Mayor of London's SPG on the Control of Dust and Emissions during Construction and Demolition [Ref 17], is detailed in Section 6.

5.3 Operation phase impacts

As noted in section 3.3 the proposed development is not expected to have significant impacts on air quality during the operation phase.

6 Mitigation

6.1 Introduction

This section summarises the recommended mitigation associated with the construction and operation phases of the proposed development. These recommendations are based on the highest level of risk to sensitive receptors from construction activities from the construction assessment (Section 5), the expected baseline conditions at the site (Section 4) and the outcome of consultation with LBRUT.

6.2 Construction Phase

Construction activities for the proposed development are predicted to have at worst a 'medium' impact in terms of generating dust for a temporary period. Best practice mitigation measures to control fugitive dust are contained in the IAQM Guidance [Ref 29] and Mayor of London's SPG on the Control of Dust and Emissions During Construction and Demolition [Ref 17] and should be incorporated into a Construction and Environment Management Plan (CEMP). Mitigation measures for a medium Risk site are presented below.

- **General Dust Management**
  - Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
  - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary.
  - Display head or regional office contact information.
  - Develop and implement a Dust Management Plan (DMP)
  - Record all dust and air quality complaints, identify cause(s), 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 offsite, 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 an inspection log available to the local authority when asked.
  - Increase the frequency of site inspections 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 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 that are at least as high as any stockpiles on site. Avoid site runoff of water or mud.
  - Remove materials that have a potential to produce dust from site as soon as possible.
  - Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards.
  - Ensure all vehicles switch off engines when stationary - no idling vehicles.
  - Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
  - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.

  - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using 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 whenever appropriate.
  - Avoid bonfires and burning of waste materials.
  - Avoid the use of diesel of petrol generators – where possible use renewable, mains or battery powered plant items instead
- **Measures Specific to Demolition**
  - Soft strip inside buildings before demolition.
  - Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
  - Avoid explosive blasting, using appropriate manual or mechanical alternatives.
  - Bag and remove any biological debris or damp down such material before demolition.

6.3 Operational Phase

As discussed in section 3.3, operation phase impacts are not expected to be significant and have not been assessed in detail. However, following consultation with LBRUT it is understood that the following operation phase mitigation measures should be considered for any proposed development in the Borough, in the interests of improving air quality:

- The proposed CHP installed at the site would meet the minimum emission standard recommended in IAQM (2015) and would meet the emission limits prescribed in the Mayor of London's SPG for Sustainable Design and Construction.
- As requested by LBRUT during Pre-Application Meeting 3, an emissions control scheme for the proposed CHP will be developed and submitted to LBRUT for approval prior to operation.

7 Conclusions

This report provides a qualitative assessment of the following key impacts associated with the construction and operation of the proposed development.

A qualitative assessment of construction dust effects was undertaken for the proposed development to identify the risk to sensitive receptors from construction activities. Using the best practice guidance from the IAQM and the Mayor of London's SPG on the Control of Dust and Emissions During Construction and Demolition, construction for the proposed development was deemed to cause a 'medium risk' to nearby sensitive receptors while demolition and earthworks activities were deemed to cause 'low risk' to nearby sensitive receptors (Section 5). Mitigation measures, consistent with best practice guidance, were therefore recommended in line with 'medium risk' construction sites (Section 6) which, if followed, would reduce the risk and result in construction phase air quality impacts that are not significant.

Overall, the operational impacts from the proposed development on local air quality (operational traffic increases and the installation of a CHP) would not be significant based on the required emission limits being met and the CHP flue being sited appropriately as set out in IAQM (2015) and the Mayor of London's Sustainable Design and Construction Supplementary Planning Guidance. Prior to operation an emissions control scheme will be developed and submitted to LBRUT.

The proposed development is not considered to conflict with any national, regional or local planning policy within LBRUT.

8 References

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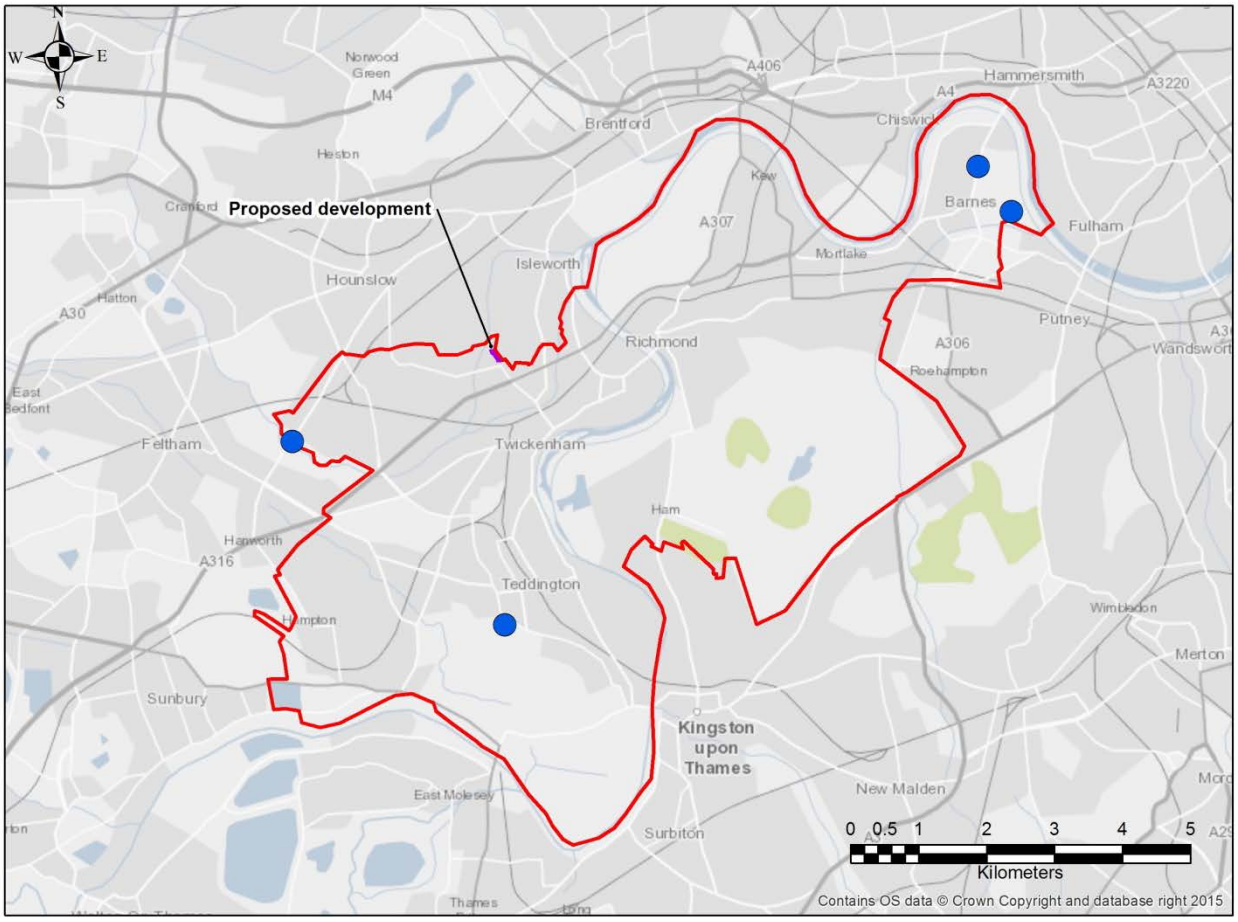
Appendices

Appendix A. London Borough of Richmond upon Thames AQMA

Figure A.1: LBRUT AQMA and automatic monitoring site locations



Appendix B. Dust assessment criteria

Table B.1: Determination of dust raising magnitude

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

Source: IAQM

Table B.2: Receptor sensitivity

Source	High	Medium	Low
Sensitivities of people to dust soiling effects	Users can reasonably expect an 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 include dwellings, museums and other culturally important collections, medium and long term car parks b and car showrooms.	Users would expect a 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 include parks and places of work.	The enjoyment of amenity would not reasonably be expected a; or Property 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 include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks b

Source	High	Medium	Low
			and roads.
Sensitivities of people to the health effects of PM10	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (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).c Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	Locations where the people exposed are workers d, and exposure is over a time period relevant to the air quality objective for PM_{10} (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). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	Locations where human exposure is transient e Indicative examples include public footpaths, playing fields, parks and shopping streets.
Sensitivities of receptors to ecological effects f	Locations with an international or national designation and the designated features may be affected by dust soiling; or Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain g. Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. • Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a local Nature Reserve with dust sensitive features.

A People's expectations will vary depending on the existing dust deposition in the area

B Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

C This follows Defra guidance as set out in LAQM.TG(09).

D Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM_{10}. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

E There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health impacts, albeit less certain.

F A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

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

Table B.3: Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table B.4: Sensitivity of the area to human health impacts

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

Table B.5: Sensitivity of the area to ecological impacts

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

Table B.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 B.7: Risk of dust impacts - earthworks

	Dust emission magnitude		
Sensitivity of area	**Large**	**Medium**	**Small**
High	High risk	Medium risk	Medium risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table B.8: Risk of dust impacts - construction

	Dust emission magnitude		
Sensitivity of area	**Large**	**Medium**	**Small**
High	High risk	Medium risk	Medium risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

Table B.9: Risk of dust impacts – trackout

	Dust emission magnitude		
Sensitivity of area	**Large**	**Medium**	**Small**
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

Appendix C. Construction dust information request

This Appendix presents the construction phase information provided by the Project team (in red), which has informed the air quality construction dust assessment.

Stage / aspect		Select category, or complete details if known	Additional relevant information e.g. specific volumes / vehicle numbers
Demolition	Total building volume to be demolished (select one)	>50.000m^3	No major demolition works. Ground works - pile arisings, and pile caps >10,000m3
		20,000-50,000m^3	
		<20,000m^3	
	Materials to be demolished (list, if known e.g. concrete/timber)		Soils, clay, sand, gravels
	Height of demolition activities (select one)	>20m above ground level	Ground level
		10-20m above ground level	
		<10m above ground level	
	Duration of demolition activities	4 weeks, minimal demolition internal. No major demolition external.	
	Timing of demolition activities (e.g. winter/summer if known)	Spring 2018	
Earthworks	Total site area (select one)	>10,000m^2	
		2,500m^2-10,000m^2	
		<2,500m^2	
	Number of heavy earth moving vehicles active at any one time	>10	
		5-10	
		<5 less than	
	Bund height (select one)	>8m	
		4m-8m	
		<4m less than	
	Total material moved (select one)	>100,000 tonnes	
		20,000 – 100,000 tonnes	
		<20,000 tonnes	
	Duration of earthworks activities	12 weeks	
	Timing of earthworks activities (e.g. winter/summer if known)	Spring 2018	
Construction	Total building volume (select one)	>100,000m^3	
		25,000-100,000m^3	
		<25,000m^3	
	On site concrete batching?	No	
	Piling?	Yes	
	Sandblasting?	No	
	Construction materials (list, if known e.g. concrete / metal cladding / timber)	Steel frame, metal decking, cladding tbc likely to be a mix of metal and glass.	
	Duration of construction activities	18 months	
	Timing of construction activities (e.g. winter/summer if known)	March 2017 to September 2018	
Trackout of dust from site	Maximum number of heavy duty vehicle (HDV i.e. >3.5t) outward movements in any one day	>50	
		10-50	
		<10 less than	
	Site surface material (e.g. high clay content soils, sand)	Asphalt	
	Unpaved road length (select one)	>100m	
		50-100m	
		<50m	
	Duration of period requiring HDV movements to/from site	12 months	
	Timing of period requiring HDV movements to/from site (e.g. winter/summer if known)	March 2017 to February 2018	
	Likely haulage routes used by construction vehicles on the public highway, up to 500m from site entrance(s).	Off Rugby Road, Twickenham, public highway	