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Prepared by:	Mr Bob Thomas

Air Quality Assessments Ltd
Tel: 07940 478134
Email: bob@aqassessments.co.uk
Web: http://aqassessments.co.uk

Registered Office: c/o Ardwyn Channon, 12 Victoria Street, Burnham-on-Sea, Somerset, TA8 1AL
Companies House Registration: 8895617

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1 Introduction

1.1. Proposed Development

1.1.1 Air Quality Assessments Ltd (AQA) has been commissioned by Sherbourne Developments to undertake an air quality assessment for a proposed mixed-use development at the site of the Former St. Peter's Junior School, Marlborough. The application site location is shown in **Figure 1**. The proposed development will provide a 22 room hotel and eight houses.

1.2. Scope of Assessment

1.2.1 This report describes the existing air quality conditions in proximity to the site. The scale of the development is such that it will not significantly increase traffic on local roads. The proposed development will result in 46 fewer daily vehicle movements on the local road network than the extant land use, which will improve local air quality. Therefore, the net change in traffic on a road due to the proposed development is less than the indicative screening criteria of 100 daily light vehicle movements within an air quality management area (AQMA) that would require an assessment of the air quality impact on existing local receptors (EPUK and IAQM, 2017).

1.2.2 The new residential properties will be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter ($PM_{2.5}$ and PM_{10}).

1.2.3 The assessment has been prepared taking into account all relevant local and national guidance and regulations.

1.2.4 The references and a glossary of common air quality terminology used in this assessment are shown in **Section 10** and **Section 11** respectively.

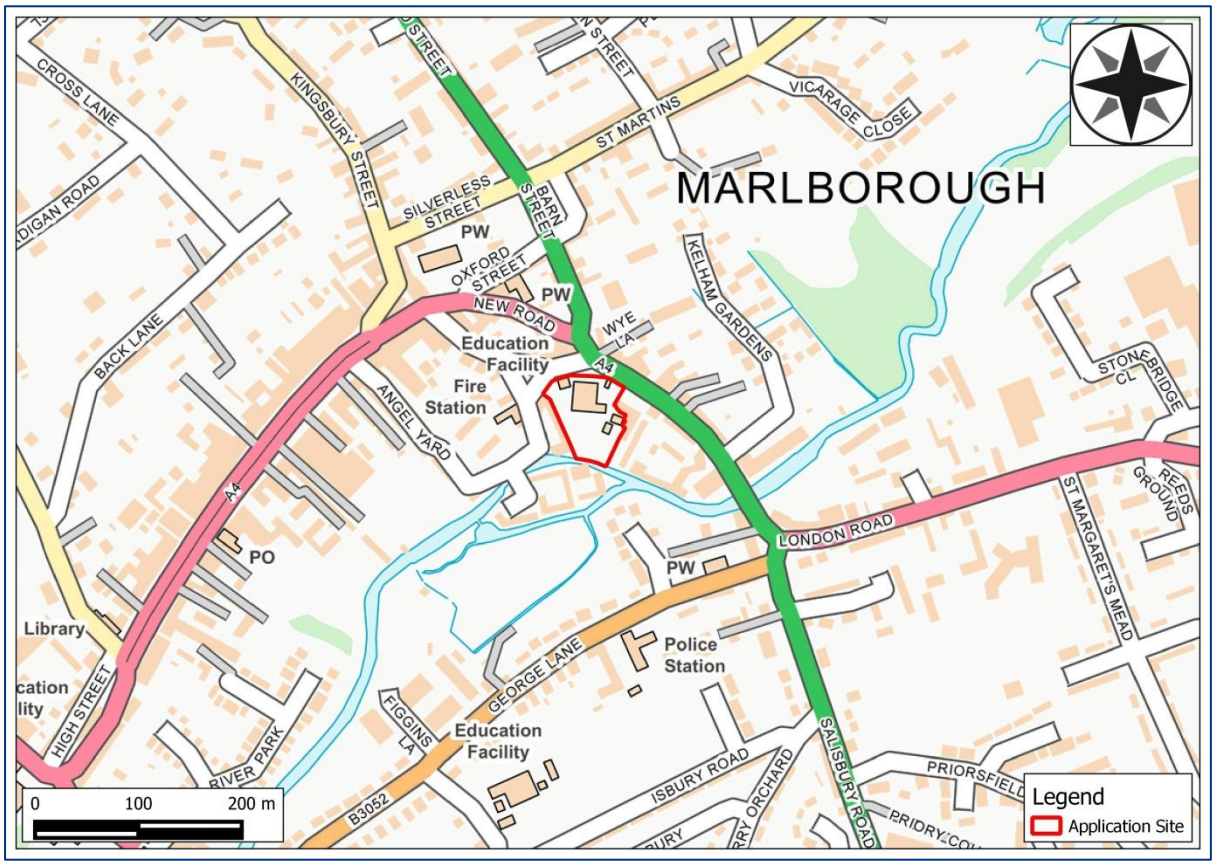

Figure 1: Application Site Location
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2 Air Quality Legislation and Policy

2.1. EU Limit Values

2.1.1 The European Union's Directive on ambient air quality and cleaner air for Europe (European Parliament, Council of the European Union, 2008) set legally binding limit values for NO_2, PM_{10} and $PM_{2.5}$. The Air Quality Standards Regulations 2010 (The Stationary Office, 2010) implement the EU Directive limit values in English legislation. Achievement of the limit values is a national obligation rather than a local one.

2.1.2 The limit values are the same as the objective values (see **Table 1**); however, the compliance dates differ, and the limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway). The PM_{10} and NO_2 limit value applied from 2005 and 2010 respectively, whereas the $PM_{2.5}$ limit value applied from2015.

2.2. Clean Air Strategy

2.2.1 Part IV of The Environment Act 1995 required the UK Government to prepare an Air Quality Strategy which includes standards and objectives for air quality and sets out measures which are to be taken by local authorities and the government in order to achieve those objectives. The Clean Air Strategy provides an overview of the actions that the government will take to improve air quality and promises new legislation that will tackle air pollution (Defra, 2019a).

2.2.2 Standards are the concentrations of pollutants in the atmosphere, below which there is a minimum risk of health effects or ecosystem damage; they are set with regard to scientific and medical evidence. Objectives are the policy targets set by the Government, taking account of economic efficiency, practicability, technical feasibility and timescale, where the standards are expected to be achieved by a certain date.

2.2.3 Part IV of the Environment Act 1995 also describes the system of Local Air Quality Management (LAQM), which requires every local authority to carry out regular review and assessments of air quality in its area. Where an objective has not been, or is unlikely to be achieved, the local authority must declare an AQMA, and prepare an action plan which sets out appropriate measures to be introduced in pursuit of the objectives.

2.2.4 The objectives for NO_2 and PM_{10}, as prescribed by the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 are shown in **Table 1** (The Stationary Office, 2000; The Stationary Office, 2002). The objectives for PM_{10} and NO_2 were to have been achieved by 2004 and 2005 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective, also shown in **Table 1**, is to be achieved by 2020; however, there is no obligation for local authorities to try to meet the $PM_{2.5}$ objective, and it is not included in the Regulations.

Table 1: The Objectives for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration Measured As	Objective
NO_2	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
PM_{10}	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
$PM_{2.5}$	Annual Mean	25 µg/m^3

2.2.5 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Examples of where the objectives should apply are provided in the Local Air Quality Management Technical Guidance (Defra, 2016) issued by the Department for Environment, Food and Rural Affairs (Defra). The annual mean NO_2 and PM_{10} objectives should apply at the building façades of residential properties, schools, hospitals, care homes etc.; they should not apply at the building façades of places of work, hotels, gardens or kerbside sites. The 24-hour mean PM_{10} objective should apply at all locations where the annual mean objective applies, as well as the gardens of residential properties and hotels. The 1-hour mean NO_2 objective should apply at all locations where the annual and 24-hour mean objectives apply, as well as at kerbside sites where the public have regular access, e.g. the pavements of busy shopping streets.

2.3. Planning Policy

National Policies

2.3.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied (Ministry of Housing, Communities & Local Government, 2019). It provides a framework within which locally-prepared plans for development can be produced. It states that the purpose of the planning system is to contribute to the achievement of sustainable development and includes an overarching environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.3.2 The NPPF states that:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well

as the potential sensitivity of the site or the wider area to impacts that could arise from the development."

2.3.3 With specific reference to air quality, the NPPF states that:

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

2.3.4 The NPPF goes on the say that:

"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

2.3.5 The NPPF is supported by Planning Practice Guidance (PPG) (DCLG, 2014). The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit."

2.3.6 The PPG goes on to state that:

"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)."

2.3.7 The PPG also sets out the information that may be required in an air quality assessment, stating that:

"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality."

2.3.8 It also provides guidance on options for mitigating air quality impacts, and makes clear that:

"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact."

Local Policies

2.3.9 The Wiltshire Local Plan includes Core Policy 55 Air Quality, which states (Wiltshire Council, 2015):

"Development proposals, which by virtue of their scale, nature or location are likely to exacerbate existing areas of poor air quality, will need to demonstrate that measures can be taken to effectively mitigate emission levels in order to protect public health, environmental quality and amenity. Mitigation measures should demonstrate how they will make a positive contribution to the aims of the Air Quality Strategy for Wiltshire and where relevant, the Wiltshire Air Quality Action Plan. Mitigation may include:

i. landscaping, bunding or separation to increase distance from highways and junctions;

ii. possible traffic management or highway improvements to be agreed with the local authority;

iii. abatement technology and incorporating site layout/separation and other conditions in site planning;

iv. traffic routing, site management, site layout and phasing;

v. where appropriate, contributions will be sought toward the mitigation of the impact a development may have on levels of air pollutants."

3 Methodology

3.1. Existing Conditions

3.1.1 Information on existing air quality within the study area has been collated from the following sources:

- The results of monitoring and the LAQM review and assessment reports undertaken by Wiltshire Council (Wiltshire Council, 2019);
- Maps of roadside concentrations published by Defra have been used to identify current exceedances of the annual mean NO_2 EU limit value (Defra, 2019b)[1];
- Background pollutant concentration maps published by Defra (Defra, 2019c); and
- Defra's Pollutant Release and Transfer Register has been used to screen for local industrial and waste management sources (Defra, 2019d).

3.2. Road Traffic Impacts

Modelling Methodology

3.2.1 Pollutant concentrations have been predicted at sensitive receptors using the ADMS Roads (v4.1.1.0) dispersion model. The model requires the input of a range of data, details of which are provided in **Appendix A1**, along with details of the model verification calculations.

Sensitive Locations

3.2.2 Receptors have been located within the proposed development where the impact from existing sources is likely to be greatest, where there is relevant exposure. The receptors are described in **Table 2** and are shown in **Figure 2**. Receptors have been modelled at heights of 1.5m and 4.5m to represent exposure on the first and second floor levels. There is no relevant exposure to the annual mean objectives at the site of the proposed spa (R1 and R2) or hotel (R3 and R4); however, receptors are included to assess impacts against the short-term (1-hr and 24-hr) objectives.

Assessment Scenarios

3.2.3 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at the receptors assuming an opening year of 2021.

3.2.4 In addition to predictions using emissions data published by Defra, a sensitivity analysis has been undertaken that assumes higher NOx emissions from some diesel vehicles. This sensitivity analysis provides a worst-case assessment of future impacts (see **Section 3.3** on uncertainty below).

3.2.5 Concentrations have also been predicted at diffusion tube monitoring sites operated by Wiltshire Council in 2018 in order to verify the model (see **Appendix A1**).

[1] There are no exceedences of the PM_{10} limit values.

Table 2: Description of Receptors

Receptor	Location	x	y	z (m) [a]
R1	Proposed spa	419032.4	169127.6	1.5 & 4.5
R2	Proposed spa	419042.4	169130.5	1.5 & 4.5
R3	Proposed hotel	419051.3	169125.8	1.5 & 4.5
R4	Proposed hotel	419070.0	169124.2	1.5 & 4.5
R5	Proposed dwelling	419087.9	169092.9	1.5 & 4.5
R6	Proposed dwelling	419096.8	169089.5	1.5 & 4.5
R7	Proposed dwelling	419040.3	169090.8	1.5 & 4.5

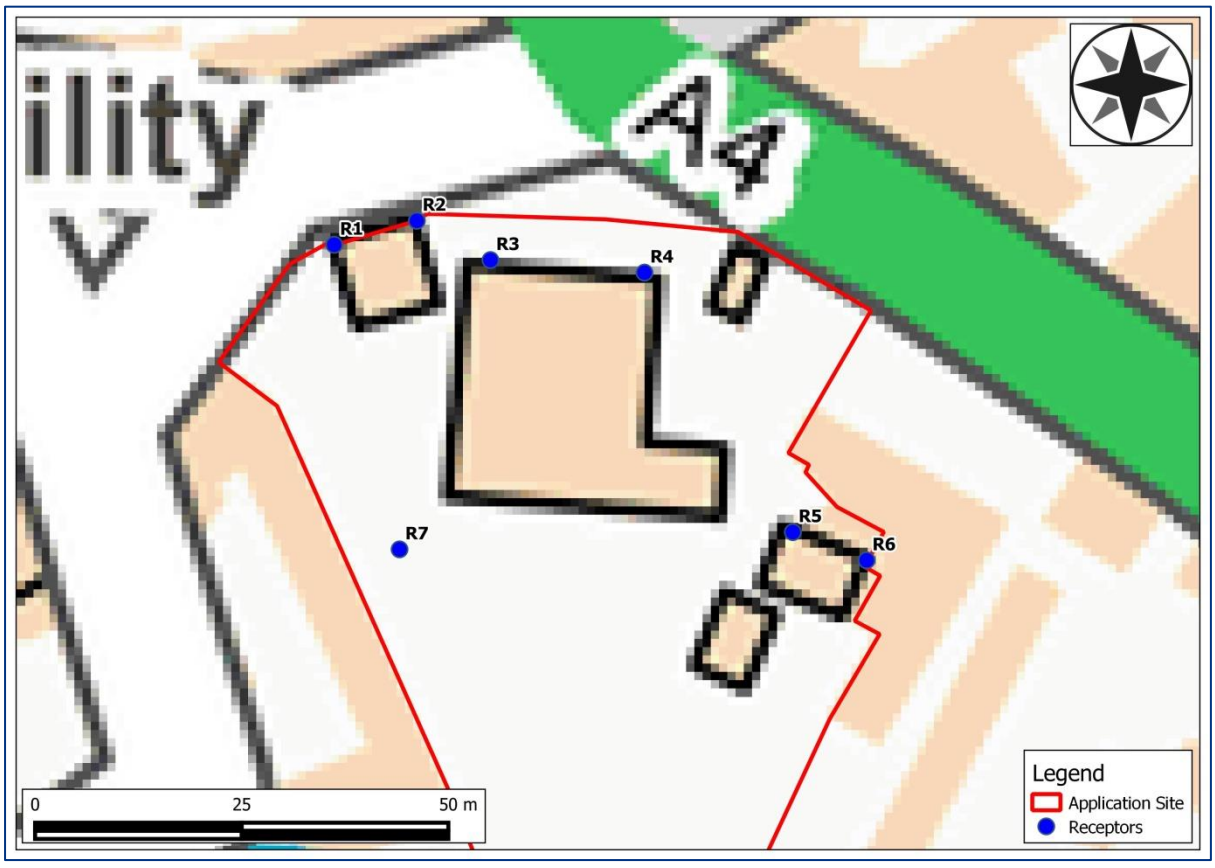

Figure 2: Location of Receptors
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3.3. Uncertainty

3.3.1 There are many factors that contribute to uncertainty when predicting pollutant concentrations. The emission factors utilised in the air quality model are dependent on traffic data, which have inherent uncertainties associated with them. There are also uncertainties associated with the model itself, which simplifies real world conditions into a series of algorithms. The model verification process, as described in

Appendix A1, minimises the uncertainties; however, future year predictions use projected traffic data, emissions data, and background concentrations. The most recent emission factors and background data have been used in this assessment; however, there are still uncertainties associated with this data.

3.3.2 Past analysis has shown a disparity between historical monitoring data and the projected background concentrations published by Defra (Carslaw et al., 2011). Overall, there has been little evidence of the consistent downward trend in NO_2 and NOx concentrations suggested by previous emission inventory estimates.

3.3.3 This disparity is believed to have arisen due to the actual on-road performance of diesel vehicles when compared with emissions calculations based on the Euro standards and published in the Emissions Factor Toolkit (EFT) used for modelling.

3.3.4 Air Quality Consultants Ltd (AQC) have produced the Calculator Using Realistic Emissions for Diesels (CURED) tool that applies adjustments to diesel emission factors from the EFT for use by consultants when undertaking sensitivity analysis of future air quality impacts (AQC, 2018a). A report comparing CURED v3A with the most recent EFT v9.0 concludes that, for most modelling studies verified against annual mean measurements made in 2017 or 2018, CURED V3A will predict higher concentrations than EFT V9.0 from 2021 onwards (AQC, 2019). As this study predicts concentrations in 2021 a sensitivity analysis used CURED has been undertaken.

3.4. Assessment Criteria and Significance

Health Criteria

3.4.1 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. The approach suggested by Environmental Protection UK (EPUK) and the IAQM in guidance on Land-Use Planning & Development Control: Planning for Air Quality has been used for this assessment (EPUK and IAQM, 2017).

3.4.2 The predicted concentrations at each receptor have been compared with air quality assessment levels (AQALs) based on the objectives shown in **Table 1**. Measurements of PM_{10} have shown that exceedances of the 24-hour mean PM_{10} objective may occur above an annual mean PM_{10} concentration of 32 µg/m^3; therefore, 32 µg/m^3 has been used as the AQAL for PM_{10} (Defra, 2016). Where an exceedance of the AQAL occurs, the effect is judged as significant, unless provision is met to reduce exposure by some means. Predicted concentrations below the air quality objectives will be considered as insignificant.

3.4.3 The determination of the significance of the effects includes elements of professional judgement and the professional experience of the consultant preparing the report is set out in **Appendix A2**.

4 Baseline Conditions

4.1. Industrial Sources

4.1.1 The search of the UK Pollutant Release and Transfer did not identify any significant industrial or waste management sources that are likely to affect air quality at the application site.

4.2. EU Limit Values

4.2.1 There are no AURN monitoring sites within the study area and none of the A roads within Marlborough are included in modelling undertaken by Defra.

4.3. LAQM Review and Assessment

4.3.1 Wiltshire Council has declared eight AQMAs. One of the AQMAs, declared for exceedances of the annual mean NO_2 objective, covers the town of Marlborough and the application site lies within this area.

4.4. Local Air Quality Monitoring

4.4.1 Wiltshire Council does not operates any automatic monitoring sites within Marlborough; however, a number of diffusion tube monitoring sites are located close to the application site. Measured annual mean NO_2 concentrations from the monitoring sites located in Marlborough are shown in **Table 3**, and the monitoring locations are shown in **Figure 3**.

4.4.2 The annual mean NO_2 objective has been exceeded at monitoring sites located close to the A346 through Marlborough. Annual mean NO_2 concentrations close to Marlborough's roads ranged from 28-54 µg/m^3 between 2014 and 2018.

Table 3: Measured Annual Mean NO_2 Concentrations (2014 to 2018) [a]

Site ID	Location	Site Type	Annual Mean (µg/m^3)				
			2014	2015	2016	2017	2018
22	6 Herd Street	R	**54**	**53**	**52**	**45**	**50**
24	High Street	R	-	34	37	30	35
25	27 Herd Street	R	**47**	**41**	**44**	35	**44**
26	Barn Street	R	**44**	**45**	**43**	35	**42**
27	Salisbury Road	R	**41**	**43**	**43**	35	37
28	War Memorial	R	33	32	34	28	32
29	London Road	R	**41**	40	**41**	35	36
Objective			**40**				

a Exceedances are shown in bold. R = roadside.

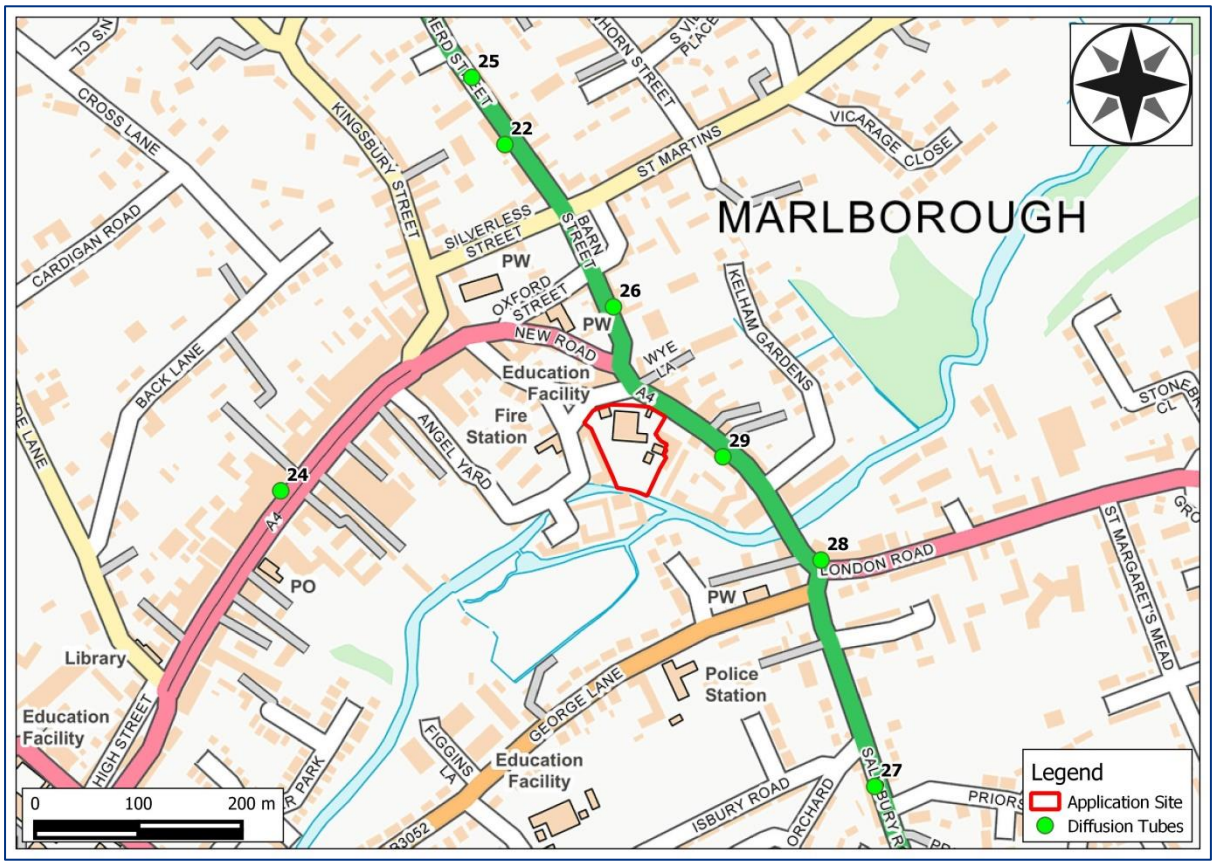

Figure 3: Diffusion Tube Monitoring Sites
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4.5. Background Concentrations

4.5.1 Estimated background concentrations at the application site are shown in **Table 4**. The background concentrations have been derived from data in the national maps published by Defra. The background concentrations are well below the objectives.

Table 4: Estimated Annual Mean Background Concentrations in2018 and 2021 (µg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2018	13.2	9.8	13.0	8.7
2021 - EFT	11.6	8.7	12.5	8.3
2021 - CURED	11.8	8.8	-	-
Objective	**-**	**40**	**40**	**25**

5 Road Traffic Impacts

5.1.1 Predicted concentrations at the receptors within the proposed development are shown in **Table 5**. All the values are below the AQALs; therefore, air quality will be acceptable at the proposed development where there is relevant exposure.

Table 5: Predicted Impacts on the Development in 2021 [a]

Receptor	Annual Mean (µg/m^3)							
	NO_2				PM_{10}		$PM_{2.5}$	
	EFT		CURED					
	Grnd Floor	1st Floor	Grnd Floor	1st Floor	Grnd Floor	1st Floor	Grnd Floor	1st Floor
R1	22.2	18.6	23.1	19.3	15.2	14.5	9.9	9.4
R2	24.8	19.6	25.8	20.3	15.7	14.7	10.1	9.6
R3	25.0	19.5	26.0	20.2	15.8	14.7	10.2	9.6
R4	28.7	20.1	29.9	20.8	16.8	14.9	10.7	9.7
R5	20.2	17.1	20.9	17.7	15.0	14.3	9.7	9.3
R6	20.4	17.1	21.2	17.7	15.1	14.3	9.8	9.4
R7	17.1	15.6	17.7	16.1	14.2	13.9	9.3	9.1
AQAL	**40**				**32**		**25**	

a Exceedances are shown in bold.

6 Mitigation

6.1.1 The assessment has demonstrated that the scheme will not introduce receptors into an area where the objectives are exceeded. Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation. It is not considered appropriate to propose further mitigation measures for this scheme.

7 Residual Impacts

7.1.1 The residual impacts will be the same as those identified in **Section 5**.

8 Conclusions

8.1.1 The impacts on air quality at the proposed development due to emissions from the local road network have been shown to be acceptable, with predicted concentrations being below the air quality objectives.

8.1.2 The overall operational air quality impacts on the development are judged to be *insignificant*. Therefore, there should be no constraints to residential use at any location within the application site with regard to air quality.

8.1.3 The proposed development is consistent with:

- The NPPF; and
- Core Policy 55 of the Wiltshire Local Plan.

9 References

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10 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System
AQAL	Air quality assessment level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
µg/m^3	Microgrammes per cubic metre
NAEI	National Atmospheric Emissions Inventory
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

11 Appendices

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A1 Modelling Methodology

A1.1. Model Inputs

Traffic Data

A1.1.1 The AADT flows and the vehicle fleet composition data have been determined using data from the interactive web-based map provided by the Department for Transport (DfT) (DfT, 2019a). The traffic flows have been factored forward to the assessment year (2021) using the TEMPRO System v7.2 (DfT, 2017). Traffic speeds have been estimated based on the speed limit, reduced to 20km/h within 25m of a stop line. The traffic data are shown in **Table A1**. The modelled road network is shown in **Figure 4**.

A1.1.2 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2019b).

Table A1: Summary of Traffic Data used in the Assessment

Road Link	DfT Count Point	AADT		Heavy Duty Vehicles (%) [a]
		2018	2021	
A4 London Road E of Salisbury Road	6130	8,957	9,302	3.5
A346 Barn Street	8530	15,219	15,805	6.3
A4 High Street	16119	18,343	19,049	4.5
A346 Salisbury Hill	26981	9,325	9,684	6.3
A4 London Road N of Salisbury Road	56118	20,831	21,633	5.3

a Heavy goods vehicle and buses.

Emissions

A1.1.3 Emissions have been calculated using the most recent version of the Emissions Factor Toolkit (EFT) v9.0 (Defra, 2019c). The traffic data were entered into the EFT in order to calculate a combined emission rate for each of the road links in the modelled network.

A1.1.4 Emissions for the sensitivity analysis have been calculated using the CURED V3A tool published by Air Quality Consultants.

Meteorological Data

A1.1.5 The model has been run using the full year of meteorological data that corresponds with the most recent set of published NO_2 monitoring data (2018). The meteorological data have been taken from the monitoring station located at RAF Fairford, which is considered suitable for the area.

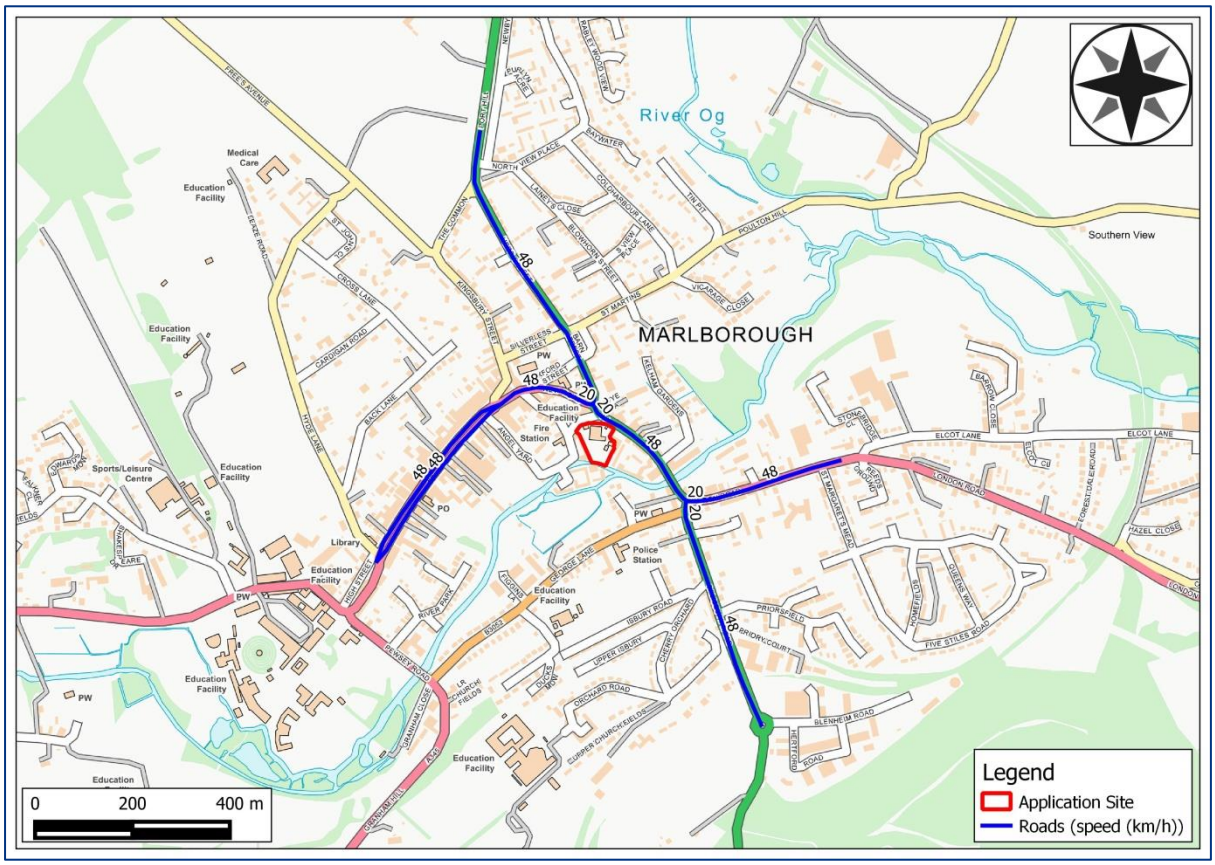

Figure 4: Modelled Roads
Contains Ordnance Survey data © Crown copyright and database right 2019

A1.2. Background Concentrations

A2.1.1 Background concentrations have been derived from those published by Defra (Defra, 2019c). These cover the whole country on a 1 km by 1 km grid and are published for each year from 2017 to 2030. The current maps have been verified against measurements undertaken during 2017. The background concentrations for the sensitivity analysis have been adjusted using the CURED methodology (AQC, 2018b).

A1.3. Verification

A3.1.1 The verification process seeks to minimise uncertainties associated with the air quality model by comparing the model output with locally measured concentrations. The verification methodology is described below.

NO_2

A3.1.2 Most NO_2 is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the 2017 annual mean NOx concentrations at Wiltshire Council's diffusion tube monitoring sites 22, 24, 25, 26, 27, 28 and 29 (as described in **Table 3**, and shown in **Figure 3**).

A1.3.3 The model output of road-NOx has been compared with the 'measured' road-NOx, calculated from the measured annual mean NO_2 concentrations and the background concentrations using the NOx from NO_2 calculator v7.1 published by Defra (Defra, 2019c).

A1.3.4 The slope of the best-fit line between the 'measured' road-NOx contribution and the model derived road-NOx contribution, forced through zero, has been used to determine the adjustment factor (**Figure 5**). The adjustment factor of 4.62 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The NOx to NO_2 calculator has then been used to determine total NO_2 concentrations from the adjusted modelled road-NOx concentrations and the background NO_2 concentrations.

A1.3.5 A comparison of the final adjusted modelled total NO_2 at each monitoring site to the measured total NO_2 shows close agreement (**Figure 6**).

A1.3.6 The results imply that the model has under-predicted the road-NOx contribution. This is a common experience with this and most other models. An evaluation of the model performance using statistical methods is shown in **Table A2**.

PM_{10} and $PM_{2.5}$

A1.3.7 No monitoring for PM is undertaken within the study area; therefore, the model outputs of road-PM have been adjusted by applying the adjustment factor calculated for road NO_x.

A1.4. Model Post-processing

NO_2

A1.4.1 The NOx to NO_2 calculator v7.0 published by Defra has been used to convert the modelled, verified road-NOx output for each receptor to road-NO_2. The background NO_2 concentrations have then been added to the predicted road-NO_2 concentrations and adjusted using the secondary verification factor to give the final predicted concentrations.

PM_{10} and $PM_{2.5}$

A1.4.2 The verified road-PM outputs need no further processing, and have been added to the background concentrations to give the final predicted concentrations.

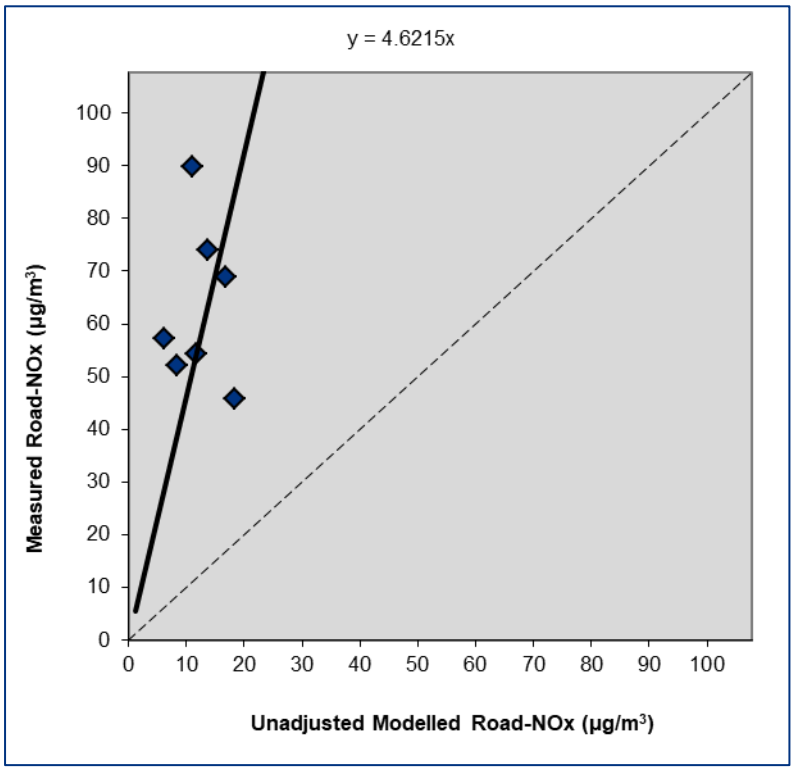

Figure 5: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations.

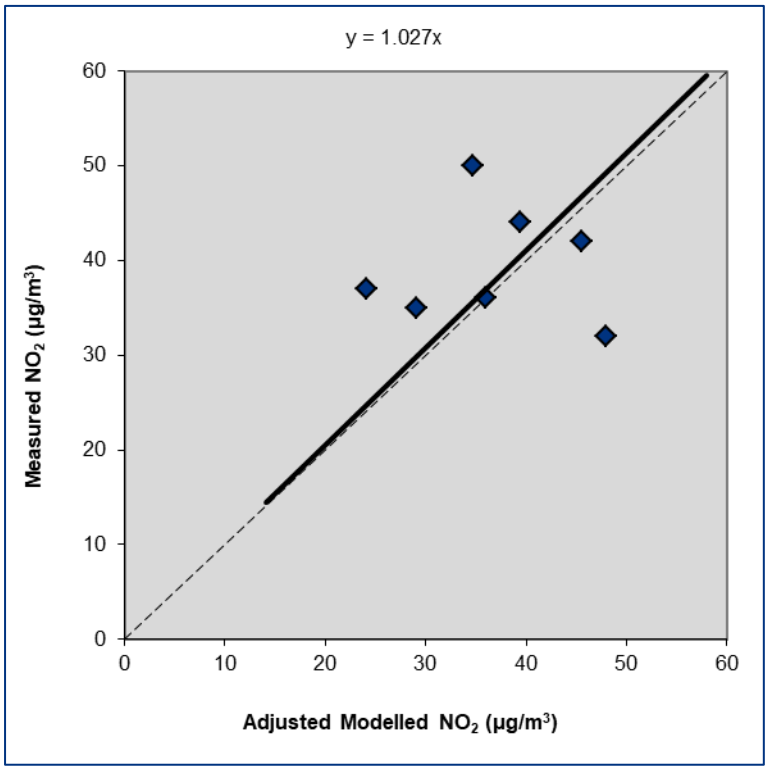

Figure 6: Comparison of Measured Total NO_2 to Primary Adjusted Modelled Total NO_2 Concentrations.

Table A2: Evaluation of Model Performance

Statistical Parameter	Description	Values		
		Before verification (Figure 5)	After verification (Figure 6)	Ideal
Correlation coefficient	Linear relationship between predicted and observed data. Less useful for small datasets as single high/low values can have a large effect.	-0.03	-0.01	1
Fractional bias	Identifies systematic tendency to over/under predict (negative = over-predict, positive = under-predict).	1.35	0.07	0.0
Root mean square error (RMSE)	Average error of the model (µg/m^3). Ideally within 10% of the annual mean NO_2 objective, i.e. 4 µg/m^3; however, within 25% acceptable, i.e. 10 µg/m^3.	53.0	10.2	0.0

A2 Professional Experience

Bob Thomas, BSc (Hons) PgDip MSc MIEnvSc MIAQM CSci

Bob Thomas is a Director at AQA, with over twelve years' experience in the field of air quality management and assessment. He has carried out air quality assessments for a wide range of developments, including residential, commercial, industrial, minerals and waste developments. He has been responsible for air quality projects that include ambient air quality monitoring of nitrogen dioxide, dust and PM_{10}, the assessment of nuisance odours and dust, and the preparation of Review and Assessment reports for local authorities. He has extensive dispersion modelling experience for road traffic, energy centre and industrial sources, and has completed many stand-alone reports and chapters for inclusion within an Environmental Statement. Bob has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers, architects and process operators, and has provided expert witness services at public inquiry. He is a Chartered Scientist, a Member of the Institute of Air Quality Management and a Member of the Institution of Environmental Sciences.

A full CV for Bob Thomas is available at http://aqassessments.co.uk/about