Air Quality Assessment

Thames Quarter, Reading

Prepared for
Lochailort Reading Limited

by

Stuart Michael Associates Limited

November 2018

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SMA Ref: 5277/AQ

Issue Status: 01

DOCUMENT CONTROL			
Project	**Thames Quarter, Reading**		
Job No.	**5277**		
Document Title	**Air Quality Assessment**		
File Location	N:\Admin Project\5200 to 5299\5277 - Thames Quarter (Swan Heights 2)\Reports\Air Quality\5277 - Air Quality Assessment - 01.docx		
Prepared by	Jason Mills	**Date**	06/11/2018
Reviewed by	William Hicks	**Date**	07/11/2018
Approved by	Stewart Andrews	**Date**	08/11/2018
Document Issue	**Description / Changes**	**Revised by**	**Date**
First draft	Internal review and comment	JPM	07/11/2018
01	Issued to Client	JPM	08/11/2018

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ACRONYMS AND ABBREVIATIONS

ADMS-Roads	Atmospheric Dispersion Modelling System (ADMS) Air Quality Management System Version 4.0.1
ATC	Automated Traffic Count
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
DEV	Development generated traffic
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
g/km/s	grams per kilometre per second
ha	Hectares - a unit of measure equal to 2.471 acres or 10,000 m^3
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Managements
MCC	Manual Classified Traffic Count
ms^{-1}	wind speed in meters per second
MVHR	Mechanical Ventilation and Heat Recovery
NAQO	National Air Quality Objectives (2002)
NSCA	National Society for Clean Air
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
NTM	National Transport Model
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 microns
RBC	Reading Borough Council
SDPD	Sites and Detailed Policies Document
SMA	Stuart Michael Associates Limited
TEMPRO	Trip End Model Presentation Program
μgm^{-3}	Micrograms per cubic meter

Non-Technical Summary

The Air Quality Assessment (AQA) considers the air quality impacts and constraints of the proposed Thames Quarter development. Proposals for the site are for the erection of a part 13 storey, part 23 storey building comprising 338 apartments and the demolition of existing multi-storey car park.

The report addresses the effects of air pollutant emissions from road traffic using the adjacent roads, rail traffic on the adjacent railway line and the way they impact the site and surrounding area. The AQA takes into account the emissions associated with the construction of the development, and recommends relevant construction mitigation. The report also assesses the constraints on the development (i.e. how the existing environment will impact on the development). The assessment has had due regard for national legislation and local council policy for Reading, noting the fact that the proposed development is located within an Air Quality Management Area. NO_2 contour plots have been modelled at the location of the proposed development site for a number of varying representative heights.

Based on the impact assessment, it has been calculated that the Thames Quarter development is predicted to have a negligible impact on local sensitive receptors in 2021. As a result of this, the impact of the development is deemed “not significant”. With regards to mitigation against the potential constraints of the development, all plots will benefit from alternative ventilation in the form of Mechanical Ventilation and Heat Recovery Systems (MVHR), whereby it is recommended that clean air inlets should be positioned at a minimum height of 25 metres above ground surface level. Network Rail’s electrification of the Great Western Main Line is predicted to significantly improve air quality for the Thames Quarter development. NO_2 concentrations at the Level 11 roof terrace, which is the resident’s main amenity area, are predicted to be well below the National Air Quality Objectives based on the existing use of the railway lines (and notwithstanding future improvements to air quality resulting from the electrification of the Great Western Railway Line).

Based on the results of the AQA, it has been concluded that with appropriate mitigation, air quality levels are acceptable for future residents of the proposed Thames Quarter development. Moreover, the impact of development on local sensitive receptors is predicted to be negligible during both the construction and operational phases of development. The proposed development is therefore acceptable from an air quality perspective.

1.0 INTRODUCTION

1.1 Stuart Michael Associates (SMA), Consulting Engineers, has been appointed by Lochailort Reading Limited (the Applicant) to undertake an Air Quality Assessment for the proposed development at Thames Quarter, Reading (refer to **Figure 1.1** for the site location). The development site is situated within the area administered by Reading Borough Council (RBC).

1.2 Proposals for the site are for the erection of a part 13 storey, part 23 storey building comprising 338 apartments in a mix of studio, one-bedroom, two-bedroom and 3-bedroom units; residents' lounges, tech-hub, dining room, and cinema room; various rooftop outdoor amenity spaces; concierge/reception with coffee meeting area; residents' storage facilities; postroom; ancillary back-of-house facilities; 38 secure cycle parking spaces; 49 car parking spaces; landscaping; and associated works and the demolition of existing multi-storey car park.

1.3 The site is bounded to the west by the A329 Vastern Road, to the north by King's Meadow Road and to the south by the railway line (on embankment). There are existing commercial units to the east of the site. The site is currently occupied as a car park.

1.4 Vehicular access to the proposed development will be from King's Meadow Road and the existing site access. Wider vehicular access to the site is from the A329 Vastern Road, B3345 George Street (over Reading Bridge), A329 Forbury Road, the A329 Caversham Road and the A4155 Caversham Road.

1.5 Pedestrian access to the site will be from the A329 Vastern Road (town centre and the train station) and King's Meadow Road (from the north and east).

1.6 The proposed development is located within the Reading Borough Council's (RBC's) Air Quality Management Area (AQMA). All the major roads and a large area of Reading Town Centre were declared an AQMA in 2009, after a "Further Assessment" in 2008 found that annual mean nitrogen dioxide levels were predicted to exceed the National Air Quality Objective (NAQO) levels in 2015.

1.7 Following consultation with RBC it was agreed that dispersion modelling would be the most appropriate and robust method of determining the future concentrations of air pollutants at the site and potential impacts at local sensitive receptors. For further information, refer to the statement of pre-application consultation which was submitted with the planning application number 162166/FUL.

Assessment Methodology

1.8 The report addresses the effects of air pollutant emissions from road traffic using the adjacent roads, rail traffic on the adjacent railway line and the way they impact the site and surrounding area. Also considered are the emissions associated with the construction of the Proposed Development.

1.9 The report has been split into two parts; the first part assesses the impact of the development on surrounding sensitive receptors and the second part assesses the constraints on the development (i.e. how the existing environment will impact on the development).

1.10 Road traffic flows on the local highway network have been obtained from RBC, permanent automatic traffic counters (ATC) and manual classified counts (MCC) at the junctions. Where necessary, the collected traffic flows have been growthed to the assessment years using TEMPRO and NTM.

1.11 The dispersion modelling software ADMS-Roads (Version 4.1.1) has been used to determine the concentrations of pollutants at the development site and assess the likely changes in the concentrations of pollutants. Background concentrations of pollutants have been obtained from the Department for Environment Food and Rural Affairs (DEFRA) website.

1.12 Construction dust impacts on local receptors have been assessed using the method detailed in the Institute of Air Quality Management (IAQM) publication "Guidance on the assessment of dust from demolition and construction" (2014).

Report Outline

1.13 The report assess the overall levels of oxides of nitrogen (NO_X), nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) in the vicinity of the development site, at the Caversham Road permanent monitoring station (RD1) and at four diffusion tube locations (DT) adjacent to the A4155 Caversham Road (DT 73, 74 and 75) and the A329 Vastern Road (DT 59). The base year for the development is 2016 and the future year of assessment is 2021, which is five years after submission of the planning application.

2.0 LEGISLATION AND PLANNING POLICY CONTEXT

Introduction

2.1 Poor air quality is the largest environmental risk to public health. Over recent years, UK air quality has improved significantly as a result of concerted action. Total UK emissions of nitrogen oxides (NO_x) fell by almost 70% between 1970 and 2015 and by over 19% between 2010 and 2015 (DERFA / DfT; Improving air quality in the UK: tackling nitrogen dioxide in our towns and cities – Draft UK Air Quality Plan for tackling nitrogen dioxide – May 2017).

2.2 In the UK at the present time, emissions from road transport account for a substantial proportion of national air pollutant emissions. Road transport currently contributes almost 22% of national carbon dioxide (CO_2) emissions even though emissions have fallen by 6.3% between 2000 and 2014. (Department for Transport Statistics: Road Traffic Estimates: Great Britain 2016). Total pollutant emissions from cars peaked in 1990/91 and declined to 2009. "*Since 2002, the average emissions from new cars have fallen by 31%*" (Department for Transport (DfT), Vehicle licensing Statistics: Annual 2016).

2.3 Private car ownership has grown from 24.4 million in 2000 to 30.9 million at the end of 2016. Of the vehicles using the highway network, cars accounted for 82.8%, motorcycles 3.3%, light goods vehicles (<3.5t) 10.2%, HGV's (>3.5t) 1.3%, buses and coaches 0.4% and "other vehicles" 1.9% of all motor vehicle traffic at the end of 2016 (DfT Statistics - Vehicle Licensing Statistics: Table VEH0101 - 2016). In 2016, 84% of newly registered vehicles fell into one of the lowest five Vehicle Excise Duty (VED) Bands (A to E, up to 140 hkm^{-1}) with 60% in Band C or lower and 17% in Band A. By the end of 2016, 47% of cars fall into Band E or lower. UK emissions of NOx from road transport fell by 17% between 2010 and 2015

2.4 The percentage of different fuel type usage for private cars has significantly changed since the mid-1990s. At the end of 2016 there were 12.1 million diesel cars, accounting for 39% of the total, up from 10% in 1996. Alternative fuel vehicles which include gas, electricity, or a combination such as gas bi-fuel and hybrid electric were up to 388,000 at the end of 2016. Of the 388,000 vehicles, 95,879 were classed as Ultra-Low Emission Vehicles (ULEVs) where tailpipe emissions of CO_2 are less than 75 gkm^{-1} or fully electric powered.

2.5 It should be noted that during 2016, 41,819 new ULEVs were registered for the first time, which is a 40% increase when compared with the previous year (29,965 ULEVs). This amounted to 1.3% of all new vehicle registrations in 2016, up from 0.9% in 2015 and 0.5% in 2014 (DfT Statistics - Vehicle Licensing Statistics: Table VEH0170 and Annual 2016).

2.6 Most of this increase has been due to vehicles eligible for plug-in car and van grants. New registrations in 2016 included 36,782 cars and 1,025 vans of models that were eligible for these grants, 30% up on 2015.

National Air Quality Strategy

2.7 In 1997 the United Kingdom National Air Quality Strategy (NAQS) was published and for the first time in history this document set out an analysis of the magnitude and potential health and environmental problems associated with, amongst other things, air pollutant emissions resulting from road traffic.

2.8 It proposed a schedule of air quality objectives which were to be met in the years up to 2005. In setting these objectives, health and socio-economic cost-benefit factors were taken into account, together with consideration of the practical and pragmatic aspects of whether targets would be achievable. Whilst it was identified in the NAQS that the objectives for benzene, 1,3-butadiene, lead (Pb) and carbon monoxide (CO) could be achieved as a result of improvement measures already put in place, complying with targets for NO_2 and PM_{10} would be more difficult.

2.9 Considering the additional measures that would have to be introduced to counter these apparent shortfalls, the Government voiced the following thought:

“Changes in planning and transport policies (are needed) which would reduce the need to travel and reliance on the car”.With regard to the necessity for encouraging a shift away from private car usage, the Strategy commented, in terms of the new package approach to transport funding:

“As a general rule, traffic demand management and restraint measures should be included and this, together with proposals to promote and enhance other modes of transport, should aim to achieve modal shifts away from the private car”.

2.10 The Environment Act 1995 sections 82-84 requires that Local Authorities shall carry out reviews of air quality within their administrative areas and, where it is assessed that the air quality objectives may not be complied with in the future, an Air Quality Management Area (AQMA) must be declared. The Local Authority must then formulate an Action Plan, setting out the measures that will be employed to achieve compliance with the objectives.

2.11 A review of the UK Air Quality Strategy was undertaken in 1998 and a consultation document was published in January 1999 which outlined proposals for amending the Strategy. In August 1999, in response to the consultation, the Government then published a draft Air Quality Strategy for England, Scotland, Wales and Northern Ireland. The Air Quality Regulations (England) 2000 were enacted in April 2000, and the Air Quality (England) (Amendment) Regulations 2002 gives legal force to the air quality standards set out in the Strategy. A new strategy was released in July 2007 with various amendments to the air quality objectives. The proposals, in brief, consisted of recommendations to adopt the provisions of the EU Air Quality Daughter Directives. The National Air Quality Objectives (NAQO's) included in the Regulations are set out in **Appendix 1**.

2.12 Given the significant influence that motor vehicle exhausts exert on air quality in the UK and the apparent links between elevated levels of certain air pollutants and premature mortality, it is clear that current and emerging Government policy is geared towards several essential objectives, which are:

- continued action to reduce pollutant emissions from vehicles across the EU, which can be exemplified by the plethora of Directives concerning limitation of motor vehicle emissions since the 1970's and specific targeted initiatives such as the Auto-Oil Study programme;
- concerted action at a National level to reduce private car trips in urban and inter-urban uses and encourage use of alternative forms of transportation;
- action at a local level to manage transportation and air quality in order to reduce the number of car trips in urban areas specifically and to aim for compliance with the NAQS by the appointed dates; and

to ensure that Local Authorities in the execution of their development control responsibilities take account of the consequent air quality impacts.

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

2.14 Levels of lead (Pb) and sulphur dioxide (SO_2) are also controlled by the NAQO. Lead levels have reduced significantly since its reduced use as a fuel additive, and the abolition of four-star petrol in January 2000 means that the amount of Pb in petrol is reduced to a negligible level. SO_2 is predominantly associated with emissions from industrial processes and when assessing the effects of traffic, neither SO_2 nor Pb need be assessed.

Local Council Policy

2.15 The current local policy for Reading Borough Council is the Local Development Framework (LDF) which includes the Core Strategy, Reading Central Area Action Plan, and, Sites and Detailed Policies Documents (SDPD) which are under review with the aim of drawing up a Local Plan for the Borough. Following the declaration of the AQMA in 2008 an Air Quality Action Plan (AQAP) was implemented in 2009 with the aim of tackling the problem of poor air quality in Reading.

2.16 Within the Core Strategy, Policy CS34: Pollution and Water Quality deals specifically with pollution and water quality with regard to development and states:

"Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development.

Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.

Development will be permitted on land affected by contamination where it can be demonstrated, to the satisfaction of the LPA, that the contamination can be satisfactorily remediated so that it is suitable for the proposed end use."

2.17 The Reading Central Area Action Plan is one of RBC's Development Plan Documents (DPD) and should be read in conjunction with other LDF documents. Policy RC9: Living in the Centre presents criteria which proposed development in the centre of Reading should be assessed against. The policy covers a number of criteria and with regard to air quality states that:

"Proposals for residential development within the central area will be assessed against the following criteria:

ii. Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated."

2.18 The SDPD Section 9.2 Air Quality identifies that air quality is a key issues within Reading and Policy DM19: Air Quality identifies what development should have regard to the need to improve air quality. DM19 states that:

"Development should have regard to the need to improve air quality and reduce the effects of poor air quality.

i. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

> Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly reduce air quality;
>
> Whether the development is within, or accessed via, an Air Quality Management Area; and

Whether it can be demonstrated that a local reduction in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.

ii. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application.

iii. Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring."

2.19 In 2008 the six AQMAs were revoked and a single AQMA which covers all the major roads, the railway line and a large area of the centre of Reading was declared (refer to **Appendix 2** for the Reading AQMA plan). An Air Quality Action Plan (AQAP) was produced in 2009 with the aim tackling poor air quality in Reading Borough AQMA. The AQAP should be read in conjunction with the SDPD (DM19: Air Quality).

3.0 METHODOLOGY AND ASSESSMENT CRITERIA

Assessment of the Prevailing Air Quality

3.1 This section summarises the methodology used to consider whether there are "Significant" air pollution impacts on sensitive receptors or constraints on development. In order to determine the extent to which air quality issues will affect the sensitive receptors, the study has considered the following:

Any air quality measurements carried out in Reading Borough (which are in the public domain);

The Review and Assessment of air quality carried out by RBC for the area, as submitted to the Department for the Environment, Food and Rural Affairs (DEFRA);

Predictions of air pollutant concentrations adjacent to the site and within the Reading AQMA.

The predictions have been carried out utilising the ADMS Roads (version 4.1.1) dispersion modelling program.

Assessment Criteria

3.2 The NAQO levels are derived from air quality standards set to protect health. The objectives address social and economic factors as well as the health standards.

3.3 For the purposes of this development proposal, the NAQO will form the basis of the air quality assessment. The NAQO levels are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether the air quality in the vicinity of a road is likely to be detrimental to human health. In determining whether air pollutant levels may constrain development, the results of the study have been compared against the acceptability criteria.

3.4 The effects of dust generation from construction have been undertaken following the methodology presented in the Institute of Air Quality Management (IAQM) publication "Guidance on the assessment of dust from demolition and construction" (2014).

3.5 In determining whether air pollutant levels may constrain development, the results of the study have been compared against the acceptability criteria.

Impact Magnitude and Impact Descriptors (Significance) – Air Quality Assessments

Construction Phase

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

- site clearance and preparation;
- storage of materials;
- laying of hard surfaces;
- construction of buildings;
- vehicle movements to and from the Site.

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

3.8 A qualitative assessment of the potential impacts during construction has been undertaken using information in guidance documents produced by IAQM.

3.9 According to this guidance; a human receptor refers to any location where a person may experience the annoyance effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period relevant to the air quality objectives. In terms of annoyance effects, this will most commonly relate to residential dwellings and schools.

3.10 Activities on construction sites can be divided into four types to reflect their different potential impacts, with the potential for dust emissions to be assessed only for each activity taking place:

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

3.11 The assessment methodology considers three separate dust effects:

annoyance due to soiling;

harm to ecological receptors; and

the risk of health effects due to a significant increase in exposure to PM_{10}.

3.12 Account is also to be taken of the distance of the receptors that may experience these effects. The assessment procedure assumes no mitigation measures are applied except those required by legislation.

3.13 The potential dust emission magnitude for the proposed Development Site is determined for the four construction activities using the criteria presented in IAQM guidelines. The magnitude is based on the scale of the anticipated works and classified as “Small”, “Medium” or “Large”.

3.14 The “Sensitivity of an Area” to dust soiling effects on people and property is determined by using the criteria presented in **Table 3.1**. The “Sensitivity of an Area” to human health impacts is presented in **Table 3.2.** The “Sensitivity of an Area” and to ecological impacts is presented in **Table 3.3**.

Table 3.1: 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 3.2 : Sensitivity of the area to human health impacts

Receptor Sensitivity	Annual Mean PM_{10} conc.	Number of Receptors	Distance from the Source (m)				
			<20	*<50*	*<100*	*<200*	*<350*
High	*>32 µgm^{-3} (>18 µgm^{-3} in Scotland)*	*>100*	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µgm^{-3} (16-18 µgm^{-3} in Scotland)	*>100*	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µgm^{-3} (14-16 µgm^{-3} in Scotland)	*>100*	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µgm^{-3} (<14 µgm^{-3} in Scotland)	*>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 3.3 : 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

3.15 **Figure 3.1** and **Figure 3.2** demonstrate that are the main dust sensitive receptors within the vicinity of the site boundary. However, there is a small number of residential properties to the north of the site which will also be included in the assessment.

Figure 3.1: Sensitivity to Dust Soiling Effects on People and Property

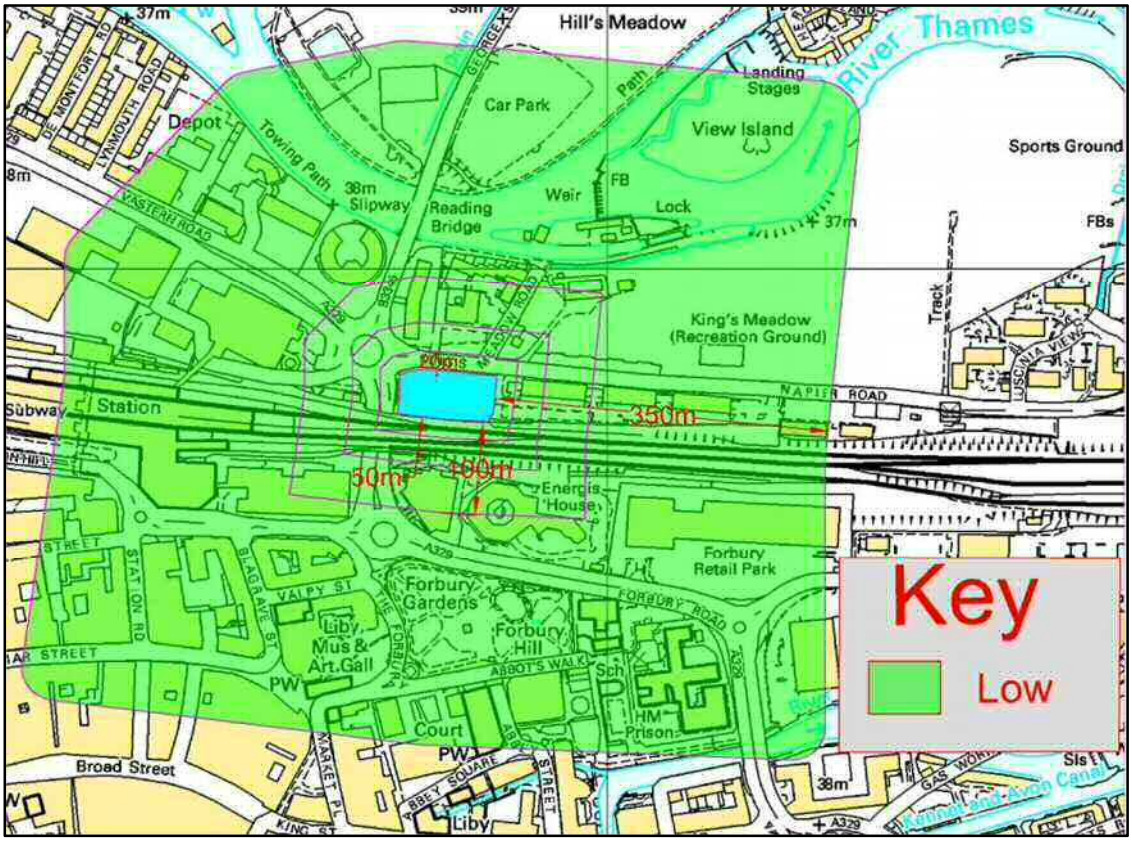
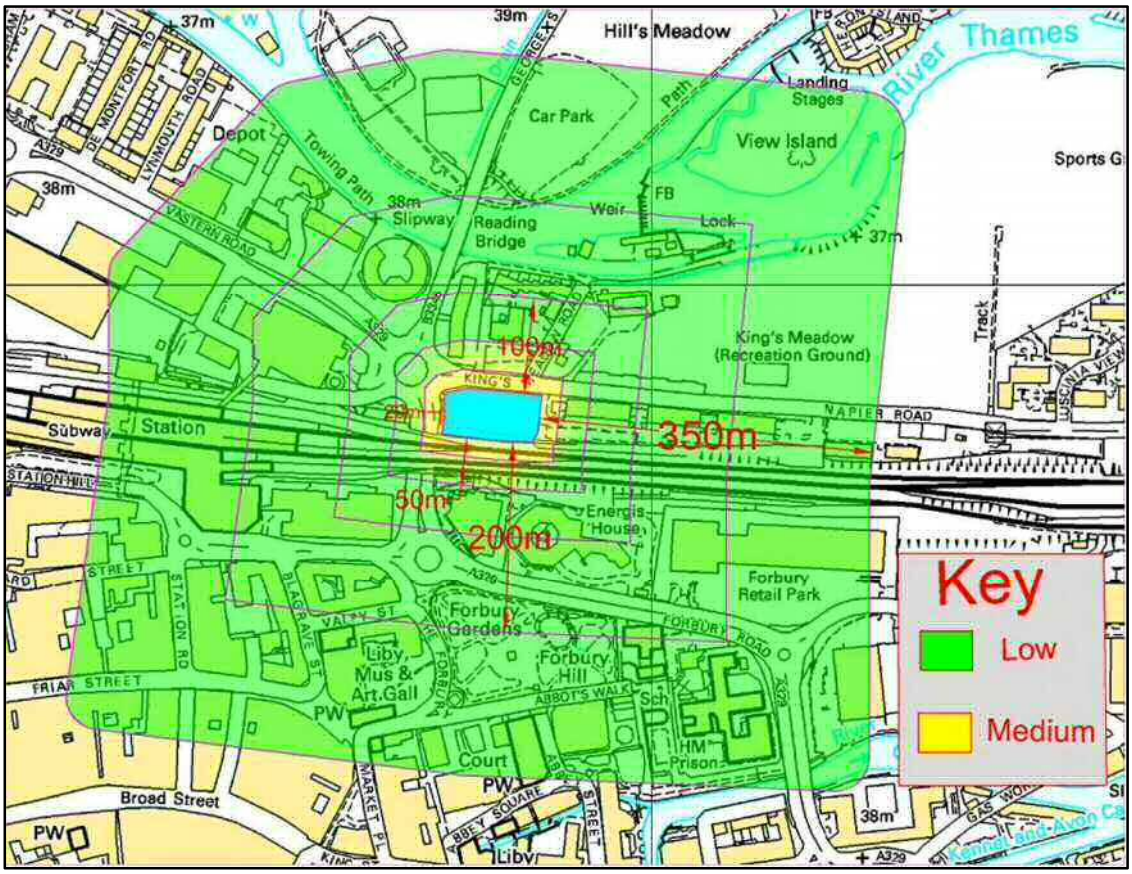


Figure 3.2: Sensitivity of the Area to Human Health Impacts



3.16 As the potential dust emissions magnitude and the sensitivity of the area have been determined the results can be combined to define the risks of impact using the criteria in the following tables.

Table 3.4: Risk of Dust Impacts – Demolition (For info only)

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 3.5: Risk of Dust Impacts – Earthworks and Construction

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

Table 3.6: Risk of Dust Impacts – Trackout

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

3.17 The proposed development's site specific results and significance of these tables are discussed in Section 5 of this Report.

Operational Phase

3.18 The impact of local traffic growth, development generated traffic and other potential sources of air pollution have been assessed for the magnitude of change and for the extent to which change in air quality from existing to future levels would be significant.

3.19 Descriptors for the magnitude of change in annual mean concentrations of NO_2 and PM_{10} and the number of days with PM_{10} concentrations greater than 50 μgm^{-3} are presented in **Table 3.7**.

Table 3.7: Descriptors for the magnitude in changes in annual mean concentrations of NO_2 and PM_{10} and the number of days with PM_{10} concentrations greater than 50 µgm^{-3}

Magnitude of Change	Annual Mean NO_2/PM_{10}	Days PM_{10} >50 µgm^{-3}
Large	Increase/decrease >4 µgm^{-3}	Increase/decrease >4 days
Medium	Increase/decrease 2 - 4 µgm^{-3}	Increase/decrease 2 - 4 days
Small	Increase/decrease 0.4 - 2 µgm^{-3}	Increase/decrease 1 - 2 days
Imperceptible	Increase/decrease <0.4 µgm^{-3}	Increase/decrease <1 day

3.20 Following on from the determination of the magnitudes of the impact of change of NO_2 and PM_{10} levels, the assessment of the significance of the impact with reference to the NAQO Levels can be undertaken. Descriptors of the changes to annual mean concentrations of NO_2 and PM_{10} and the number of days with PM_{10} concentrations greater than 50 µgm^{-3} are presented in **Table 3.8**.

Table 3.8: Impact descriptors for changes to annual mean concentrations of NO_2 and PM_{10} and the number of days with PM_{10} concentrations greater than 50 µgm^{-3}

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration /Number of Days**		
	Small	***Medium***	***Large***
Increase with Scheme			
Above Objective/Limit Value With Scheme (>40 µgm^{-3}/>35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-40 µgm^{-3}/>32-35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-36 µgm^{-3}/>26-32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µgm^{-3}/<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (>40 µgm^{-3}/>35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-40 µgm^{-3}/>32-35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-36 µgm^{-3}/>26-32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<30 µgm^{-3}/<26 days)	Negligible	Negligible	Slight Beneficial
Note – an “Imperceptible” change would be described as “Negligible”			

3.21 Table 3.7 and Table 3.8 detail the magnitude and "Significance" of changes in NO_2 and PM_{10} levels. The tables have been extracted from the Environmental Protection UK (formerly National Society for Clean Air (NSCA)) publication "*Development Control: Planning for Air Quality (2010 Update) – Table 5 and Appendix 3*".

Traffic Data

Road Traffic

3.22 The future concentrations of NO_X, NO_2 and PM_{10} at representative sensitive receptors and at the locations of four diffusion tubes and the continuous air quality monitor have been predicted using the ADMS - Roads (Version 4.0.1) dispersion model based on forecast traffic flows for the local road network.

3.23 Two "Base" (Do Nothing) and one "Future" (Do Something) scenarios have been assessed along with a 2013 scenario for the verification of the model. The base scenarios are 2016, 2021 + Committed Development and the future scenario is 2021 + Committed Development + Development.

3.24 Road traffic data for the opening year of Reading Train Station improvements on the local highway network has been provided partially by Peter Brett Associates via Reading Borough Council. The remaining traffic data was collected using the permanent ATC's on A329 Forbury Road, A329 Caversham Road and the A4155 Caversham Road and has been obtained from the Department for Transport (DfT) website.

3.25 The collected traffic flows have been growthed from 2014 to the assessment years using TEMPRO and NTM. Committed development generated traffic has been added to the base year traffic flows to provide a "Future" year scenario. Where 24hr AADT flows were not available, existing traffic proportions on the highway network have been used to growth the available traffic data.

3.26 The "Base" scenario vehicle flows on the local highway network used in the assessment are detailed in **Table 3.9**.

Table 3.9: Traffic flow data (no development generated traffic)

Link	Base	
	AADT	%HGV
King's Meadow Road/Napier Road	7854	2.0
B3345 George Street (Reading Bridge)	35858	2.5
A329 Vastern Road (E of Reading Bridge Roundabout)	41329	4.5
A329 Vastern Road (under the railway line)	42290	4.8
A329 Forbury Road	25039	2.4
Forbury Road	10200	9.3
A329 Vastern Road (Caversham Rd Rounbabout)	48541	5.0
A329 Caversham Road	35717	4.7
A4255 Caversham Road	28637	4.2
Richfield Avenue	29201	2.0
Caversham Bridge	47720	2.0

3.27 The local highway network has been modelled as distinctive links where vehicle speeds change, width of roads change and at roundabout junctions. Also included are changes in vehicle speed due to pedestrian crossings and traffic lights.

Rail Traffic

3.28 The Great Western Main Line is currently undergoing electrification. It is anticipated that new electric trains will start running on the line from 2019. Once complete, the electric trains will emit significantly less air pollutants into the atmosphere.

3.29 There are three train companies which have routes that pass through Reading Station. The operators are Great Western Railway *(formerly First Great Western*), South West Trains and Cross Country. Passenger train numbers starting, terminating and passing through Reading Station have been calculated from publically available train time tables.

3.30 Rail freight train frequencies through Reading Station have been approximated using the data available from the subscription website "Freightmaster online". The website is run by rail enthusiasts and covers the entire rail network in the UK.

3.31 Within the timetables it is approximated that 21 freight trains pass through Reading Station on an average day. Night time freight trains have been approximated from local observations and an average of two trains has been used in the model.

3.32 Adjacent to the development site there are currently three sets of two railway lines (six lines in total). The southern two lines terminate to the west of the site and for this model have been combined into one line. Whilst out on site it was observed which type of train uses which line and in what direction, which resulted in the observation that SWT uses the southern lines and GWR "Regional" trains use the four remaining lines. GWR "Intercity" trains were observed to use the two middle lines and the second from the top. Freight trains were observed to use the middle two lines. This may change in the future, but the current line usage has been incorporated into the model.

3.33 The results from the on-site observations and scrutiny of the train timetables are presented in **Table 3.10**.

Table 3.10: Train Frequencies

Train Lines	Approximate distance from the site to the train line (metres)	Train Type (Intercity, Regional or Freight)	Daytime (0700 – 2300)	Night Time (2300 – 0700)
North	17	Regional	233	43
	22 EB	Intercity, Regional	220	30
Middle	32 WB	Intercity, Regional, Freight	85	3
	35	Intercity, Regional	86	10
South	42	Regional	74	11

3.34 The pollutants from three train types has been taken from the Network Rail – Reading Station Area Redevelopment ES – 2010 and originally sourced from the National Atmospheric Emissions Inventory (NAEI). The emission factors (gkm^{-1}) used in the modelling are:

Intercity: NO_X = 103.4 gkm^{-1}; PM_{10} = 8.42 gkm^{-1}

Regional: NO_X = 22 gkm^{-1}; PM_{10} = 0.122 gkm^{-1}

Freight: NO_X = 107.2 gkm^{-1}; PM_{10} = 5.0 gkm^{-1}

Background Concentrations of Air Pollutants

3.35 Background concentrations of air pollutants for the dispersion modelling were obtained from the UK National Air Quality Information Archive (DEFRA website), in accordance with Local Air Quality Management Technical Guidance TG(09). Data sets for 2011 were published by DEFRA in June 2014 and the 2014 background concentrations have been utilised for the impact assessment. **Table 3.11** identifies the background concentrations of NO_X, NO_2, PM_{10} and $PM_{2.5}$ used in the ADMS-Roads model.

3.36 Concentrations of Ozone (O_3) are recorded at the Cemetery Road automatic monitoring site as part of the Automatic Urban and rural Network (AURN). The concentrations of O_3 were obtained from the DEFRA website and were measured as 56.68 μgm^{-3} in 2013.

3.37 The background concentrations of NO_x are source apportioned enabling removal of different sources of NO_x to avoid double counting. Road traffic sources for the "Primary 'A' Roads" have been removed from the background concentrations of NO_x. Once removed, the resulting NO_2 concentrations need to be recalculated. This has been undertaken using the "NO_2 Background Sector Tool – for Source Apportioned Background NO_x".

Table 3.11 : Background pollutant concentrations for 2016 and 2021

Grid Reference	2016				2021			
	NO_x	***NO_2***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***NO_2***	***PM_{10}***	***$PM_{2.5}$***
X 471500, Y 174500	35.91	23.03	19.71	13.80	32.97	21.45	19.04	13.19
X 471500, Y 173500	33.08	21.65	19.37	13.47	31.08	20.54	18.65	12.81

4.0 BASELINE CONDITIONS

Air Quality Review and Assessment

4.1 As previously indicated, Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the NAQO. In areas where these objectives are unlikely to be achieved, local authorities must designate these areas as Air Quality Management Areas (AQMA's) and prepare a written Action Plan to achieve the NAQO.

4.2 The review of air quality takes on several prescribed stages, of which each stage is reported. The review and assessment of air quality is the responsibility of Reading Borough Council (RBC).

4.3 From the Annual Status Report undertaken in June 2017 by RBC, it can be seen that the development site is located in an AQMA. Refer to Appendix 2 for the Reading AQMA plan.

4.4 Six AQMAs were declared in 2006 for exceedance of annual average concentrations of NO_2. The AQMAs are located at Caversham Centre, Caversham Road (south of the railway line), George Street, Castle Hill, Southampton Street and Kings Road/London Road.

4.5 The six AQMAs were revoked in 2009 following a Further Assessment and a single AQMA was declared for exceedances of hourly and annual average concentrations of NO_2. The single AQMA covers the town centre, the railway lines and all the major roads within the Borough and extends approximately 100 metres either side of the roads and railway line.

Air Quality Monitoring

4.6 RBC currently operates two continuous monitoring sites within their administrative boundary, both of which are roadside. A third monitoring site measures background concentrations as part of the Automatic Urban and Rural Network (AURN). The monitoring sites are at Reading New Town (Cemetery Junction) (AURN), Caversham Road (RD1) and Oxford Road (RD3). The closest site, RD1, is approximately 840 metres from the eastern corner of the development site. RBC withdrew an automatic monitoring site at Kings Road (RD2) in February 2016.

4.7 RBC operates a network of non-automatic monitoring sites and at the end of 2016 there were 56 active sites monitoring NO_2 via diffusion tube (DT).

4.8 The closest DT to the development site is at 31a Vastern Road (Site ID – 59). There are three DTs (Site ID – 73, 74 and 75) at locations adjacent to the A4155 Caversham Road south east of the continuous monitor RD1 and they are all in the Reading AQMA. The four DTs and RD1 have been used to verify the ADMS model. Presented in **Table 4.1** are recorded concentrations of NO_2 available for 2012 to 2016 and where concentrations are at or above the NAQO level the cells have been shaded light grey.

Table 4.1: Measured Annual Mean NO_2 Concentrations (µg/m^3)

Site ID	Location	Within AQMA?	Annual mean concentrations (µg/m^3)				
			2012	*2013*	*2014*	*2015*	*2016*
RD1	A329 Caversham Rd	Y	47	43	41	42	39
59	31a Vastern Road	Y	40	38	40	36	37
73	131 Caversham Rd	Y	43	43	47	40	36
74	108 Caversham Rd	Y	41	43	48	41	41
75	197 Caversham Rd	Y	44	42	43	39	35

4.9 From Table 4.1 it can be seen that at RD1, annual mean concentrations of NO_2 were just above the NAQO level of 40 µgm^{-3} up to the end of 2015, with a drop in levels to 39 µgm^{-3} in 2016. Up to the end of 2014, concentrations adjacent to Caversham Road were also above the NAQO level for NO_2. However, in the last two years there has been a slight decrease in levels of NO_2except at DT 74 which has remained the constant.

4.10 Concentrations of PM_{10} are recorded at RD1 using Beta-Attenuation Mass (BAM) analysers and concentrations for the past five years have been 32 µgm^{-3} in 2012, 34 µgm^{-3} in 2013, 33 µgm^{-3} in 2014, 28 µgm^{-3} in 2015 and 20 µgm^{-3} in 2016. It should be noted that concentrations are below the current NAQO level of 40 µgm^{-3} for PM_{10} however they are not below the proposed NAQO level of 20 µgm^{-3} except in 2016 which was at that level

Dispersion Modelling – ADMS-Roads

4.11 The existing and future concentrations of pollutants within the assessment area for all scenarios have been modelled using the Atmospheric Dispersion Modelling System software ADMS-Roads (Version 4.1.1). The software is PC based and models the release of pollutants from road and industrial sources into the atmosphere.

4.12 ADMS-Roads is designed to allow the modelling of simple scenarios such as single carriageway roads up to complex scenarios such multiple lane roads and junctions. Allowance is made in the model for initial release of pollutants which are affected by vehicle wake, traffic induced turbulence and street canyons. Boundary layer structure based on the Monin-Obukhov length and the boundary layer height are incorporated in the model which allows for a realistic representation of the changing characteristics of dispersion with height.

4.13 Multiple road traffic sources were used in the model to represent the changing concentration of traffic, the different speeds of traffic and the changing road geometry. Also included were rail traffic sources representing the railway line to the south of the proposed site.

4.14 Meteorological data for 2015 was obtained from the MET Office. The best representative observation station for the development site is a weather station located in Farnborough. The MET data has been used for the verification of the model, base modelling and future years and a wind rose for 2015 is presented in **Appendix 3**.

4.15 Background pollutant concentrations for the kilometre squares covering the assessment area were obtained from the DEFRA website and the concentrations for 2016 and 2021 are presented in Table 3.11. Ozone is recorded in Reading at the AURN site and concentrations for 2013 have been used in the modelling.

4.16 Specific receptors were modelled at the development site, the continuous monitor RD1 and the DT 59, 73, 74, and 75. RD1 was modelled at 1.5 metres above ground level, the DTs were modelled at 2 metres above ground level and multiple heights above ground level were modelled within the development site.

4.17 Copies of the model inputs are available on request.

Model Verification

4.18 Model verification has been undertaken using the guidance provided in LAQM.TG(16). The process requires the comparison of the monitored roadside contribution of NO_2 with the modelled roadside contribution of NO_2.

4.19 Within the assessment area there is one automatic monitoring site and four diffusion tubes (refer to previous paragraphs). ADMS-Roads has been used to calculate NO_X, NO_2 and PM_{10} concentrations for 2013 which have been verified against the recorded NO_2 and NO_X levels at RD1, DT 59, 73, 74 and 75 for 2013. The results from the monitoring and the ADMS-Roads modelling are presented in **Table 4.2**.

Table 4.2: Comparison of the monitored (AMS and DT) and modelled (ADMS) concentrations of NO_2

Site ID	Monitor Type	Site Type	Site Description	Background NO_2	Monitored NO_2	Modelled NO_2	Difference [(monitored - modelled)/monitored] x100 (%)
RD1	AMS	R	Urban	24.63	43.49	40.84	-6.1
59	DT	R	Urban	24.63	38.21	39.05	2.2
73	DT	R	Urban	24.63	42.97	39.80	-7.4
74	DT	R	Urban	24.63	43.44	38.93	-10.4
75	DT	R	Urban	24.63	41.74	38.99	-6.6

4.20 It is evident from Table 4.2 that the dispersion modelling is under predicting the NO_2 concentrations at the AMS and at three of the four DT locations by an average of 6.2%. However, even though the majority of the modelled results are below the recorded concentrations, the modelled NO_2 concentrations are within 10% of the monitored NO_2 concentrations except at RD1 the AMS.

4.21 Within TG(16) there is guidance on how to apply an adjustment factor to the road contribution NO_X to reduce the inaccuracy of the results from the modelling. Using the TG(16) “Example 2”, the modelled road contribution NO_X is under predicting the contribution of NO_X to the overall contribution. Therefore a correction factor will need to be applied to the modelled road contribution NO_X to bring it to within comparable levels with the monitored data.

4.22 The calculated adjustment factor of 1.7635 which would be applied to the modelled road contribution NO_X results in the vicinity of the proposed development site. Presented in **Table 4.3** are the adjusted NO_2 concentrations.

Table 4.3: Comparison of the monitored (AMS and DT) and modelled (ADMS) ADJUSTED concentrations of NO_2

Site ID	Monitor Type	Site Type	Site Description	Background NO_2	Monitored NO_2	(ADJUSTED) Modelled NO_2	Difference [(monitored - modelled)/monitored] x100 (%)
RD1	AMS	R	Urban	24.63	43.49	47.67	9.62
59	DT	R	Urban	24.63	38.21	40.62	6.31
73	DT	R	Urban	24.63	42.97	43.53	1.31
74	DT	R	Urban	24.63	43.44	41.70	-4.00
75	DT	R	Urban	24.63	41.74	42.44	1.67

4.23 From Table 4.3 it can be seen that after the road contribution NO_X has been adjusted, the modelled results are higher than the measured concentrations by an average of 3.0%.

4.24 However, when the concentrations of NO_X are modelled for 2014 and the adjustment factor is applied to the road contribution NO_X the resulting NO_2 concentrations are above the monitored results for 2013 by an average of 22.7%. Therefore no adjustment factor has been applied to the road contribution NO_X.

Pollutant Concentrations

4.25 To characterise the air pollutant concentrations adjacent to the roads that would be affected by the proposed development traffic, predictions have been made at a sensitive receptor adjacent to the site and at the AMS and four DT for the base year 2016 using ADMS-Roads dispersion modelling. The locations of the receptors are illustrated on **Figure 4.1** and the results of the predictions are presented in **Table 4.4**.

Table 4.4: Predicted air quality concentrations at sensitive receptors 2016

Receptor Number and Name		NO_X	NO_2	PM_{10}	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
R1	22 The Lodge	71.82	43.37	25.12	12.69
RD1	Caversham Road	71.73	41.05	23.03	8.15
59	31a Vastern Road	64.68	40.97	25.12	12.69
73	131 Caversham Rd	56.67	37.72	21.90	6.14
74	108 Caversham Rd	63.78	39.80	22.73	7.59
75	197 Caversham Rd	53.53	36.13	21.57	5.60
NAQO	-	-	40	40	35

4.26 If the pollutant concentrations in Table 4.4 are compared to the NAQO, it can be seen that concentrations of NO_2 are predicted to be close to the NAQO level of 40 μgm^{-3}. However, the predicted concentrations of PM_{10} are well below the NAQO level of 40 μgm^{-3} and the number of days when the concentration of PM_{10} is greater than 50 μgm^{-3} is well below the Air Quality Objective level of 35 days.

5.0 AIR QUALITY ASSESSMENT

5.1 The assessment has been split into two parts, the potential "Impacts" of development generated traffic and construction activities and the "Constraints" on the development.

5.2 The "Impact" section of the assessment assesses whether development generated traffic flows on the highway network are likely to result in a significant change in annual mean concentration of NO_2 and PM_{10} at sensitive off-site receptors. Also assessed are the potential dust impacts and PM_{10} changes on sensitive receptors.

5.3 The "Constraints" part of the assessment compares the predicted concentration of NO_2 and PM_{10} within the development site against NAQO levels and assesses whether predicted levels within the site are above the objective levels.

Impacts

Dust Assessment: Predicted Construction Impacts

5.4 The main sources of dust and PM_{10} during construction activities are:

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

5.5 The majority of the releases are likely to occur during the typical "working-week". The construction impact assessment has been split into two sections. The first deals with the potential impacts from dust soiling and changes in PM_{10} concentrations due to on-site works and the second deals with the effect of emissions from construction traffic.

Dust soiling and changes in PM_{10} concentrations

5.6 The site will require demolition, earthworks, construction and trackout of vehicles associated with all phases of the Site. The resulting dust emission magnitudes are:

Demolition – **Medium** (Total site area between 2,500 m^2 and 10,000 m^2, moderately dusty soil type, 5-10 heavy earth moving vehicles active at any one time, total material moved 20,000 -100,000 tonnes),

Earthworks – **Medium -** Total site area between 2,500 m^2 and 10,000 m^2, moderately dusty soil type, 5-10 heavy earth moving vehicles active at any one time, total material moved 20,000 - 100,000 tonnes),

Construction – **Large** (Total building volume is greater than 100,000 m^3, on site concrete batching),

Trackout – **Medium** (10-50 HGV outward movements in any one day, moderately dusty surface material).

5.7 Using the information presented in Section 3 and the criteria presented in Table 3.1, Table 3.2 and Table 3.3, the sensitivity of the construction for the proposed development can be defined. The results of defining the sensitivity of the area are presented in **Table 5.1**.

Table 5.1: Outcome of Defining the Sensitivity of an Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	***Earthworks***	***Construction***	***Trackout***
Dust Soiling	Low	Low	Low	Low
Human Health	Medium	Medium	Medium	Low
Ecological	Negligible	Negligible	Negligible	Negligible

5.8 From Table 5.1 it can be seen that the predicted sensitivity of the surrounding area to dust soiling is “Low” during the demolition, earthworks, construction, and trackout phases. The sensitivity of the surrounding area to changes in PM_{10} affecting human health is “Medium” during the demolition, earthworks and construction and “Low” during the trackout phase. As there are no ecological receptors within 50m of the development, the predicted sensitivity impact is “Negligible”.

5.9 The dust emission magnitude determined in paragraph 5.6 is combined with the sensitivity of the area summarised in Table 5.1 to determine the risk of impacts with no mitigation applied. The risk of impacts are summarised in **Table 5.2**.

Table 5.2: Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	***Earthworks***	***Construction***	***Trackout***
Dust Soiling	Low Risk	Low Risk	Medium Risk	Low Risk
Human Health	Medium Risk	Medium Risk	Medium Risk	Low Risk
Ecological	Negligible	Negligible	Negligible	Negligible

5.10 During the Demolition and Earthworks phases of development, there is a Low Risk of annoyance caused by dust soiling and a medium risk of health effects due to increase exposure in PM_{10}.

5.11 During the Construction phase of development, it has been assessed that there is a Medium Risk of potential annoyance to people and property caused by dust soiling and a Medium Risk of health effects due to an increase exposure in PM_{10}. Therefore, mitigation may be required.

5.12 Throughout the Trackout processes, there is a Low Risk of dust soiling and human health effects due to an increase exposure in PM_{10}.

5.13 For those cases where the risk category is Negligible (i.e. ecological), no specific mitigation measures is required beyond specific legislation.

Predicted Operational Impacts

5.14 The air quality impact of the proposed development on the surrounding area has been assessed by considering the changes in traffic flows which will occur on the existing highway network with the development in place.

5.15 Potential impacts from the proposed development would occur following the completion of the proposed development in 2021. Therefore, the year of assessment is 2021 “do nothing” and “do something”. For this development a Transport Assessment (TA) has been undertaken and part of the assessment was the collection and analysis of road traffic data from manual classified traffic counts (MCC), automated traffic counts (ATC), and the proposed development (Thames Quarter).

Traffic Generation –2021 with development

5.16 Road traffic data for the opening year of Reading Train Station improvements on the local highway network has been provided partially by Peter Brett Associates via Reading Borough Council. The remaining traffic data was collected using permanent ATC on A329 Forbury Road, A329 Caversham Road and the A4155 Caversham Road. The "Base" traffic flows have been growthed using TEMPRO and NTM, which takes into account traffic from Committed Development projects. Development generated traffic has then been added to the 2021 traffic flows and a summary is presented in **Table 5.3**.

Table 5.3: Changes in traffic flow "with" and "without" the development in 2021

Link	2021 "do nothing"		2021 "do something"		Change	
	AADT	%HGV	AADT	%HGV	Number	%
King's Meadow Road/Napier Road	8546	2.0	9830	1.7	1284	15.0
B3345 George Street (Reading Bridge)	39017	2.5	39036	2.5	19	0.0
A329 Vastern Road (E of Reading Bridge Roundabout)	44970	4.5	45550	4.4	580	1.3
A329 Vastern Road (under the railway line)	46016	4.8	46701	4.7	685	1.5
A329 Forbury Road	27245	2.4	27930	2.3	685	2.5
Forbury Road	11098	9.3	11098	9.3	0	0.0
A329 Vastern Road (Caversham Rd Rounbabout)	52818	5.0	53398	4.9	580	1.1
A329 Caversham Road	38865	4.7	39243	4.6	379	1.0
A4255 Caversham Road	31161	4.2	31362	4.2	201	0.6
Richfield Avenue	31775	2.0	31865	2.0	90	0.3
Caversham Bridge	51925	2.0	52036	2.0	111	0.2

5.17 From Table 5.3 it can be seen that, with the completion of the development, there is predicted to be an increase of between 0.0% and 15.0% in 24 hour traffic flows along the links within the assessment area. The greatest predicted change in traffic flows are on Napier Road and King's Meadow Road.

Background Concentrations – 2021

5.18 From Table 4.1, it can be seen that although there has been a slight reduction in measured concentrations of NO_2 in the past five years it is not considered significant enough to warrant using DEFRA future concentrations in the modelling. Therefore, the background concentrations in NO_X, NO_2 and PM_{10} for 2016 have been used for the future 2021 assessment of NO_X, NO_2 and PM_{10}.

Screening Assessment – 2021 with development

5.19 Sensitive receptors adjacent to the development site and where there is predicted to be an impact from the development have been assessed for the two scenarios, "do nothing" and "do something". The results from the assessment are presented in **Table 5.4** and **Table 5.5**.

Table 5.4: Predicted air quality concentrations at sensitive receptors in 2021 "do nothing"

Receptor Number and Name		NO_X	NO_2	PM_{10}	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
R1	22 The Lodge	57.17	37.57	25.09	12.62
RD1	Cont. mon.	52.50	36.18	22.94	7.98
59	31a Vastern Road	49.42	34.59	25.09	12.62
73	131 Caversham Rd	69.93	42.59	21.82	6.01
74	108 Caversham Road	59.05	38.98	22.62	7.38
75	197 Caversham Rd	61.25	37.68	21.49	5.48
NAQO	-	-	40	40	35

Table 5.5: Predicted air quality concentrations at sensitive receptors in 2021 "do something"

Receptor Number and Name		NO_X	NO_2	PM_{10}	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
R1	22 The Lodge	57.23	37.59	25.14	12.72
RD1	Cont. mon.	52.54	36.19	22.80	7.73
59	31a Vastern Road	49.46	34.60	22.96	8.01
73	131 Caversham Rd	70.12	42.66	21.83	6.02
74	108 Caversham Road	59.13	39.01	22.63	7.40
75	197 Caversham Rd	61.34	37.71	21.50	5.49
NAQO	-	-	40	40	35

5.20 Presented in **Table 5.6** are the predicted change in concentrations of NO_2 and PM_{10} and the change in the number of days where concentrations of PM_{10} are greater than 50 μgm^{-3}.

Table 5.6: Predicted change in air quality concentrations at sensitive receptors in 2021 "do something"

Receptor Number and Name		NO_x		NO_2		PM_{10}			
		Change in annual mean μgm^{-3} (%)		Change in annual mean μgm^{-3} (%)		Change in annual mean μgm^{-3} (%)		Change in days >50 μgm^{-3} (%)	
R1	22 The Lodge	0.19	(0.27)	0.06	(0.14)	0.01	(0.05)	0.01	(0.17)
RD1	Cont. mon.	0.09	(0.15)	0.03	(0.08)	0.01	(0.05)	0.01	(0.18)
59	31a Vastern Road	0.08	(0.14)	0.03	(0.08)	0.01	(0.04)	0.02	(0.27)
73	131 Caversham Rd	0.04	(0.08)	0.02	(0.06)	0.01	(0.04)	0.02	(0.26)
74	108 Caversham Road	0.07	(0.12)	0.02	(0.05)	0.04	(0.16)	0.10	(0.79)
75	197 Caversham Rd	0.04	(0.08)	0.01	(0.03)	0.02	(0.09)	0.03	(0.38)

5.21 From Table 5.6 it can be seen that changes in concentration of NO_2 are predicted to be 0.06 μgm^{-3} or less and changes in concentration of PM_{10} are predicted to be 0.04 μgm^{-3} or less. It can also be seen that the change in the number of days where the concentration of PM_{10} is predicted to be more than 50 μgm^{-3} will be 0.10 days or less.

Magnitude of Change – 2021 with development

5.22 Comparing the results in Table 5.6 with the magnitude of change in Table 3.7 it can be seen that all the receptors are predicted to experience a change in annual mean NO_2 concentrations which is "Imperceptible" (<0.4 ∝gm^{-3}).

5.23 It can also be seen that all the receptors are predicted to experience an increase in annual mean PM_{10} concentrations which is "Imperceptible" (<0.4 ∝gm^{-3}) and an "Imperceptible" (<1 day) increase in the number of days where PM_{10} levels are greater than 50 ∝gm^{-3}.

"Significance" of Change – 2021 with development

5.24 The "Significance" of the predicted changes in NO_2 and PM_{10} annual mean concentrations are presented in **Table 5.7**.

Table 5.7: NO_2 – Significance of change in annual mean concentrations following the completion of the proposed development in 2021

Receptor Number and Name		NO_2		
		Change in annual mean (μgm^{-3})	Magnitude of change	"Significance" of change
R1	22 The Lodge	0.06	Imperceptible	Negligible
RD1	Cont. mon.	0.03	Imperceptible	Negligible
59	31a Vastern Road	0.03	Imperceptible	Negligible
73	131 Caversham Rd	0.02	Imperceptible	Negligible
74	108 Caversham Road	0.02	Imperceptible	Negligible
75	197 Caversham Rd	0.01	Imperceptible	Negligible

5.25 With reference to the overall concentration of NO_2 presented in Table 5.5 being close to the NAQO level of 40 μgm^{-3} and the magnitude of change being "Imperceptible" the "Significance" of change in NO_2 concentrations is considered "Negligible".

Table 5.8: PM_{10} – Significance of change in annual mean concentrations following the completion of the proposed development in 2021

Receptor Number and Name		PM_{10}		
		Change in annual mean (μgm^{-3})	Magnitude of change	"Significance" of change
R1	22 The Lodge	0.01	Imperceptible	Negligible
RD1	Cont. mon.	0.01	Imperceptible	Negligible
59	31a Vastern Road	0.01	Imperceptible	Negligible
73	131 Caversham Rd	0.01	Imperceptible	Negligible
74	108 Caversham Road	0.04	Imperceptible	Negligible
75	197 Caversham Rd	0.02	Imperceptible	Negligible

5.26 With reference to the overall concentrations of PM_{10} presented in Table 5.5 being well below the objective level of 40 μgm^{-3} and the magnitude of change presented in Table 5.8 being "Imperceptible", the "Significance" of change in PM_{10} concentration is considered to be "Negligible".

Constraints

5.27 The concentrations of NO_2 and PM_{10} have been modelled within the development site using ADMS-Roads. Sources include the adjacent highway network and the railway line to the south of the site. The railway line has been modelled as an elevated source due to the railway tracks being on embankment. The same parameters used in the model for the verification of the model have been used in the modelling of the concentrations in the site.

5.28 Proposals for the development are for a multi-storey building consisting of ground and first floor level parking, a third floor roof terrace. All the proposed residential dwellings are located 5m and above ground level.

5.29 Six different heights have been modelled at the development site. The first height is one metre above ground level and represents the modelled concentrations at head height. The second height is five metres above ground level and represents the first level of apartments. The third height is 12 metres above ground level and represents the receptor height at the 3rd floor terrace. The fourth height modelled is 25 metres above ground level and represents the recommended minimum height for air inlets. The fifth height modelled is 35 metres above ground level (level 11) and represents the principal resident's

amenity terrace. The final height is 70m above ground, and represents the top of the building.

5.30 The results from the ADMS-Roads model are presented in **Appendix 4** as contour plots for the six heights.

5.31 At ground level the main contributing source is from road traffic on the A329 Vastern Road (under bridge) and to a lesser extent King's Meadow Road and the Vastern Road Roundabout. Concentrations of NO_2 are approximately 48 μgm^{-3} at the western site boundary and decrease steadily in an easterly direction across the site.

5.32 5 metres above ground level, at the first level of apartments, concentrations are predicted to be between 46 - 48 μgm^{-3} across the development site.

5.33 12 metres above ground level, at the representative level of the 3rd floor roof terrace, concentrations of NO_2 are predicted to be between 44 and 46 μgm^{-3} across the development site. With the electrification of the Great Western Railway Line, NO_2 levels at this height are expected to be well below the NAQO levels.

5.34 25 metres above ground level, concentrations of NO_2 are predicted to be between 34 - 36 μgm^{-3} across the development site.

5.35 35 metres above ground level, at the principal residents' amenity terrace, concentrations of NO_2 are predicted to be 32 μgm^{-3}.

5.36 70 metres above ground level, concentrations of NO_2 are predicted to be 28 μgm^{-3}.

5.37 As previously mentioned, NO_x emissions in the local area are expected to significantly decrease as a result of the electrification of the Great Western Main Line, and the associated introduction of a new fleet of electrified trains in 2019. However, due to the significant variabilities involved in the electrification project, it was not deemed appropriate to attempt to predict and quantify the associated air quality benefits of the project. In any case, whilst air quality levels are expected to be below NAQO levels at 12 metres above ground level at the year of opening, the assessment has assumed no benefit arising from the electrification project to assess a worst-case scenario.

5.38 In summary, concentrations of NO_2 are predicted to be above the NAQO of 40 μgm^{-3} up to a height of 25 metres within the development site. Mitigation projects are explored in Chapter 6 of the Assessment.

5.39 The main amenity terrace on level 11 enjoys low levels of air pollutant concentrations. The proposals have been incorporated so that residents of the proposed development will benefit from the excellent air quality at that height.

6.0 MITIGATION

Construction Phase

6.1 Monitoring during the construction phase should be considered in the management of operations to ensure that the nuisance thresholds are not exceeded at nearby sensitive locations. However, it is important to note that such limits are subjective (as “nuisance” caused by dust does not currently have a statutory limit applied to it).

6.2 Monitoring of dust could be achieved using a variety of sampling techniques, for example deposit (“Frisbee”) gauges, glass slides or high-volume air samplers located around the site perimeter and at the sensitive locations up to 400 metres from the site boundary.

6.3 In addition, there are a number of Best Practice mitigation measures that can be used by contractors to ensure that the impacts experienced in close proximity to the construction site are minimal. Sample mitigation:

6.4 Specific to demolition:

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

6.5 Effective site planning:

Erect solid barriers to site boundary;
Dust generating activities to be located away from sensitive receptors;
All site personnel will be fully trained;
There will be a trained and responsible manager on site during working times to maintain a logbook and carry out site inspections
There will be no run off of mud or water from the site;
Relevant legislation and guidance will be adhered to; and

6.6 Construction Traffic

All vehicles to switch off engines (no idling);

On road vehicles will comply to set emission standards;

Effective vehicle cleaning and specific wheel-washing on leaving site;

All loads entering site must be covered;

All non-road mobile machinery (NRMM) should use ultra-low sulphur diesel where available; and

6.7 Site Activities

Minimise dust generating activities where possible;

Use water as a dust suppressant where applicable;

Stockpiles will be covered, enclosed, seeded or kept them sheeted; and

If applicable, any concrete crushers/batchers will have the required permits.

6.8 It is recommended that liaison with Reading Borough Council Environmental Health Department be maintained throughout the construction process. In addition, the main contractor should nominate a representative (possibly the site manager) to act as a point of contact with the Council, the construction team and the local community to ensure that any air quality related issues that occur during the construction period can be dealt with efficiently, effectively and promptly.

6.9 All other site sub-contractors should also nominate or appoint a suitable team member responsible for liaison with the lead contractor's representative and to ensure that sub-contractor construction activities are managed effectively.

6.10 Details of the proposed methodology for achieving this and procedures to follow should be set out in a Construction Environmental Management Plan (CEMP). This would be held on-site and would include relevant contact names, details, lines of communication and mitigation action plans. The document should be available to all site personnel who should be made aware of its existence and provide an undertaking that they will adhere to the guidance provided therein.

6.11 The mitigation of PM_{10} releases due to material disturbance will be achieved in the same manner as the control of dust releases. By achieving effective control of sources of dust release, PM_{10} releases can be minimized.

6.12 The most effective control of particulate releases from site plant will be achieved by ensuring that it is maintained in good working order, and is of the appropriate capacity and specification for the job being carried out. It should also be located away from the site perimeter, thereby maximizing the distance between source and receptor.

6.13 There may be occasions where breakdown of site plant could cause short-term releases of excess particulate matter (smoke) and odour. Short-term releases may also occur during start up (of diesel engines, etc). Regular visual checks and routine maintenance should be applied in accordance with the plant specification, to ensure that these releases are minimised. Faulty site plant should be decommissioned until repairs have been carried out and have been tested and found to be operating satisfactorily.

6.14 Detailed mitigation measures to control construction traffic should be discussed with officers from Reading Borough Council, in order to establish the most suitable access routes for the site traffic and service vehicles. The most effective mitigation will be achieved by ensuring that construction traffic vehicles are kept clean and sheeted when on public highways (through the use of wheel washers) and avoid using sensitive roads. Timing of large-scale vehicle movements to avoid peak hours on the local road network would also be beneficial. Clear signposting to the site access for construction traffic should also be provided and direct traffic along routes agreed with the Council.

6.15 Early morning delivery vehicles, which may arrive prior to the site opening, should be prevented from waiting on the approach roads to the site. If site deliveries arrive prior to the site opening, they should wait at a suitable location, and if possible, turn the engine off.

6.16 With the implementation of the appropriate mitigation measures detailed above, but not restricted to the information detailed above, the residual effects will normally be “Not Significant”.

Mitigation: Operational Phase

6.17 Taking into account that recorded concentrations of NO_2 have not decreased significantly over the past five years (refer to Table 4.1), concentrations of NO_2 for the base year 2016 (refer to Table 4.4) are predicted to be around the NAQO level of 40 μgm^{-3}. Concentrations of PM_{10} are predicted to be below the NAQO level of 40 μgm^{-3}.

6.18 "Negligible" increases in NO_2 concentrations and "Negligible" increases in PM_{10} concentrations are predicted due to development generated traffic following the completion of the development. Therefore no mitigation at sensitive receptors is proposed due to development generated traffic.

6.19 Within the development site concentrations of NO_2 are predicted to be above the NAQO level of 40 μgm^{-3} up to a height of 25 metres. However, concentrations of PM_{10} are predicted to be below the NAQO level of 40 μgm^{-3}. Therefore, to protect future residents against elevate levels of NO_2, a commensurate level of mitigation is required.

6.20 Mitigating the pollutant at source is not practicable, however where the use of Mechanical Ventilation and Heat Recovery (MVHR) is proposed the air inlets will have to be at sufficient height to provide "clean" are to the apartments. The results from the modelling indicate that the inlets would need to be above 25 metres above ground level.

6.21 Mechanical Ventilation and Heat Recovery systems and trickle vents offer mitigation solutions for the operational phase. A well designed mechanical ventilation system can provide clean and fresh air.

6.22 Passive ventilation will be provided for the car park, which will provide fresh natural air flow. As a result of the directional south-westerly winds, inlets should be on the southern façade of the development.

6.23 As discussed in Section 5.36 and Appendix 4, the main resident's amenity terrace located on level 11 is at a height which will benefit from excellent air quality concentrations. Therefore, no mitigation is proposed for this roof terrace.

6.24 With regards to the level 3 roof terraces, passive ventilation for the car park can be extended to these terraces. Acoustic air louvre vents and grills should be placed next to the acoustic barrier on the terrace boundary to extract stale air. The supply and the extract of the air should be monitored. All inlets and extracts from the passive ventilation system should be cleaned and well maintained.

6.25 The electrification of the Great Western Main Line will significantly improve air quality at the Thames Quarter development by 2019. The majority of trains passing the proposed development site will not emit diesel, significantly reducing NO_x emissions and NO_2 levels to well below NAQO levels at 12m at the proposed development. Therefore, whilst the assessment has undertaken a worst-case scenario, it should be reiterated that air quality at the year of opening is anticipated to significantly improve.

7.0 SUMMARY AND CONCLUSIONS

7.1 Stuart Michael Associates has been engaged by Lochailort Reading Limited to undertake an air quality assessment at the proposed development site adjacent to King's Meadow Road, Reading.

7.2 The assessment has been undertaken to demonstrate the impact on concentrations of NO_2 and PM_{10} at sensitive receptors as a result of development generated traffic. Annual average concentrations have been compared to the National Air Quality Objective Levels and the magnitude and significance of change has also been assessed against national guidelines.

7.3 Constraints on development have been assessed using background concentrations, existing and future emissions from road and rail traffic at the proposed development site.

7.4 Also assessed are the likely impacts from the construction of the development. The impact assessment has been undertaken using the method detailed in the Institute of Air Quality Management (IAQM) publication "Guidance on the assessment of dust from demolition and construction" (2014).

7.5 Concentrations of NO_2 and PM_{10} at four diffusion tube (DT) sites (59, 73, 74 and 75) and the Caversham Road (RD1) automatic monitoring site (AMS) within the Reading AQMA have been assessed using ADMS-Roads. The 2013 NO_2 concentrations from RD1, DT 59, 73, 74 and 75 have been used to verify the results from the modelling.

7.6 Background concentrations for the future year assessments (2021) have been kept the same as the base year (2016) assessment. The reason for using the base year background concentrations is due to recorded local concentrations of NO_2 not decreasing significantly as predicted over the past five years, and a worst case scenario has therefore been modelled.

7.7 Base concentrations have been calculated for 2016 and two scenarios have been assessed for the future year 2021. The first is a "Do Nothing" scenario with committed development generated traffic but no development generated traffic and the second scenario is "Do Something" with committed development generated traffic and development generated traffic. The two scenarios have been assessed to gauge the magnitude of change in concentrations NO_2 and PM_{10} and the significance of those changes.

7.8 Road traffic data has been obtained from Reading Borough Council and permanent ATC sites within the assessment area. Future traffic flows have been determined by adding Committed Development to the base year 2016 to obtain the future year 2021. Development generated traffic has been obtained from the Transport Assessment produced by SMA.

7.9 Following the completion of the development, there is predicted to be an increase of between 0.0% and 15.0% (worst-case scenario) in 24 hour traffic flows along the links within the assessment area.

7.10 The concentrations of NO_2 in 2021 are predicted to be just below the objective level of 40 μgm^{-3}. The magnitude of change in annual mean concentrations at all the receptors due to development generated traffic is predicted to be "Imperceptible". Therefore the "Significance" of change is considered to be "Negligible".

7.11 Concentrations of PM_{10} are predicted to be below the objective level of 40 μgm^{-3} at the receptor locations and the magnitude of change due to development generated traffic is "Imperceptible". Therefore, the significance is considered "Negligible".

7.12 From the construction dust assessment: during the Demolition and Earthworks phases of development, there is a "Low Risk" of annoyance caused by dust soiling and a "Medium Risk" of health effects due to increase exposure in PM_{10}.

7.13 During the Construction phase of development, it has been assessed that there is a "Medium Risk" of potential annoyance to people and property caused by dust soiling and a "Medium Risk" of health effects due to an increase exposure in PM_{10}. Therefore, mitigation may be required. Throughout the Trackout processes, there is a "Low Risk" of dust soiling and human health effects due to an increase exposure in PM_{10}.

7.14 For those cases where the risk category is Negligible (i.e. ecological), no specific mitigation measures is required beyond specific legislation.

7.15 Within the development site concentrations of NO_2 are predicted to be above the NAQO levels 40 μgm^{-3} and mitigation measures are proposed.

7.16 Mitigating the pollutant at source is not practicable, however where the use of Mechanical Ventilation and Heat Recovery (MVHR) is proposed the air inlets will have to be at sufficient height to provide “clean” are to the apartments. The results from the modelling indicate that the inlets should be a minimum of 25 metres above ground level. As the electrification of the Great Western Main Line is predicted to significantly improve air quality in Reading by 2019, the 25 metre height for the air inlets provides mitigation for a worst case scenario.

7.17 Passive ventilation will be provided for the car park, which will provide fresh natural air flow. As a result of the directional south-westerly winds, inlets should be on the southern façade of the development.

7.18 The proposals incorporate the main amenity roof terrace on level 11 of the development. This roof terrace will benefit from excellent air quality as a result of its height and location.

7.19 With regards to the level 3 roof terrace, passive ventilation for the car park can be extended to the roof terrace. With supplementary air flow, the electrification of the rail network, and the intrinsic nature of a green roof terrace, good air quality is predicted within the level 3 roof terrace.

7.20 Based on the worst-case results of the AQA, it has been concluded that with appropriate mitigation, air quality concentrations are acceptable for future residents of the proposed Thames Quarter development. Moreover, the impact of development on local sensitive receptors is predicted to be negligible during both construction and operational phases.

7.21 Therefore, in terms of the planning application, the proposed Thames Quarter development is acceptable from an air quality perspective.

FIGURES

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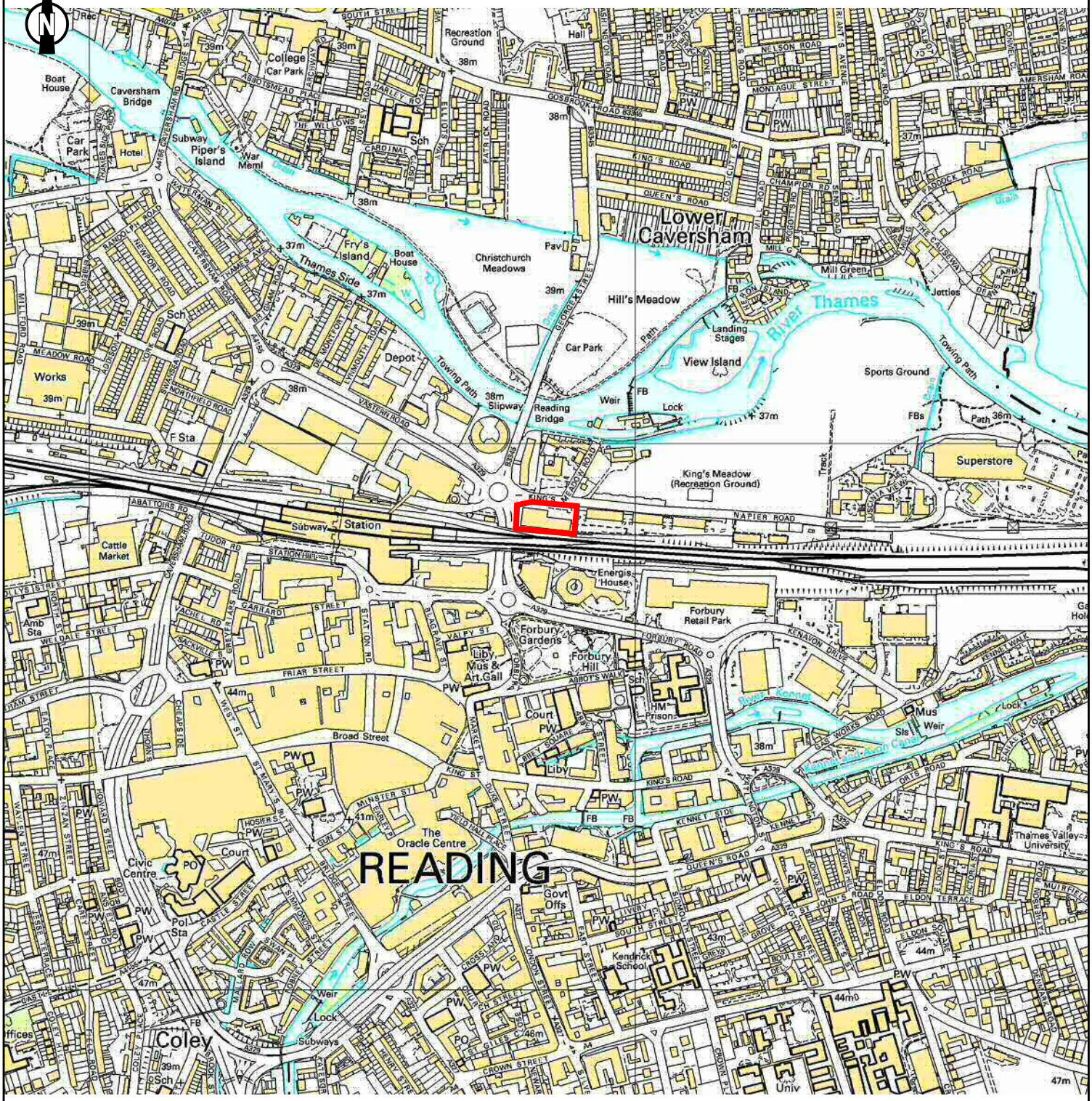

Legend

Site Boundary

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JOB TITLE
Thames Quarter, Reading

DRAWING TITLE
SITE LOCATION PLAN

FIGURE 1.1

SCALE:
NTS @ A4

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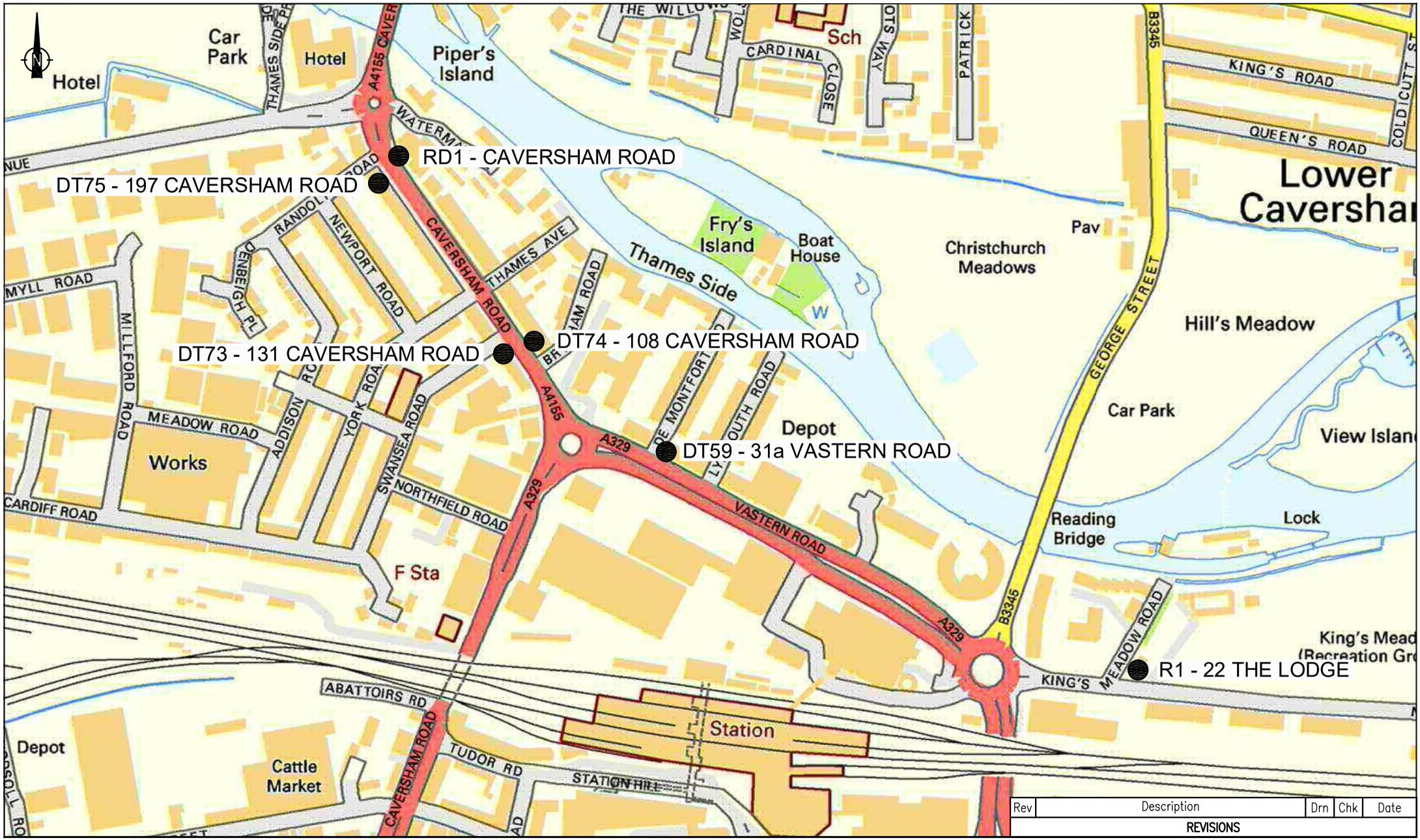

Rev	Description	Drn	Chk	Date
	REVISIONS			

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LOCHAILORT DEVELOPMENTS LIMITED

JOB TITLE
THAMES QUARTER
READING

DRAWING TITLE
RECEPTOR LOCATION PLAN

DATE	DRAWN	CHECKED	ISSUE CHECKBOX
NOVEMBER 2016	WAH	SWA	

DRAWING No.	REV.	SCALE
FIGURE 4.1	.	NTS @ A4

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Appendix 1 – National Air Quality Objectives

APPENDIX 1

National air quality objectives and European Directive limit and target values for the protection of human health						
Pollutant	Applies	Objective	Concentration measured as [10]	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved (by and maintained thereafter)
Particles (PM_{10})	UK	50 µg/m³ not to be exceeded more than 35 times a year	24 hour mean	31 December 2004	50 µg/m³ not to be exceeded more than 35 times a year	1 January 2005
	UK	40 µg/m³	annual mean	31 December 2004	40 µg/m³	1 January 2005
	Indicative 2010 objectives for PM_{10} (from the 2000 strategy and Addendum) have been replaced by an exposure reduction approach for $PM_{2.5}$ (except in Scotland – see below)					
	Scotland	50 µg/m³ not to be exceeded more than 7 times a year	24 hour mean	31 December 2010	50 µg/m³ not to be exceeded more than 35 times a year	1 January 2005
	Scotland	18 µg/m³	annual mean	31 December 2010	40 µg/m³	1 January 2005
Particles ($PM_{2.5}$) Exposure Reduction	UK (except Scotland)	25 µg/m³	annual mean	2020	Target value – 25 µg/m³	2010
	Scotland	10 µg/m³		31 December 2020	Limit value – 25 µg/m³	1 January 2015
	UK urban areas	Target of 15% reduction in concentrations at urban background		Between 2010 and 2020	Target of 20% reduction in concentrations at urban background.	Between 2010 and 2020

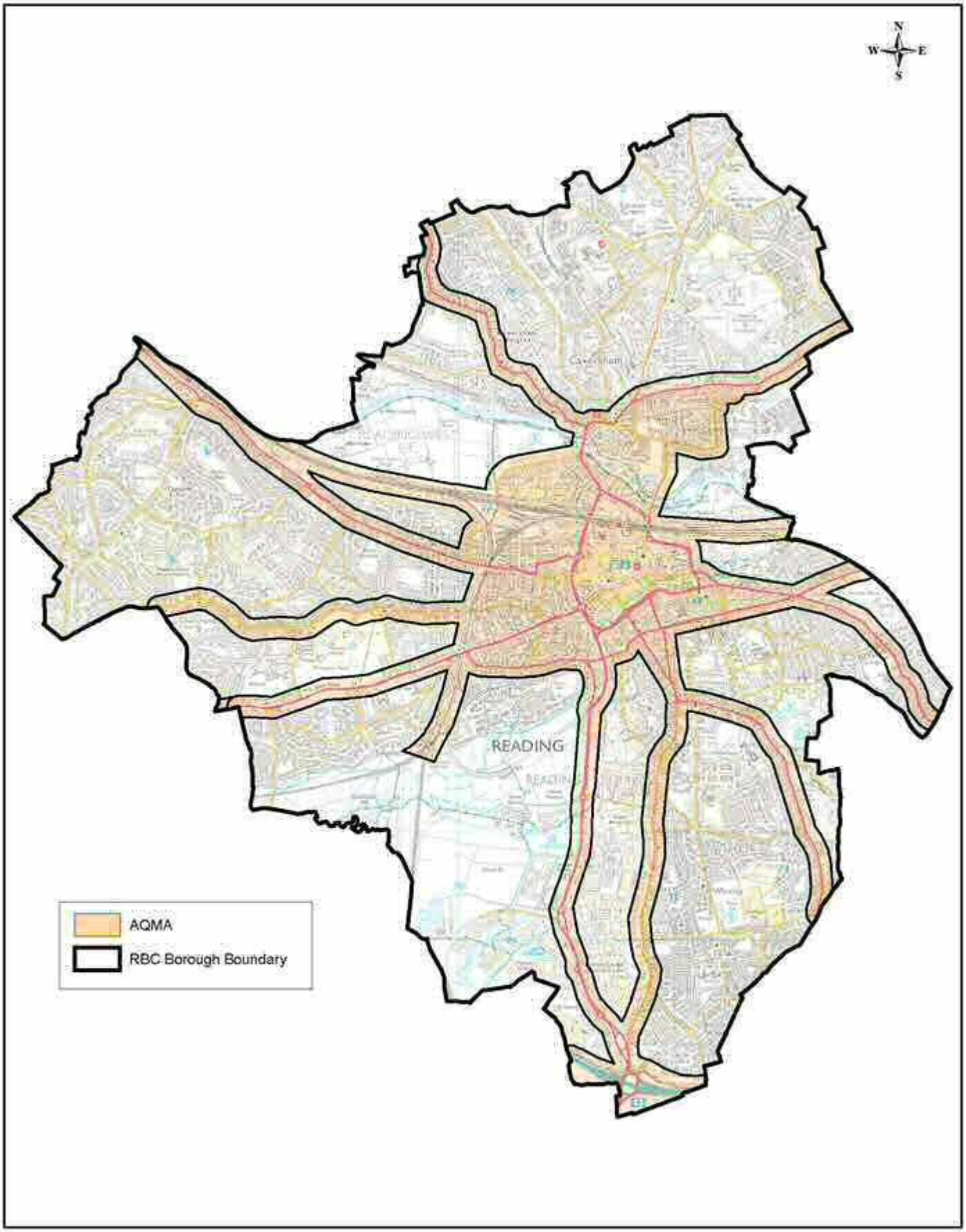
National air quality objectives and European Directive limit and target values for the protection of human health						
Pollutant	Applies	Objective	Concentration measured as[1]	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)
Nitrogen dioxide	UK	200 µg/m^3 not to be exceeded more than 18 times a year	1 hour mean	31 December 2005	200 µg/m^3 not to be exceeded more than 18 times a year	1 January 2010
	UK	40 µg/m^3	annual mean	31 December 2005	40 µg/m^3	1 January 2010
Ozone	UK	100 µg/m^3 not to be exceeded more than 10 times a year	8 hour mean	31 December 2005	Target of 120 µg/m^3 not to be exceeded by more than 25 times a year averaged over 3 years	31 December 2010
Sulphur dioxide	UK	266 µg/m^3 not to be exceeded more than 35 times a year	15 minute mean	31 December 2005	–	–
	UK	350 µg/m^3 not to be exceeded more than 24 times a year	1 hour mean	31 December 2004	350 µg/m^3 not to be exceeded more than 24 times a year	1 January 2005
	UK	125 µg/m^3 not to be exceeded more than 3 times a year	24 hour mean	31 December 2004	125 µg/m^3 not to be exceeded more than 3 times a year	1 January 2005
Polycyclic Aromatic Hydrocarbons	UK	0.25 ng/m^3 B[a]P	as annual average	31 December 2012	1.0 ng/m^3	31 December 2012

National air quality objectives and European Directive limit and target values for the protection of human health						
Pollutant	Applies	Objective	Concentration measured as[1]	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)
Benzene	UK	16.25 µg/m^3	running annual mean	31 December 2003	–	–
	England and Wales	5 µg/m^3	annual average	31 December 2010	5 µg/m^3	1 January 2010
	Scotland, Northern Ireland	3.25 µg/m^3	running annual mean	31 December 2010	–	–
1,3-butadiene	UK	2.25 µg/m^3	running annual mean	31 December 2003	–	–
Carbon monoxide	UK	10 mg/m^3	maximum daily running 8 hour mean/in Scotland as running 8 hour mean	31 December 2003	10 mg/m^3	1 January 2005
Lead	UK	0.5 µg/m^3	annual mean	31 December 2004	0.5 µg/m^3	1 January 2005
		0.25 µg/m^3	annual mean	31 December 2008	–	–

National air quality objectives and European Directive limit and target values for the protection of vegetation and ecosystems						
Pollutant	Applies	Objective	Concentration measured as[1]	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)
Nitrogen oxides	UK	30 µg/m^3	annual mean	31 December 2000	30 µg/m^3	19 July 2001
Sulphur dioxide	UK	20 µg/m^3	annual mean	31 December 2000	20 µg/m^3	19 July 2001
	UK	20 µg/m^3	winter average	31 December 2000	20 µg/m^3	19 July 2001
Ozone: protection of vegetation and ecosystems	UK	Target value of 18,000 µg/m^3 based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	1 January 2010	Target value of 18,000 µg/m^3 based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	1 January 2010

Appendix 2 – Reading AQMA

APPENDIX 2



Title: **Reading Air Quality Management Area**

Reading BOROUGH COUNCIL

Drg.No.: Date: 29/04/2009 Scale at A3: 1:32000

Produced by GIS & Mapping Services Ref: G:\AQMA A3.WOR

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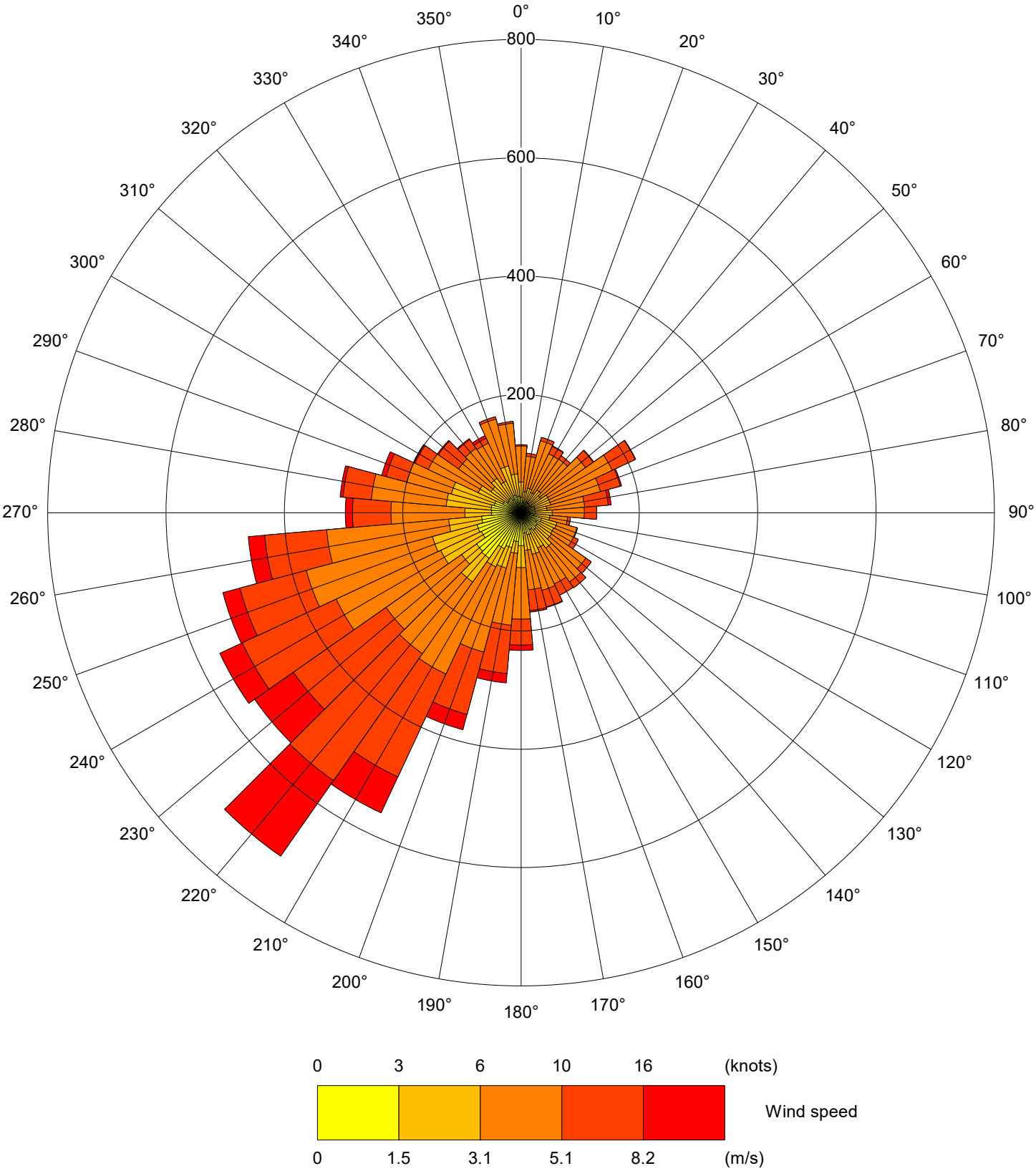
Appendix 3 - Wind Rose 2015 - Farnborough

APPENDIX 3

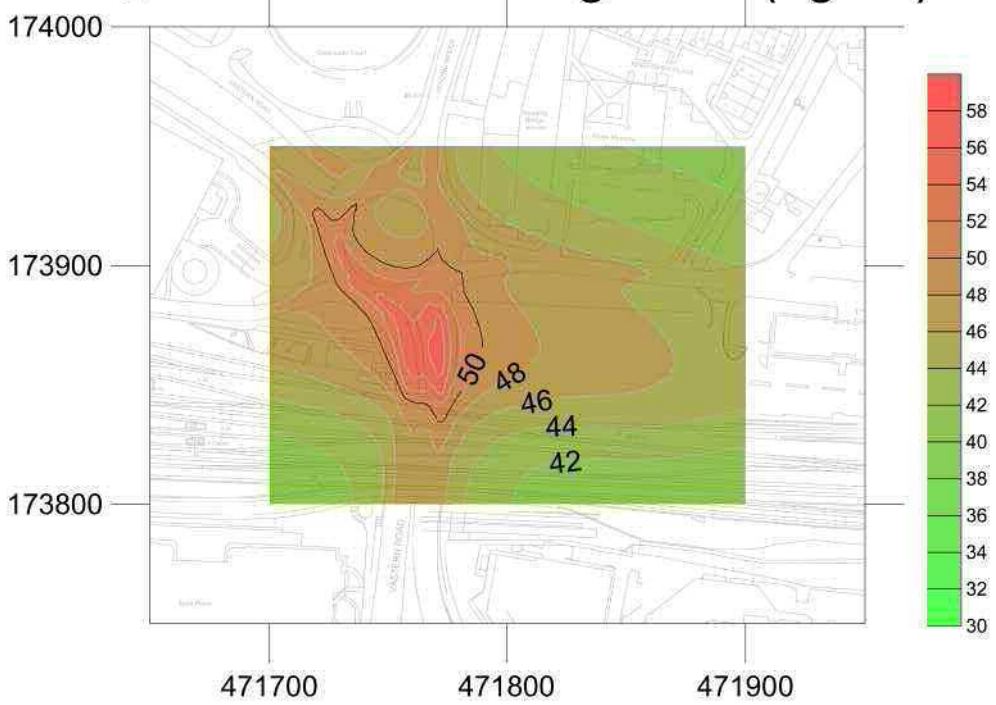
Appendix 3 - Farnborough Wind Rose - 2015



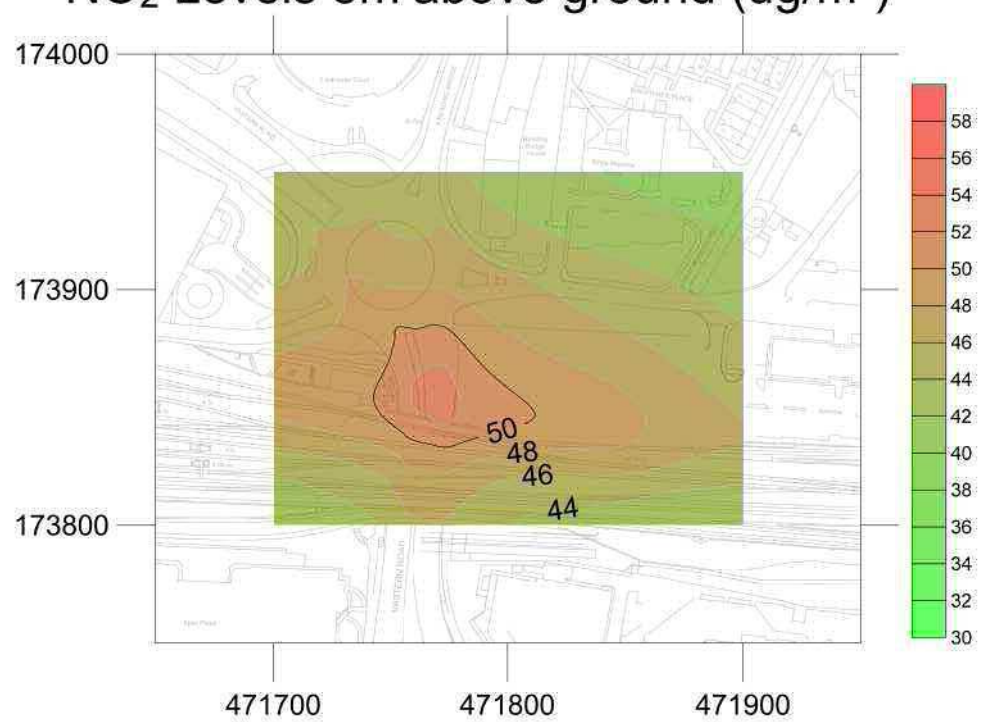
Appendix 4 – NO2 Concentrations at Different Heights

APPENDIX 4

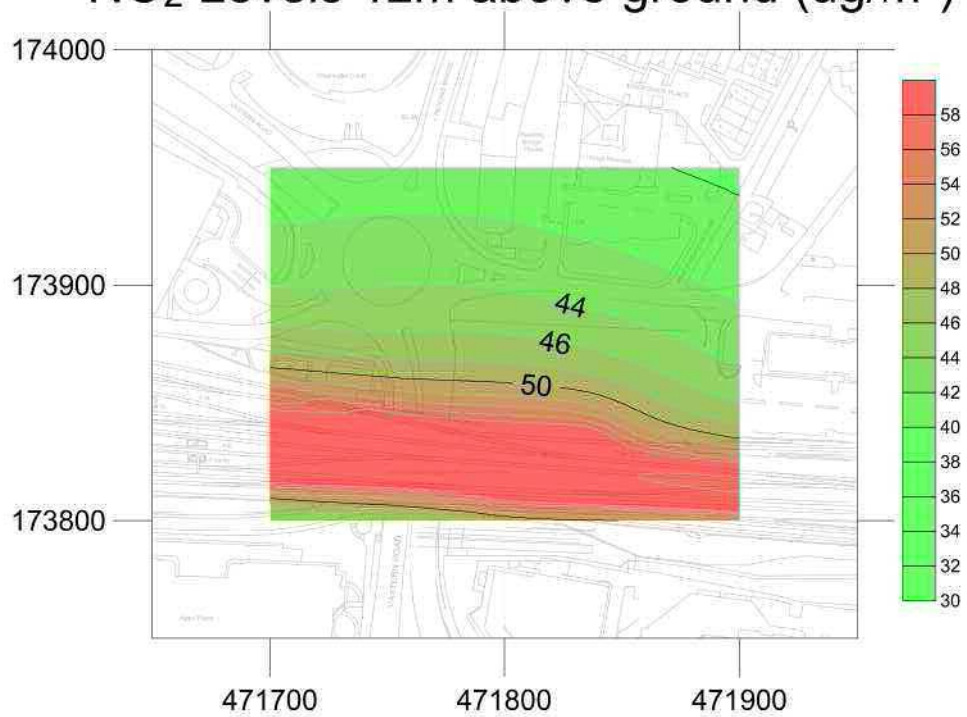
NO_2 Levels 1m above ground (ug/m³)



NO_2 Levels 5m above ground (ug/m³)



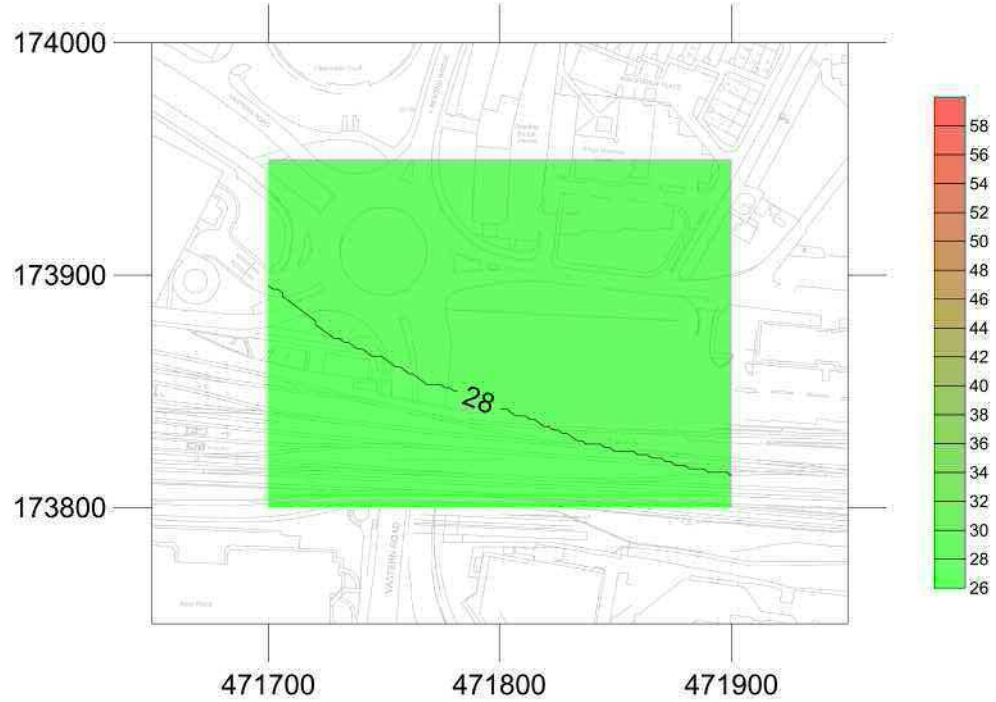
NO_2 Levels 12m above ground (ug/m³)



NO_2 Levels 25m above ground (ug/m³)

NO_2 Levels 35m above ground (ug/m³)

NO_2 Levels 70m above ground (ug/m³)



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JOB TITLE
THAMES QUARTER,
READING

DRAWING TITLE
AIR QUALITY CONCENTRATIONS
NO_2 LEVELS AT VARIABLE HEIGHTS

Rev	Description	Drn	Chk	Date
	REVISIONS			

Preliminary		Approval		Tender		Const.	
DRAWING STATUS							

DATE	DRAWN	CHECKED	ISSUE CHECKBOX
APRIL 2018	WAH	SWA	

DRAWING No.	REV	SCALE	
APPENDIX 4	.	.	@ A3

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