Air Quality Assessment	
Radstone Fields, South Northamptonshire	
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1 Introduction

1.1.1 Air Quality Assessments Ltd (AQA) has been commissioned by Mintondale Developments Ltd to undertake an air quality assessment for the proposed residential development at land northwest of Radstone Fields, off Halse Road, Brackley. The proposed development will provide up to 450 new dwellings.

1.1.2 This report describes the existing air quality conditions in proximity to the site and considers the effect of the proposed development on local air quality due to traffic generated by the scheme. The main air pollutants of concern related to road traffic are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.1.3 There is also the potential for the construction works to impact upon existing properties. The main pollutants of concern related to construction activities are dust and PM_{10}.

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

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

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 from 2015.

2.1.3 The United Kingdom left the European Union on 31st January 2020; however, EU legislation will continue to operate in UK law during the transition period, which will last until the end of December 2020.

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, 2019).

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/m³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m³
PM_{10}	24-hour Mean	50 µg/m³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m³
$PM_{2.5}$	Annual Mean	25 µg/m³

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, 2019). The PPG states that:

"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified."

2.3.6 The PPG goes on to state that:

"Whether 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 have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."

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

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific."

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

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact."

2.3.9 The PPG makes clear that:

"… dust can also be a planning concern, for example, because of the effect on local amenity."

Regional Policies

2.3.10 The West Northamptonshire Joint Core Strategy Local Plan (Part 1) includes Policy BN9 Planning for Pollution Control, the relevant parts of which state (West Northamptonshire Joint Planning Unit, 2014):

"Proposals for new development which are likely to cause pollution or likely to result in exposure to sources of pollution or risks to safety will need to demonstrate that they provide opportunities to minimise and where possible reduce pollution issues that are a barrier to achieving sustainable development and healthy communities including:

A) maintaining and improving air quality, particularly in poor air quality areas, in accordance with national air quality standards and best practice; …

Development that is likely to cause pollution, either individually or cumulatively, will only be permitted if measures can be implemented to minimise pollution to a level which provides a high standard of protection for health and environmental quality."

Local Policies

2.3.11 The South Northamptonshire Part 2 Local Plan includes Policy SS2 General Development and Design Principles, the relevant parts of which state (South Northamptonshire Council, 2020):

"Planning permission will be granted where the proposed development: …

g. has appropriate regard to its effect on air quality and the effects of air quality on its future occupiers; …"

Supplementary Planning Documents (SPDs)

2.3.12 South Northamptonshire Council has published an Air Quality and Emissions Mitigation SPD (South Northamptonshire Council, 2019). The guidance aims to maximise potential benefits to health and the environment, minimise road transport emissions and counter cumulative impacts due to emissions from new development. The SPD presents a hierarchy of principles for air quality mitigation; preventing or avoiding exposure/impacts, reducing and minimising exposure/impacts and off-setting where options for preventing/avoiding and reducing/minimising are not attainable.

2.3.13 The SPD also sets out a step by step process to determine the level of assessment required and the mitigation requirements for proposed development.

Air Quality Action Plan

2.3.14 South Northamptonshire Council has published an Air Quality Action Plan which includes a number of measures and actions that the council intends to implement in order to help meet the air quality objectives within its AQMA (South Northamptonshire Council, 2008).

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 most recent publicly available Air Quality Annual Status Report (ASR) published by South Northamptonshire Council (South Northamptonshire Council, 2020);
- Maps of roadside concentrations published by Defra have been used to identify current exceedances of the annual mean NO_2 EU limit value[1] (Defra, 2020a); and
- Background pollutant concentration maps published by Defra (Defra, 2020b).

3.2. Construction Impacts

3.2.1 A construction dust risk assessment has been undertaken following the methodology in the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2016).

3.2.2 The guidance divides activities on construction sites into four main types: demolition, earthworks, construction and trackout. The methodology is based on a sequence of steps. Step 1 screens the requirement for more detailed assessment; if there are no receptors within 50 m of the site boundary, or within 50 m of roads used by construction vehicles, then there is no need for further assessment. Step 2 assesses the risk of dust impacts from each of the four activities, considering the scale and magnitude of the works (Step 2A), and the sensitivity of the area (Step 2B). Site-specific mitigation for each of the four activities is then determined based on a dust risk category defined at Step 2C. **Appendix A1** sets out the construction dust assessment methodology in more detail.

3.2.3 The IAQM construction dust assessment methodology ensures that, with appropriate mitigation in place, the residual effect from construction dust will normally be 'not significant'. Therefore, the assessment has been used to determine an appropriate level of mitigation for the construction phase.

3.3. Road Traffic Impacts

Dispersion Model

3.3.1 Pollutant concentrations have been predicted using the ADMS Roads (v5.0.0.1) dispersion model (CERC, 2020). The model requires the input of a range of data, details of which are provided in **Appendix A2**, along with details of the model verification calculations.

Sensitive Locations

3.3.2 Receptors have been identified at locations where members of the public are likely to be regularly present over the averaging period of the air quality objectives, i.e., where there is relevant exposure to the objectives. These receptors have been located on

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

the façades of properties closest to the road sources, paying particular attention to those located close to junctions, where traffic may become congested, and there is a combined effect from several road links.

3.3.3 A receptor has also been included at the boundary of the application site closest to Halse Road, where air quality at the application site due to emissions from the road would be worst-case. The receptors are described in **Table 2** and shown in **Figure 1**.

Assessment Scenarios

3.3.4 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at the receptors for the following scenarios:

- Baseline year (2019);
- Anticipated opening year without the proposed development (2022); and
- Anticipated opening year with the proposed development (2022).

3.3.5 The construction of the proposed development will take place over a number of years; however, to provide a conservative assessment, it has been assumed that all of the development traffic is on the road in the opening year.

Table 2: Description of Receptors

Receptor	Location	x	y	Z (m)
R1	Grange Cottages	458029.1	238828.6	1.5
R2	Manor Farm Cottages	456733.3	240310.3	1.5
R3	29 Nightingale Close	458141.2	238671.9	1.5
R4	5 Poppyfields Way	458183.4	238672.5	1.5
R5	6 Sycamore Close	458214.4	238619.1	1.5
R6	97 Poppyfields Way	458726.8	238622.0	1.5
R7	104 Poppyfields Way	458792.6	238602.1	1.5
R8	107 Poppyfields Way	458797.6	238621.5	1.5
R9	Carpenters Place	459136.5	238435.5	1.5
R10	1 Lagonda Drive	459134.3	238373.4	1.5
R11	The Radstone Primary School	458486.3	238794.8	1.5
R12	37 Oak Road	458754.2	238556.0	1.5
R13	Sundale	459643.9	238961.2	1.5
R14	Versions Farm Bungalow	459504.3	238634.9	1.5
R15	20 Juno Crescent	458368.2	238937.9	1.5
R16	Application Site	458016.6	238871.5	1.5

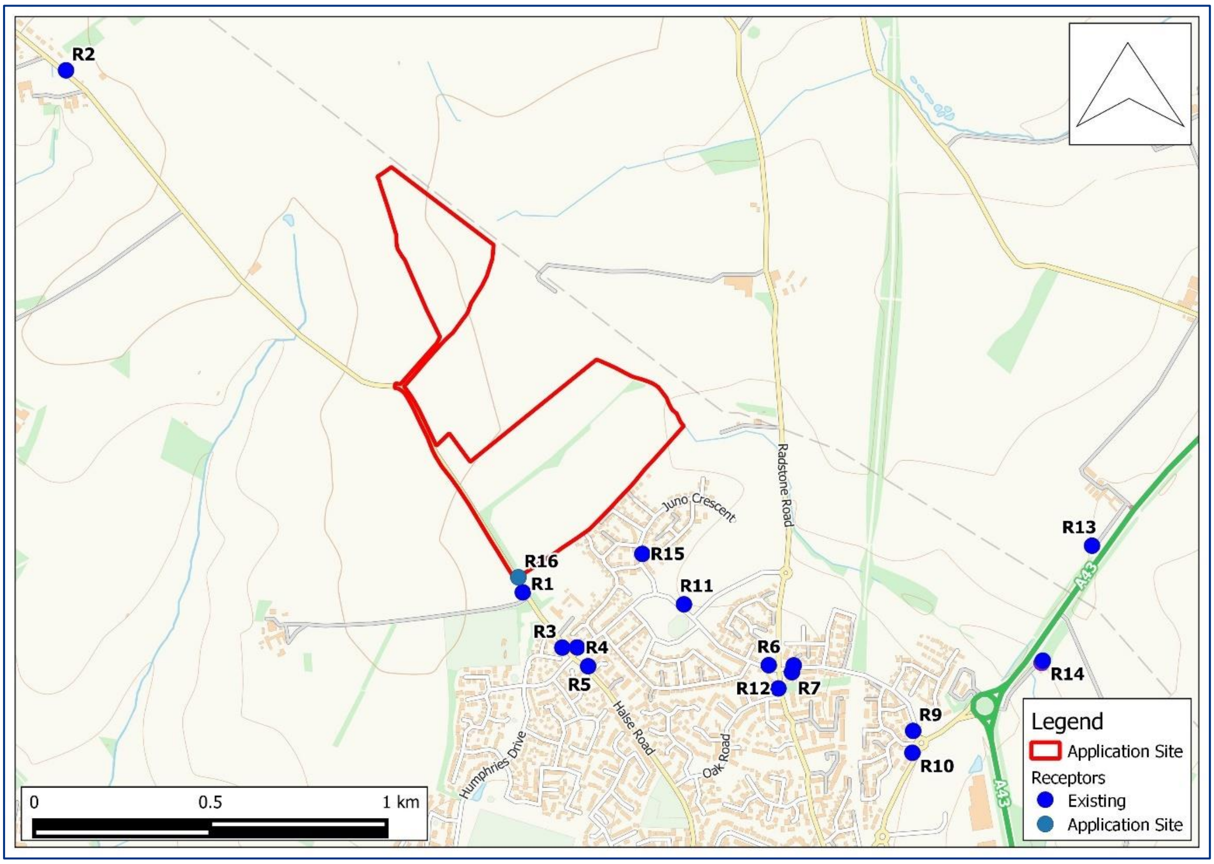

Figure 1: Location of Receptors
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Uncertainty

3.3.6 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 published by Defra have been used in this assessment.

3.3.7 Past analysis has shown a disparity between historical monitoring data and the projected background concentrations published by Defra (Carslaw, et al., 2011). 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. Air Quality Consultants Ltd (AQC) historically produced the Calculator Using Realistic Emissions for Diesels (CURED) tool that applied adjustments to diesel emission factors from the EFT to account for the possible underprediction of future emissions (AQC, 2018).

3.3.8 Recent research has identified a significant reduction in roadside NOx concentrations in recent years (AQC, 2020a). Analysis of annual mean NOx concentrations at roadside monitoring sites, adjusted to remove inter-year differences due to meteorology, show an overall decrease of 6.4µg/m^3/yr between 2013 and 2019, with an even greater rate of reduction between 2016 and 2019.

3.3.9 AQC have compared the scale of reductions in NOx emissions predicted by a recent version of the EFT (v9.0) with the reductions observed at roadside monitoring sites (AQC, 2020b). At an average site in the UK, the EFT is likely to under-predict the rate at which NOx emissions fall in the near future. Therefore, provided a dispersion model is verified against measurements made in 2016, or later, the use of EFT emissions will result in the most likely, or even conservative, future predicted NOx concentrations. AQC consider that there is little value in continuing to use, or update, the CURED tool. Based on the evidence in the reports published by AQC, it is not considered appropriate to undertake a sensitivity analysis with regard to future emissions.

Assessment Criteria and Significance

Health Criteria

3.3.10 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 the EPUK/IAQM in guidance on Land-Use Planning & Development Control: Planning for Air Quality has been used for this assessment (EPUK and IAQM, 2017). The air quality impacts have been described at each receptor by determining the percentage change in concentrations relative to an air quality assessment level (AQAL) and comparing this with the total long-term average concentration, as set out in **Table 3**.

3.3.11 For impacts on existing receptors, the AQALs for NO_2 and $PM_{2.5}$ are based on the annual mean objectives (as shown in **Table 1)**. The AQAL for PM_{10} is an annual mean concentration of 32 µg/m^3 as measured data show that the 24-hour PM_{10} objective could be exceeded where annual mean concentrations are above 32 µg/m^3 (Defra, 2016).

Significance

3.3.12 The air quality impact, i.e. the change in concentrations as a result of the development, may have an effect on human health, dependent on the severity of the impact and other factors.

3.3.13 The IAQM guidance advises that the overall effect of the air quality impacts should be judged as either significant or not significant taking account of:

- The descriptions of the predicted impacts;
- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts;
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- The potential for cumulative impacts, i.e. several slight impacts taken together could have a significant effect, or a moderate or substantial effect confined to a small area and not obviously a cause of harm to human health could be described as not significant; and

- The consequences of the impacts, i.e. will the impacts have an effect on human health that can be considered significant? The impacts from an individual development would usually not be large enough to result in a measurable change in health outcomes regarded as significant by healthcare professionals, and therefore the impact on local air quality is used as a proxy for assessing effects on health.

3.3.14 The judgement of significance should be made by a competent, suitably qualified professional, and the professional experience of the consultant preparing the report is set out in **Appendix A3**.

Table 3: Impact Descriptors for Individual Receptors

Long-term Average Concentration at Receptor in Assessment Year [b]	% Change in Concentration Relative to AQAL [a]			
	1	2-5	6-10	>10
≤ 75% of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
≥ 110% of AQAL	Moderate	Substantial	Substantial	Substantial

a The % change rounded to a whole number. Changes of 0%, i.e. less than 0.5%, are described as negligible. The AQAL for NO_2 is 40 µg/m^3, the AQAL for PM_{10} is 32 µg/m^3 and the AQAL for $PM_{2.5}$ is 25 µg/m^3.

b The without scheme concentration where there is a decrease in predicted concentrations, and the with scheme concentration where there is an increase in predicted concentrations.

4 Baseline Conditions

4.1. LAQM Review and Assessment

4.1.1 South Northamptonshire Council has declared one AQMA for exceedances of the annual mean NO_2 objective along the A5 in Towcester, between the Saracens Head crossroads at the north to Silverstone Brook at the south. The AQMA is located over 14km to the northeast of the application site and will not be affected by traffic from the proposed development.

4.1.2 South Northamptonshire Council has concluded that it is highly unlikely concentrations of PM_{10} or $PM_{2.5}$ exceed the objectives at any location in the borough.

4.2. EU Limit Values

4.2.1 There are no AURN monitoring sites within the study area and no roads within 10km of the application site are included in modelling undertaken by Defra; therefore, no information is available with regard to the NO_2 EU limit values close to the application site.

4.3. Local Air Quality Monitoring

4.3.1 South Northamptonshire Council does not operate any automatic monitoring sites; however, a number of diffusion tube monitoring sites are in operation. Data from monitoring sites located within 5km of the application site are shown in in **Table 4**, with the locations shown in **Figure 2**.

4.3.2 The annual mean NO_2 objective has been achieved by a wide margin at all of the diffusion tube monitoring sites shown in **Table 4**. Annual mean concentrations ranged from 14.9-24.4µg/m^3 between 2015 and 2019.

Table 4: Measured Annual Mean NO_2 Concentrations

Site ID	Location	Site Type [a]	Annual Mean (µg/m^3)				
			2015	2016	2017	2018	2019
BR2	High Street	R	24.4	23.7	21.6	22.9	21.1
BR4	Versions Farm Bungalow	R	24.3	24.2	22.7	21.5	19.6
F1	Main Road, Farthington	R	-	-	-	14.9	16.6
Objective			**40**				

a R = Roadside.

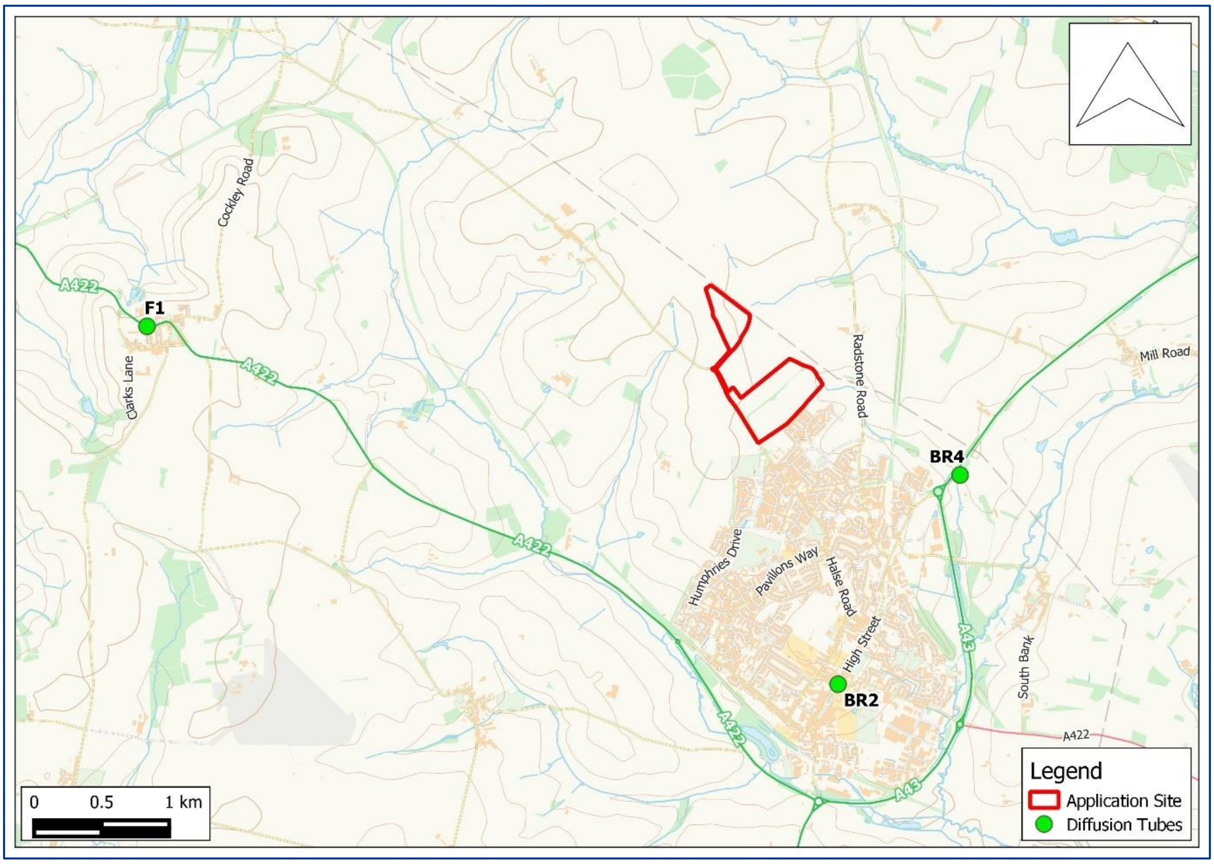

Figure 2: Air Quality Monitoring Sites
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4.4. Background Concentrations

4.4.1 Estimated background concentrations across the study area are shown in **Table 5**. The background concentrations have been derived from data in the national maps published by Defra. The background concentrations are all well below the objectives.

Table 5: Estimated Annual Mean Background Concentrations (µg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2019	9.5-13.8	7.4-10.5	13.8-15.6	8.8-9.7
2022	8.4-11.9	6.6-9.1	13.2-15.0	8.3-9.2
Objective	**-**	**40**	**40**	**25**

4.5. Predicted Baseline Concentrations

4.5.1 Baseline concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been modelled at the existing receptor locations and the results are shown in **Table 6**. Predicted annual mean baseline concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the AQALs in 2019 and 2022.

Table 6: Predicted Baseline Concentrations in 2019 and 2022 [a]

Receptor	Annual Mean (µg/m³)					
	NO_2		PM_{10}		$PM_{2.5}$	
	2019	2022	2019	2022	2019	2022
R1	10.1	8.9	13.9	13.3	9.1	8.6
R2	8.3	7.3	14.1	13.5	8.9	8.4
R3	10.4	9.1	14.0	13.4	9.1	8.7
R4	11.7	10.1	14.2	13.6	9.2	8.8
R5	12.3	10.5	14.3	13.7	9.3	8.8
R6	12.2	10.5	14.3	13.7	9.3	8.8
R7	12.4	10.7	14.3	13.7	9.3	8.8
R8	13.0	11.1	14.4	13.8	9.4	8.9
R9	14.0	11.7	16.2	15.6	10.0	9.5
R10	15.4	12.8	16.4	15.8	10.2	9.7
R11	11.0	9.6	14.1	13.5	9.2	8.7
R12	12.6	10.8	14.4	13.8	9.4	8.9
R13	17.9	14.4	16.9	16.3	10.5	9.9
R14	19.9	15.9	17.2	16.6	10.7	10.1
R15	11.8	10.2	14.3	13.7	9.3	8.8
AQAL	**40**		**32**		**25**	

a Exceedances are shown in bold.

5 Air Quality Assessment

5.1. Construction Phase

5.1.1 Without mitigation, there is a risk that the construction phase of the development will lead to dust soiling and elevated concentrations of PM_{10}. These impacts may occur during demolition, earthworks and construction, as well as from track-out of dust onto the public highway, as vehicles leave the construction site.

Screening

5.1.2 There are human receptors within 350 m of the application site to the southeast. There are also receptors within 50 m of the route used by construction vehicles on the public highway, up to 500 m from the site entrance. Therefore, further assessment of the construction phase impacts on human receptors is necessary. There are no sensitive ecological receptors within 50 m of the application site boundary, and the effects of construction on ecology will not be considered further.

Risk of Dust Impacts

Potential Dust Emission Magnitude

5.1.3 There will be no demolition at the application site; therefore, the impacts due to dust during demolition will not be considered further.

5.1.4 Earthworks will take place across approximately 60,000 m^2 of the application site; however, significant amounts of material will not need to be moved as buildings will be set at ground level. There are unlikely to be any more than 10 heavy earth moving vehicles active at any one time. Data from the UK Soil Observatory have been used to determine that the soil texture at the site is likely to be a clayey loam to silty loam, which may be moderately dusty and prone to suspension when dry (UKRI, 2020). Based on the example definitions in definitions in **Table A1** of **Appendix A1**, the dust emission class for earthworks is considered to be large.

5.1.5 The proposed development involves the construction of buildings with a total volume of more than 100,000 m^3. Based on the example definitions in **Table A1** of **Appendix A1**, the dust emission class for construction is considered to be large.

5.1.6 The number of daily outward heavy duty vehicle (HDV) movements from the application site during the construction phase is likely to be between 10-50; therefore, based on the example definitions in **Table A1** of **Appendix A1**, the dust emission class for trackout is considered to be medium.

5.1.7 A summary of the likely dust emission magnitudes is shown in **Table 7**.

Table 7: Likely Dust Emission Magnitudes

Source	Dust Emission Magnitude
Demolition	n/a
Earthworks	Large
Construction	Large
Trackout	Medium

Sensitivity of the Area

5.1.8 The sensitivity of the area depends on the specific sensitivities of local receptors, the proximity and number of receptors, local PM_{10} background concentrations and other site specific factors, e.g. natural screening by trees.

Sensitivity of the Area to Dust Soiling

5.1.9 The nearby residential properties are considered to be 'high' sensitivity receptors to dust soiling (see **Table A2** of **Appendix A1**).

5.1.10 The nearby residential properties will be further than 20m from dust generating activities; however, there will be between 10-100 residential properties within 50m. There are no commercial properties within 20m of dust generating activities. With reference to **Table A5** of **Appendix A1**, the area is considered to be of medium sensitivity to dust soiling from on-site works.

5.1.11 **Table 7** shows that the dust emission magnitude for trackout is medium, therefore there is a risk of material being tracked up to 200 m from the site exit. Construction vehicles will access the site from Halse Road and there are less than 10 receptors within 20m of the road up to 200m from the site exit. With reference to **Table A5** of **Appendix A1**, the area is thus considered to be of medium sensitivity to dust soiling from trackout.

Sensitivity of the Area to the Health Effects of PM_{10}

5.1.12 The residential properties are considered to be 'high' sensitivity receptors to the health effects of PM_{10} (see **Table A3** of **Appendix A1**).

5.1.13 Annual average PM_{10} concentrations close to the application site are likely to be similar to those predicted at local receptors in 2019, i.e. between 13.9-14.3µg/m^3 (see **Table 6**). Therefore, with reference to **Table A6** of **Appendix A1**, the area is considered to be of low sensitivity to the health effects of PM_{10} during on-site works and from trackout.

5.1.14 A summary of the sensitivity of the area to the effects of the construction works is shown in **Table 8**.

Table 8: Summary of the Area Sensitivity

Potential Effect	Sensitivity of the Area	
	On-site Works	Trackout
Dust Soiling	Medium	Medium
Health	Low	Low

Risk of Impact and Significance

5.1.15 The dust emission magnitudes in **Table 7** have been combined with the area sensitivities in **Table 8** and a risk category has been assigned to each construction activity using the matrix in **Table A8** of **Appendix A1.** The resultant risk categories, shown in **Table 9**, have then been used to determine the appropriate level of mitigation necessary for a residual effect that is likely to be 'not significant'.

Table 9: Summary of the Risk of Impacts Without Mitigation

Construction Activity	Dust Soiling	Health
Demolition	n/a	n/a
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Low	Low

5.2. Road Traffic Impacts

Impact of the Proposed Development

NO_2

5.2.1 Predicted annual mean NO_2 concentrations are shown in **Table 10**. The predicted concentrations are all below the AQAL and the impacts are described as negligible.

Table 10: Predicted NO_2 Impacts in 2022 [a]

Receptor	Annual Mean (µg/m^3)		% Change in Concentration Relative to AQAL	Total Concentration as % of AQAL	Impact Descriptor
	WO	W			
R1	8.9	9.2	1	23	Negligible
R2	7.3	7.9	2	20	Negligible
R3	9.1	9.4	1	24	Negligible
R4	10.1	10.4	1	26	Negligible
R5	10.5	11.1	1	28	Negligible
R6	10.5	11.8	3	29	Negligible
R7	10.7	11.2	1	28	Negligible
R8	11.1	11.9	2	30	Negligible
R9	11.7	12.0	1	30	Negligible
R10	12.8	12.9	0	32	Negligible
R11	9.6	10.5	2	26	Negligible
R12	10.8	11.2	1	28	Negligible
R13	14.4	14.6	0	36	Negligible
R14	15.9	16.1	1	40	Negligible
R15	10.2	11.3	3	28	Negligible
AQAL	**40**		**-**		

a WO = without scheme, W = with scheme.

PM_{10}

5.2.2 Predicted annual mean PM_{10} concentrations are shown in **Table 11**. The predicted concentrations are all well below the AQAL and the impacts are described as negligible.

Table 11: Predicted PM_{10} Impacts in 2022 [a]

Receptor	Annual Mean (µg/m³)		% Change in Concentration Relative to AQAL	Total Concentration as % of AQAL	Impact Descriptor
	WO	W			
R1	13.3	13.4	0	42	Negligible
R2	13.5	13.7	0	43	Negligible
R3	13.4	13.4	0	42	Negligible
R4	13.6	13.6	0	43	Negligible
R5	13.7	13.8	0	43	Negligible
R6	13.7	13.9	1	44	Negligible
R7	13.7	13.8	0	43	Negligible
R8	13.8	13.9	1	44	Negligible
R9	15.6	15.6	0	49	Negligible
R10	15.8	15.8	0	49	Negligible
R11	13.5	13.7	1	43	Negligible
R12	13.8	13.9	0	43	Negligible
R13	16.3	16.3	0	51	Negligible
R14	16.6	16.6	0	52	Negligible
R15	13.7	13.9	1	44	Negligible
AQAL	**32**		**-**		

a = without scheme, W = with scheme.

$PM_{2.5}$

5.2.3 Predicted annual mean $PM_{2.5}$ concentrations are shown in **Table 12**. The predicted annual mean $PM_{2.5}$ concentrations are all well below the AQAL and the impacts are described as negligible.

Table 12: Predicted $PM_{2.5}$ Impacts in 2022 [a]

Receptor	Annual Mean (µg/m³)		% Change in Concentration Relative to AQAL	Total Concentration as % of AQAL	Impact Descriptor
	WO	W			
R1	8.6	8.7	0	35	Negligible
R2	8.4	8.5	0	34	Negligible
R3	8.7	8.7	0	35	Negligible
R4	8.8	8.8	0	35	Negligible
R5	8.8	8.9	0	36	Negligible
R6	8.8	9.0	1	36	Negligible
R7	8.8	8.9	0	36	Negligible
R8	8.9	9.0	0	36	Negligible
R9	9.5	9.6	0	38	Negligible
R10	9.7	9.7	0	39	Negligible
R11	8.7	8.9	1	35	Negligible
R12	8.9	8.9	0	36	Negligible
R13	9.9	10.0	0	40	Negligible
R14	10.1	10.1	0	41	Negligible
R15	8.8	9.0	1	36	Negligible
AQAL	**25**		**-**		

a WO = without scheme, W = with scheme.

Impacts on the Proposed Development

5.2.4 Concentrations predicted at the receptor R16 at the application site boundary closest to Halse Road are 9.8µgNO_2/m^3, 13.6µgPM_{10}/m^3 and 8.8µg$PM_{2.5}$/m^3, well below the AQALs. As pollutant concentrations decrease rapidly with distance from the road source, air quality will be acceptable across the entire application site.

6 Mitigation

6.1. Construction Phase

6.1.1 The application site has been identified as a medium risk site for dust soiling and a low risk site for health effects during the construction phase, as set out in **Table 9**. The dust risk category has been used, along with the professional judgement of the consultant, to determine the appropriate level of mitigation at the site. The mitigation measures, taken from the IAQM guidance (IAQM, 2016), are described in **Appendix A4**.

6.1.2 The mitigation measures should be written into a dust management plan (DMP), which should be approved by the local planning authority prior to commencement of work on site.

6.2. Operational Phase

6.2.1 A Framework Travel Plan (FTP) has been developed for the scheme (Cotswold Transport Planning, 2020). The FTP sets out how the proposed development will promote sustainable travel and discourage car use. Measures included in the FTP include:

- Travel Information Packs for the first occupier of each dwelling, including information that will promote the use of sustainable transport modes and reduce car usage; and
- Secure and covered cycle parking for each new dwelling.

6.2.2 The assessment has shown that the air quality impacts will be insignificant. 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. Therefore, it is not considered appropriate to propose further mitigation measures for this scheme.

7 Residual Impacts

7.1. Construction Phase

7.1.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be 'not significant'. With the implementation of the mitigation measures set out in **Appendix A4**, the residual effects are judged to be insignificant.

7.1.2 During adverse weather conditions, or where there is an interruption to the water supply, there may be occasional, short-term dust annoyance; however, the likely scale and duration of these effects would not change the conclusion that the residual effects are insignificant.

7.2. Operational Phase

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

8 Conclusions

8.1.1 The air quality impacts associated with the construction and operation of the proposed residential development at land northwest of Radstone Fields, off Halse Road, Brackley have been assessed.

8.1.2 The construction phase will have the potential to create dust. It will therefore be necessary to implement mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be insignificant.

8.1.3 Concentrations have been modelled at 15 existing receptors and at the application site boundary closest to Halse Road, representing locations where the impacts are expected to be greatest.

8.1.4 It is concluded that concentrations of NO_2, PM_{10} and $PM_{2.5}$ will remain below the AQALs at the receptors in 2022, whether the scheme is developed or not, and the impacts will be negligible.

8.1.5 The overall operational air quality impacts are judged to be *insignificant*. This conclusion is based on the impacts all being described as negligible and total concentrations being below the air quality objectives at existing receptors.

8.1.6 The air quality effects of the development have been assessed and found to be insignificant. There should be no constraints to the development of the site, with regard to air quality, as the proposed development is consistent with the relevant parts of:

- the NPPF;
- Policy BN9 of the West Northamptonshire Joint Core Strategy Local Plan (Part 1); and
- Policy SS2 of the South Northamptonshire Part 2 Local Plan.

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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
µg/m³	Microgrammes per cubic metre
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
SPD	Supplementary Planning Document
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

11 Appendices

A1 Construction Dust Assessment Methodology

A1.1.1 The IAQM guidance divides activities on construction sites into four types to reflect their different potential impacts:

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

A1.1.2 A series of steps then consider the potential impact due to:

- annoyance due to dust soiling;
- the risk of health effects due to increased exposure to PM_{10}; and
- harm to ecological receptors.

A1.2. Step 1: Screen the Need for a Detailed Assessment

A1.2.1 An assessment is required where there is a human receptor within 350 m of the site boundary, and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the site boundary, and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A1.2.2 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is negligible, and any effects will be not significant.

A1.3. Step 2: Assess the Risk of Dust Impacts

A1.3.1 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emissions magnitude (Step 2A); and
- the sensitivity of the area to dust impacts (Step 2B).

A1.3.2 These two factors are combined at Step 2C to determine the risk of dust impacts from each type of construction activity, with no mitigation applied.

Step 2A: Potential Dust Emissions Magnitude

A1.3.3 The dust emission magnitude is classified as small, medium or large. Examples of how the potential dust emission magnitude for each activity can be defined are shown in **Table A1**.

Table A1: Examples of How the Dust Emission Magnitude can be Defined

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

a These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B: Define the Sensitivity of the Area

A1.3.4 The sensitivity of the area takes account of:

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

A1.3.5 The specific sensitivities of different types of receptor to dust soiling and PM_{10} are shown Table A2, Table A3 and Table A4. Professional judgement should be used to identify where on the spectrum of sensitivity a receptor lies, taking account of specific circumstances, i.e. the first occupants of residential units on a phased development may be expected to be less sensitive to dust soiling.

A1.3.6 The sensitivity of the area is then determined from the specific sensitivities of the receptors using the matrices set out in **Table A5**, **Table A6** and **Table A7**.

A1.3.7 Professional judgement should be used to determine the final sensitivity of the area, taking account of:

- any history of dust generating activities in the area:
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between source and receptors;
- any conclusions drawn from analysing local meteorological data which accurately represents the area; and if relevant, the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any other known specific receptor sensitivities.

Step 2C: Define the Risk of Impacts

A1.3.8 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts with no mitigation applied. The level of risk for each activity is determined using the matrix in **Table A8**.

A1.4. Step 3: Determine Site Specific Mitigation

A1.4.1 The dust risk category determined at Step 2C has been used, along with the professional judgement of the consultant, to determine the appropriate level of mitigation at the site. The highly recommended and desirable mitigation measures set out in the IAQM guidance form the basis of the mitigation set out in **Appendix A4**.

A1.5. Step 4: Determine Significant Effects

A1.5.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be ‘not significant’.

Table A2: Sensitivities of People to Dust Soiling

Class	Principles	Examples
High	Users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.	Dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms.
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	Parks and places of work.
Low	The enjoyment of amenity would not reasonably be expected; or property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.	Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.

Table A3: Sensitivities of People to PM_{10}

Class	Principles	Examples
High	Locations where members of the public may be exposed for eight hours or more in a day.	Residential properties, hospitals, schools and residential care homes.
Medium	Locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	Locations where human exposure is transient.	Public footpaths, playing fields, parks and shopping streets.

Table A4: Sensitivities of Receptors to Ecological Effects

Class	Principles	Examples
High	Locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species.	Special Areas of Conservation (SAC) with dust sensitive features.
Medium	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition.	Sites of Special Scientific Interest (SSSI) with dust sensitive features.
Low	Locations with a local designation where the features may be affected by dust deposition.	Local Nature Reserves with dust sensitive features.

Table A5: Sensitivity of the Area to Dust Soiling Effects on People and Property [2]

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 A6: Sensitivity of the Area to Human Health Effects [2]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	**>32 µg/m³**	**>100**	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	**>100**	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	**>100**	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	**>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

[2] For demolition, earthworks and construction, the distances are measured from the dust source, or the application site boundary. For trackout, the distances are measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A7: Sensitivity of the Area to Ecological Effects [2]

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

Table A8: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A2 Modelling Methodology

A2.1. Traffic Data

A2.1.1 Traffic data for the assessment has been provided by Cotswold Transport Planning. The traffic data was provided for a 2031 assessment year; however, in order to provide a worst-case assessment with regard to vehicle emissions, the data has been factored to a 2022 assessment year, i.e. the year when new homes could first be occupied. 2020 baseline traffic flows have been factored forward to the assessment year (2022) using the TEMPRO System v7.2b (DfT, 2020b). The development flows from 2031 have then been added to the baseline 2022 data. This method provides a conservative assessment as it assumes that all of the development traffic is on the road in the opening year, when vehicle emissions will be higher.

A2.1.2 Additional traffic data for A roads has been determined using the interactive web-based map provided by the Department for Transport (DfT) (DfT, 2020a). Traffic speeds have been estimated based on the speed limit and the road layout, reduced to 20km/h within 25m of a junction stop line. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2020c). The traffic data used to calculate emissions are shown in **Table A9** and the modelled road network is shown in **Figure 3**.

Table A9: Summary of Traffic Data used in the Assessment

Road Link	AADT [a]			% HDVs [b]
	2019	2022 wo	2022 w	
Halse Road N of Poppyfields Way	1,243	1,267	2,387	2
Humphries Drive	2,109	2,151	2,151	2
Halse Road S of Poppyfields Way	3,888	3,964	5,084	2
Poppyfields Way E of Halse Road	3,171	3,234	3,234	2
Poppyfields Way W of Juno Crescent	2,389	2,436	2,436	2
Juno Crescent	3,334	3,399	5,873	2
Poppyfields Way E of Juno Crescent	2,480	2,529	5,003	2
Poppyfields Way W Radstone Road	2,587	2,638	5,111	2
Radstone Road N Poppyfields Way	3,390	3,456	3,593	2
Poppyfields Way E of Radstone Road	2,932	2,990	4,207	2
Radstone Road S of Poppyfields Way	7,552	7,700	8,820	2
Poppyfields Way N of Northampton Road	4,965	5,063	6,280	2
Northampton Road S of Poppyfields Way	12,451	12,696	12,696	2
Northampton Road N of Poppyfields Way	14,667	14,955	16,172	2
A422	25,526	26,028	26,028	3.7
A43 S of Northampton Road	37,298	38,032	38,032	11.4
A43 N of Northampton Road	35,232	35,925	37,142	12.7

a wo = without development, w = with development.

b HDV is heavy duty vehicle >3.5 tonnes (heavy goods vehicle + buses).

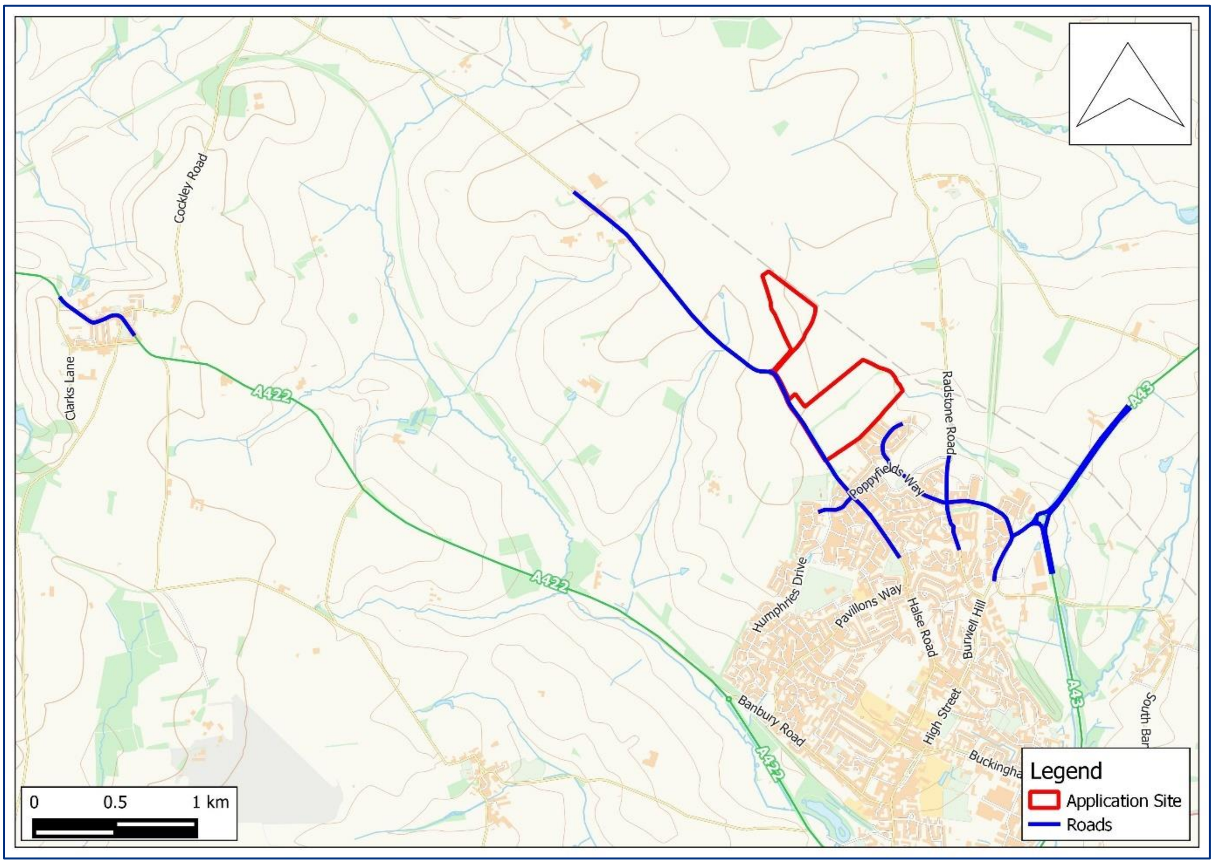

Figure 3: Modelled Roads
Contains Ordnance Survey data © Crown copyright and database right 2020

Emissions

A2.1.3 Emissions have been calculated using the most recent version of the Emissions Factor Toolkit (EFT) v10.1. 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.

Meteorological Data

A2.1.4 The model has been run using the full year of meteorological data that corresponds with the most recent set of nitrogen dioxide monitoring data (2019). The meteorological data has been taken from the monitoring station located at RAF Brize Norton , which is considered suitable for the area.

A2.2. Background Concentrations

A2.2.1 Background concentrations have been derived from those published by Defra (Defra, 2020b). These cover the whole country on a 1 km by 1 km grid and are published for each year from 2018 to 2030. The current maps have been verified against measurements undertaken during 2018.

A2.3. Verification

A2.3.1 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

A2.3.2 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 2019 annual mean NOx concentrations at diffusion tube monitoring sites BR4 and F1 (the monitoring sites are described in **Table 4** and the locations shown in **Figure 2**).

A2.3.3 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 v8.1 published by Defra (Defra, 2020b).

A2.3.4 The slope of the best-fit line between the 'measured' road-NOx contribution and the model derived road-NOx contribution, forced through zero, has determined an adjustment factor of 0.64 (**Figure 4**). **Figure 4** shows that the model has significantly over-predicted concentrations at diffusion tube monitoring site F1 and inclusion of this data in the factor calculation could lead to underpredicted concentrations at the receptors. Therefore, diffusion tube monitoring site F1 has been excluded from the verification calculation and a new factor calculated using BR4 data only.

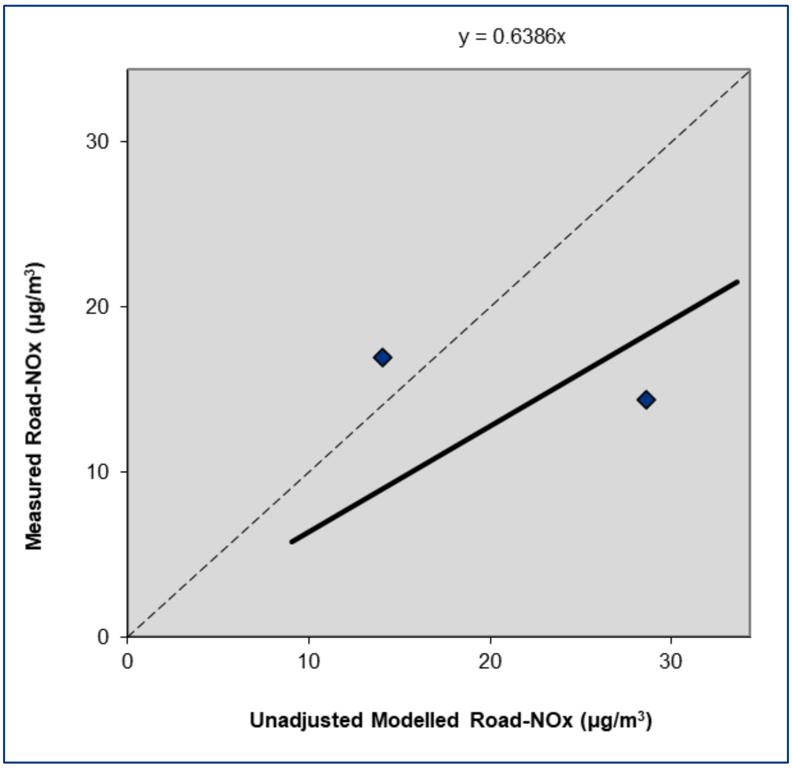

Figure 4: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations.

A2.3.5 An adjustment factor has been determined as the ratio of the ‘measured’ road-NOx contribution and the model derived road-NOx contribution at the BR4 diffusion tube monitoring site. This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with background NO_2 concentrations within the NOx to NO_2 calculator.

A2.3.6 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 19.6 µg/m^3
- Background NO_2 : 10.5 µg/m^3
- ‘Measured’ road-NOx (from NOx from NO_2 calculator): 17.0 µg/m^3
- Modelled road-NOx = 14.1 µg/m^3
- Road-NOx adjustment factor: 17.0/14.1 = **1.2**

PM_{10} and $PM_{2.5}$

A2.3.7 No PM monitoring is undertaken within the study area; therefore, the modelled road PM have been adjusted using the verification factor calculated for NOx.

A2.4. Model Post-processing

NO_2

A2.4.1 The NOx to NO_2 calculator v8.1 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 to give the final predicted concentrations.

PM_{10} and $PM_{2.5}$

A2.4.2 The verified road-PM outputs need no further processing and have been added to the background concentrations to give the final predicted concentrations.

A3 Professional Experience

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

Bob Thomas is a Director at AQA, with over thirteen 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

A4 Construction Mitigation

A4.1.1 The following is a set of measures that should be incorporated into the specification for the works.

A4.2. Communications

- Develop and implement a stakeholder communications plan that includes community engagement before and during work on site;
- display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
- display the head or regional office contact information.

A4.3. Dust Management Plan

- Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management.

A4.4. Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked; and
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book.

A4.5. Monitoring

- Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust area being carried out and during prolonged dry or windy conditions; and
- agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance on monitoring near construction sites is provided by the IAQM (IAQM, 2018).

A4.6. Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are as at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed, or fence stockpiles to prevent wind whipping.

A4.7. Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off their engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
- impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

A4.8. Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate; and
- use enclosed chutes, conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

A4.9. Waste Management

- No bonfires and burning of waste materials.

A4.10. Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- only remove the cover from small areas during work, not all at once.

A4.11. Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

A4.12. Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- record all inspections of haul routes and any subsequent action in a site log book; and
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).