SRL

Project

Exeter Road / Retreat Drive, Topsham
Air Quality Assessment

Prepared for

Heritage Developments (SW) Ltd

By

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Summary

SRL Technical Services Limited has been commissioned by Heritage Developments (SW) Ltd to prepare an air quality assessment for the proposed development of a site adjacent to Exeter Road and Retreat Drive, Topsham, hereafter referred to as the 'Proposed Development' or 'Site'. The Proposed Development will provide seven residential properties. Exeter City Council (ECC) has requested that an assessment be submitted in support of the application due to the Site's location adjacent to the M5.

This report considers the potential air quality constraints associated with the Site once operational. The Site itself will not generate a significant amount of traffic, and the impact of additional traffic emissions is not considered in this report. Construction phase impacts can be effectively managed through the routine implementation of best practice mitigation measures, and therefore construction phase impacts are not considered in this assessment.

Air quality for future residents of the Proposed Development has been predicted and found to be acceptable, with concentrations within the Site all below the relevant objectives.

Based on the results of the assessment, the Proposed Development complies with local and national policy and no air quality constraints have been identified.

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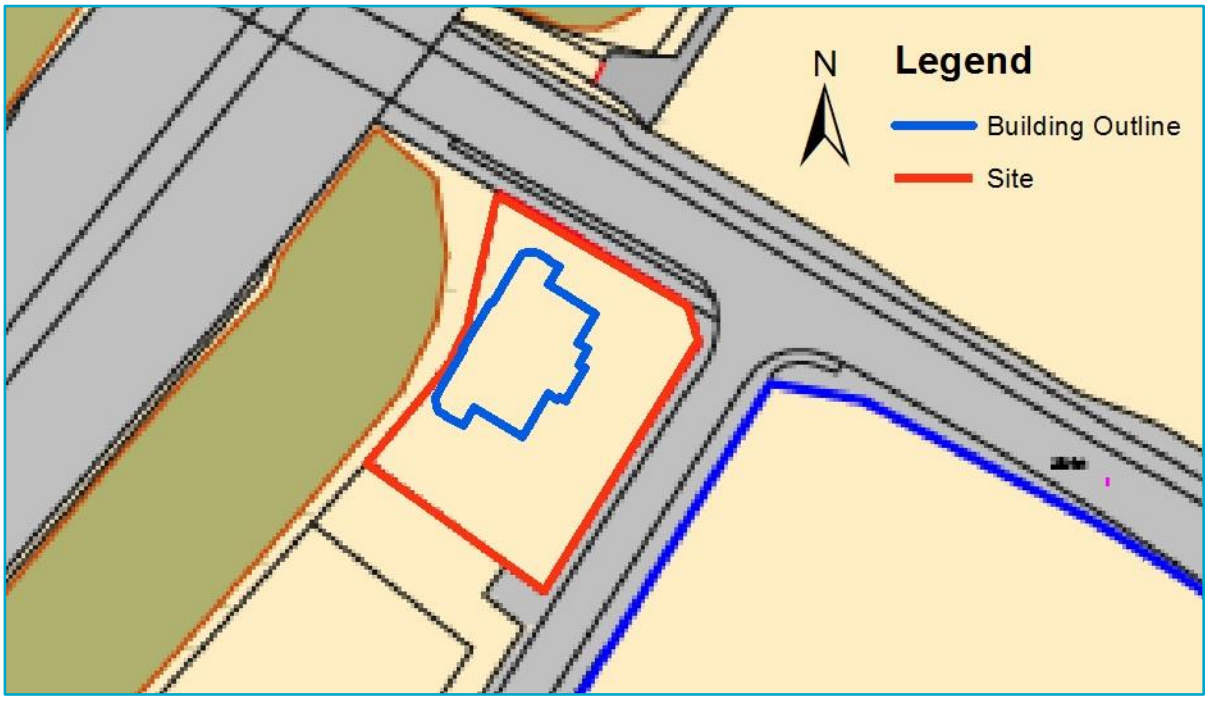
1.0 Introduction

The potential air quality constraints relating to the Proposed Development at Exeter Road / Retreat Drive, Topsham (**Figure 1.0**) have been assessed. This report sets out the findings.

There is a risk that future residents may be exposed to unacceptable air quality due to the location of the Proposed Development adjacent to the M5. This report looks at the existing air quality conditions around the Site, and predicts the exposure of future residents to concentrations of nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Mitigation measures are recommended where the assessment identifies potentially adverse effects.

The assessment takes account of relevant local and national policy and guidance. A glossary of terms used in this report is provided in **Appendix A**.

Figure 1.0 - Site Location



2.0 Relevant Policy and Guidance

The Air Quality Strategy

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[1] sets out air quality objectives (**Appendix B**) and policy options to improve air quality in the UK. The main aim of the Strategy is to ensure that ambient air quality is of an acceptable level to protect human health and the environment. It takes account of the Limit Values set out in EU legislation.

Local Air Quality Management (LAQM)

The Environment Act 1995 introduced the LAQM system, whereby local authorities have a duty to review and assess air quality within their areas against the air quality objectives defined in the Air Quality Strategy. Where exceedances of the objectives are identified during this process, the authority must then declare an Air Quality Management Area (AQMA) and define the measures which will be implemented to improve air quality.

National Planning Policy Framework

The National Planning Policy Framework (2012)[2] sets out the Government's planning policies for England and outlines how they are expected to be applied in order to achieve the Government's aim of sustainable development. The NPPF states that:

"*To prevent unacceptable risks from pollution….. planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account.*"

Exeter City Council Core Strategy

The ECC Core Strategy[3] sets out the vision, objectives and strategy for spatial development within Exeter up to 2026. Policy CP11 of the Core Strategy states that "*Development should be located and designed so as to minimise and if necessary, mitigate against the environmental impacts.*"

Guidance

The following guidance documents have also been used where appropriate, in this assessment:

- Local Air Quality Management Technical Guidance (LAQM.TG(16))[4]
- Land-Use Planning & Development Control: Planning for Air Quality[5]
- National Planning Practice Guidance – Air Quality[6]

[1] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)
[2] Department for Communities and Local Government (2012). National Planning Policy Framework.
[3] Exeter City Council (2012) Core Strategy
[4] Defra (2016). Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance (TG16)
[5] Environmental Protection UK / Institute of Air Quality Management (2015).
[6] Department of Communities and Local Government (DCLG) (2014).

3.0 Assessment

3.1 Existing Conditions

Existing air quality conditions near to the Site have been defined based on a review of the following sources of data:

- ECC Review and Assessment reports;
- Defra's Local Air Quality Management (LAQM) Support Pages, including background maps;
- Environment Agency website; and
- Maps and plans of the site and surrounding area

ECC has declared an Air Quality Management Area (AQMA) for exceedances of the annual and hourly mean NO_2 objective as a result of emissions from road transport, which covers the major roads within Exeter. The Site is located approximately 1.5km southeast of the AQMA at its closest point.

Review of the data provided by the Environment Agency indicate that there are no industrial pollution sources in the immediate vicinity of the Site that will influence the local air quality; the main influence is emissions from road transport using the local road network.

Table 1 summarises the background pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the Site in 2015 used in the assessment. In 2015, the annual mean background concentrations were below the relevant objectives.

Table 1: Background Pollutant Concentrations (µg/m³)

Grid Square	NO_2	PM_{10}	$PM_{2.5}$
295500, 89500	10.7	15.4	10.2

ECC monitor concentrations of NO_2 using diffusion tubes at a number of locations within 1.5km of the Proposed Development, as well as adjacent to the M5, approximately 5.5km north of the Site. The Council also operates two automatic analysers within Exeter city centre, both of which monitor PM_{10} concentrations. Recent data from these monitoring sites are provided below in **Tables 2** and **3**.

Table 2: Measured NO_2 Concentrations

Site ID	Site Name	Site Type	In AQMA?	Annual Mean NO_2 Concentration ($\mu g/m^3$)							
				2008	2009	2010	2011	2012	2013	2014	2015
DT44	Langaton Lane	UB	N	21.0	25.0	22.2	18.1	18.4	17.7	18.7	16.7
DT58	Topsham Road (Countess Wear)	R	Y	29.0	36.0	32.8	27.7	27.9	27.3	29.0	26.3
DT59	Bridge Road (Countess Wear)	R	N	25.0	30.0	27.5	22.8	22.2	22.5	21.6	19.3
DT60	High Street, Topsham	K	N	29.0	34.0	31.1	26.9	28.5	26.6	26.1	21.6

Data taken from Exeter CC's Annual Summary Report 2016.

Site Type Definitions: UB - Urban Background; R - Roadside; K - Kerbside

Table 3: Measured PM_{10} Concentrations

Site ID	Site Name	Site Type	Statistic	Year							
				2008	2009	2010	2011	2012	2013	2014	2015
CM1	Exeter Roadside	K	Annual mean ($\mu g/m^3$)	22	24	24	27	16	22	20	19
			No. of Days	7	8	9	21	3	8	2	6
CM2	Alphington Street	R	Annual mean ($\mu g/m^3$)	23	28	26	24	19	21	20	19
			No. of Days	7	16	17	15	3	3	2	6

Data taken from Exeter CC's Annual Summary Report 2016.

Site Type Definitions: R - Roadside; K - Kerbside

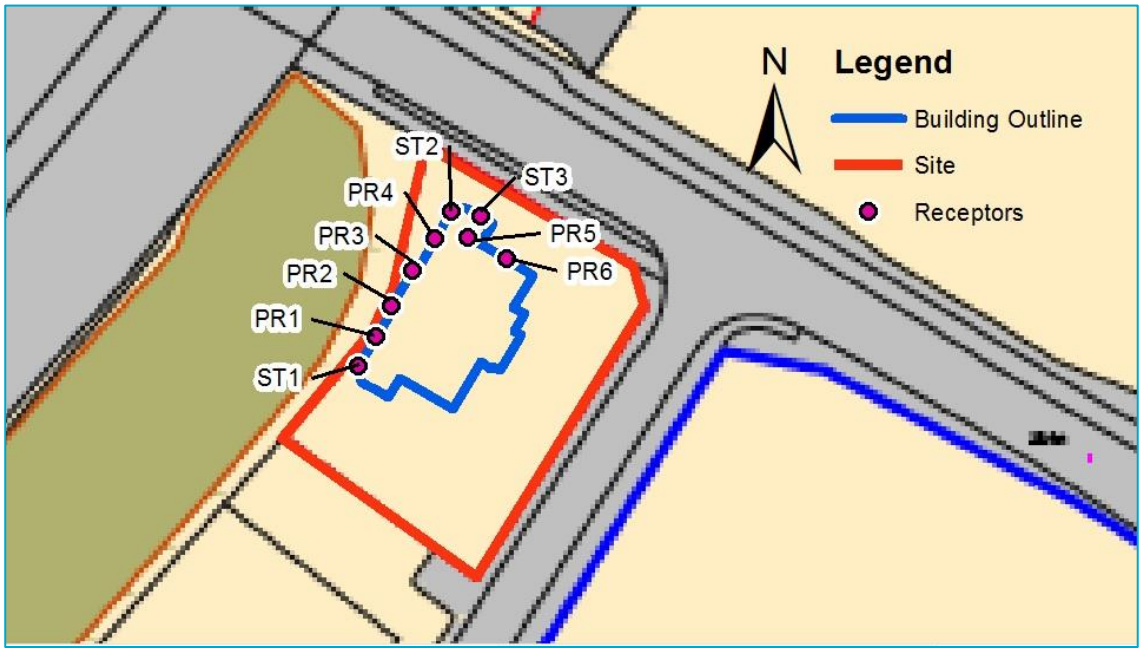
Measured concentrations of both NO_2 and PM_{10} have remained below the relevant objectives in recent years at all monitoring sites considered. Overall, concentrations have reduced at each of these sites. The Langaton Lane diffusion tube monitoring site is classified by ECC as Urban Background, however, the monitoring site is located within 20m of the northbound carriageway of the M5, which is elevated at this location. This monitoring location is considered to be the most representative of conditions at the Site.

3.2 Exposure Assessment

The Proposed Development will introduce new residential exposure approximately 20m from the southbound carriageway of the M5. There is a risk therefore that the residential properties will be exposed to concentrations which exceed the air quality objectives as a result of emissions from traffic using the M5. The impact of road traffic emissions on air quality at within the Site has been assessed using the atmospheric dispersion model ADMS Roads (version 4.0.1).

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations and heights within the Site, representing the façade of the Proposed Development closest to the M5, and to Exeter Road. These locations are shown in **Figure 2.0**. Concentrations have been predicted at a number of heights representing exposure on each floor of the Proposed Development.

Figure 2.0 - Assessment Receptors



Further details of the methodology used in the assessment are set out in **Appendix C**. Traffic data and emissions used in the assessment are set out in **Appendix D**. Full results of the assessment are detailed in **Appendix E** and are summarised below.

Annual and Hourly Mean NO_2 Concentrations

The results of the assessment show that predicted concentrations at each of the receptors considered are below the annual mean NO_2 objective of 40µg/m³ at all heights. The highest predicted concentration is 34.2µg/m³ predicted at a ground floor receptor adjacent to Exeter Road. There is a slight increase in predicted concentrations at second and third floor receptors closest to the M5 relative to first floor receptors at the same location, due to their proximity to the elevated M5, however concentrations remain below the objective.

All predicted annual mean concentrations are well below 60µg/m³; based on the relationship between hourly and annual mean NO_2 concentrations[7], it is unlikely that the hourly mean NO_2 objective will be exceeded anywhere within the Site.

Annual and Daily Mean PM_{10} Concentrations

The annual and daily mean PM_{10} objectives are predicted to be met at all receptors, with the highest concentration predicted at ground floor level adjacent to Exeter Road. The highest annual mean PM_{10} concentration is 18.7µg/m³. The highest number of days exceeding 50µg/m³ is 2 days.

Annual Mean $PM_{2.5}$ Concentrations

The predicted annual mean $PM_{2.5}$ concentrations are well below the objective of 25µg/m³ at all receptors. The highest annual mean $PM_{2.5}$ concentration is 12.3µg/m³.

4.0 Mitigation

The results of the assessment show that air quality for future residents of the Proposed Development is compliant with relevant objectives and therefore no mitigation is required.

[7] The hourly mean objective is unlikely to be exceeded where the annual mean NO_2 concentration is less than 60µg/m³.

5.0 Discussion

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at several locations within the Proposed Development site to determine the impact of existing road traffic emissions, particularly from the M5 motorway, on future residents.

The results of the air quality modelling show that concentrations across the Site are below the relevant objectives and, therefore, exposure of future residents to poor air quality is unlikely and no mitigation is required.

Based on the results of the assessment, the Proposed Development complies with relevant national and local planning policies, and there are no air quality constraints.

Appendix A - Glossary

Term	Definition
AADT	Annual Average Daily Traffic flow.
Annual mean	The average of the hourly mean concentrations measured for one year.
AQMA	Air Quality Management Area.
Defra	Department for Environment, Food and Rural Affairs.
Exceedance	Where the concentration of a pollutant is greater than the appropriate air quality objective.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
NO_2	Nitrogen dioxide.
NO_x	Oxides of nitrogen.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.

Appendix B - Air Quality Objectives

The table sets out the air quality objectives relevant to this assessment, taken from the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2), 2007.

Pollutant	Objective	Averaging Period
Nitrogen dioxide (NO_2)	40µg/m³	Annual mean
	200µg/m³ not to be exceeded more than 18 times per year	Hourly mean
Particulate Matter (PM_{10})	40µg/m³	Annual mean
	50µg/m³ not to be exceeded more than 35 times per year	Daily mean
Particulate Matter ($PM_{2.5}$)	25µg/m³	Annual mean

Appendix C - Assessment Methodology and Results

Pollutant concentrations have been predicted at several locations across the Proposed Development site using the dispersion model ADMS Roads (version 4.0.1) which is widely used for this type of modelling. The model allows concentrations to be predicted at user defined locations (receptors), taking account of local conditions (road geometry, width and height, and local meteorological conditions).

Meteorological data from Exeter Airport for 2015 has been used in the modelling as this is considered to be most representative of conditions at the Site. Traffic data (Annual Average Daily Traffic (AADT) flows, percentage of Heavy Duty Vehicles (HDVs) and speed in kph) have been obtained from the Department for Transport's (DfT) interactive map for the M5, and have been estimated for Exeter Road based on data available from a recent nearby planning application (**Appendix D** provides additional details). 2015 is the most recent year for which a full year of monitoring, meteorological and traffic data are available and has therefore been used for the assessment.

Concentrations have been predicted for 2015; although the development was not operational in 2015, as measured concentrations have reduced within the study area, this is considered a worst-case approach. This approach also removes uncertainty associated with projecting emissions and traffic flows into the future

Vehicle Emission Factors

Vehicle emission factors for PM_{10} and $PM_{2.5}$ used in the assessment were taken from Defra's Emissions Factor Toolkit (EFT) (version 7) which predict emissions from 2008 to 2030. Emission factors for NO_x were taken from the CURED tool[8], which has been developed by Air Quality Consultants (AQC) to address the uncertainty surrounding the rate of NO_x emissions reduction and to adjust for the apparent under-prediction of NO_x emissions in the Defra Emissions Factor Toolkit. The use of these emissions is considered to provide a worst-case assessment.

Background Concentrations

Defra's background maps were used to obtain background concentrations for the assessment. These provide estimated background concentrations in the UK at 1km x 1km grid resolution for years between 2011 and 2030, assuming an improvement in future years. Background concentrations of PM_{10} and $PM_{2.5}$ were taken directly from the maps, whilst the NO_x and NO_2 background concentrations have been adjusted following guidance published by AQC[9].

[8] AQC, 2016. New Calculator to Support Emissions Sensitivity Test. Available at: http://www.aqconsultants.co.uk/News/March-2016/New-Calculator-to-Support-Vehicle-Emissions-Sensit.aspx
[9] AQC, 2016. Deriving Background Concentrations of NOx and NO_2 for Use with 'CURED V2A'. Available at: http://www.aqconsultants.co.uk/getattachment/Resources/Download-Reports/Adjusting-Background-NO2-Maps-for-CURED-September-2016.pdf.aspx

Model Verification

Whilst ADMS Roads is widely validated for use in this type of assessment, model validation for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in line with methodology described in LAQM.TG(16). This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the final results.

The model was run to predict the 2015 annual mean road-NO_x contribution at the Langaton Lane diffusion tube, which is located a similar distance from the M5 motorway as the Proposed Development, and at a similar distance below the carriageway as the Site. The model output of road-NO_x has been compared with the 2015 'measured' road-NO_x, which was determined from the nitrogen dioxide concentration measured at the monitoring location, utilising the NO_x from NO_2 calculator provided by Defra and the adjusted NO_2 background concentration. **Table C1** gives further details of data used in the verification.

Table C1: Verification Data

Monitoring Site	Measured Annual Mean NO_2 Concentration (µg/m³)	Background NO_2 (µg/m³)	Measured Road-NO_x (µg/m³) (from NO_x:NO_2 Calculator)	Modelled Road-NO_x	Ratio
Langaton Lane	16.7	9.8	13.03	5.50	2.369

A verification factor of **2.369** was obtained which indicated that the model was under-predicting. This factor was applied to each of the model outputs before conversion to NO_2 concentrations using the NO_x to NO_2 calculator provided by Defra.

As there are no appropriate PM_{10} or $PM_{2.5}$ monitoring locations within the study area (none near the M5), the modelled road-PM_{10} and road-$PM_{2.5}$ components have been adjusted using the road-NO_x factor before adding the appropriate background concentration. The number of days where PM_{10} concentrations were greater than 50µg/m³ was then estimated using the relationship with the annual mean concentration described in LAQM,TG(16).

Processed results were compared against the objectives set out in **Appendix B**. LAQM.TG(16) advises that an exceedance of the 1 hour mean NO_2 objective is unlikely to occur where the annual mean concentration is below 60µg/m³. This concentration has been used to screen whether the hourly mean objective is likely to be achieved.

Limitations and Assumptions

There are uncertainties associated with both measured and predicted concentrations. The model relies on input data, which also have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS Roads model will not take into account.

In order to reduce the uncertainty associated with predicted concentrations, model verification has been carried out following guidance set out in LAQM.TG(16). As the model has been verified against 2015 measured concentrations and has been adjusted to take account of the apparent under-prediction, there can be reasonable confidence in the predicted concentrations.

Appendix D - Traffic Data and Emissions

Traffic data for use in the model have been determined from the DfT's interactive map. Data are available for the M5 motorway adjacent to both the Site and the diffusion tube used for model verification purposes. Data are not, however, available for Langaton Lane (adjacent to the diffusion tube) or Exeter Road (adjacent to the Site).

The omission of traffic flows for Langaton Lane adjacent to the diffusion tube means that the model will under-predict concentrations at the diffusion tube, and will result in a higher verification factor than if traffic flows on this road were included. As the omission results in a higher verification factor, this is considered to provide a worst-case approach to model verification.

Omitting flows for Exeter Road adjacent to the Site is more significant, as this would also result in an under-prediction of concentrations within the Site, which may not be accounted for by the application of a precautionary verification factor. Therefore, a search of recent planning applications submitted to Exeter City Council near to the Proposed Development identified an application for Newport Caravan Club (13/3185/01). A Transport Assessment (TA) was submitted in support of this application. Data presented within this TA indicate that average peak hour flows on Exeter Road are in the region of 1,000 vehicles. An estimate of daily traffic flows can be made by applying a factor of 12 to the average peak flow. This gives an estimate of 12,000 vehicles per day on Exeter Road. To provide a worst-case assessment, we have increased this estimate to 15,000. The percentage of Heavy Duty Vehicles (HDVs) on Exeter Road has been taken from the DfT data for a count point on Topsham Road approximately 2km north of the Site and is considered to provide a reasonable proxy.

The data used in the assessment are presented in **Table D1**.

Table D1: Traffic and Emissions Data

Road Name	AADT	%HDV	Speed (kph)	NO_x Emissions (g/km/s)	PM_{10} Emissions (g/km/s)	$PM_{2.5}$ Emissions (g/km/s)
M5 adjacent to the Site	84,607	8.01	100	0.68588	0.02866	0.02028
Exeter Road	15,000	4.26	48	0.08747	0.00690	0.00415
M5 adjacent to the Langaton Lane diffusion tube	62,752	9.18	100	0.53555	0.02186	0.01544

Appendix E - Results

Receptor ID	Annual Mean NO_2 Concentrations ($\mu g/m^3$)	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Days with PM_{10} Concentrations >50$\mu g/m^3$	Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)
Ground Floor (1.5m)				
PR1	29.1	17.4	1	11.5
PR2	30.0	17.6	1	11.6
PR3	31.4	17.8	1	11.8
PR4	33.3	18.2	2	12.0
PR5	34.2	18.4	2	12.1
PR6	33.9	18.3	2	12.1
ST1	*28.3*	*17.3*	*1*	*11.5*
ST2	*35.4*	*18.6*	*2*	*12.2*
ST3	*36.2*	*18.7*	*2*	*12.3*
First Floor (4.4m)				
PR1	29.2	17.3	1	11.4
PR2	29.6	17.3	1	11.5
PR3	30.1	17.4	1	11.5
PR4	30.5	17.5	1	11.6
PR5	30.3	17.5	1	11.6
PR6	29.8	17.4	1	11.5
ST1	*28.9*	*17.2*	*1*	*11.4*
ST2	*30.8*	*17.5*	*1*	*11.6*
ST3	*30.6*	*17.5*	*1*	*11.6*

Receptor ID	Annual Mean NO_2 Concentrations ($\mu g/m^3$)	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Days with PM_{10} Concentrations >50$\mu g/m^3$	Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)
Second Floor (7.3m)				
PR1	31.9	17.3	1	11.5
PR2	32.2	17.4	1	11.6
PR3	32.5	17.4	1	11.6
PR4	32.6	17.4	1	11.6
PR5	31.8	17.3	1	11.5
PR6	30.4	17.2	1	11.4
ST1	*31.7*	*17.3*	*1*	*11.5*
ST2	*32.8*	*17.4*	*1*	*11.6*
ST3	*31.8*	*17.3*	*1*	*11.5*
Third Floor (10.1m)				
PR1	30.3	17.1	1	11.4
PR2	30.6	17.1	1	11.4
PR3	30.8	17.2	1	11.4
PR4	30.9	17.2	1	11.4
PR5	30.1	17.1	1	11.4
PR6	28.7	17.0	1	11.3
ST1	*30.1*	*17.1*	*1*	*11.4*
ST2	*31.1*	*17.2*	*1*	*11.5*
ST3	*30.2*	*17.1*	*1*	*11.4*

Concentrations have been predicted at a number of receptors which represent locations where the short-term objectives apply only (ST - Short term; proposed balconies**.** Results for these receptors are italicised). They do not represent relevant exposure for the annual mean objectives.

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