Report

Carisbrook Road, Mitcheldean

# Air Quality Assessment

For Gladman Developments Ltd

7 March 2025

Air Quality CONSULTANTS | PART OF Logika Group

## Document Control

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## Executive Summary

The air quality impacts associated with the proposed residential development of land at Carisbrook Road in Mitcheldean, Forest of Dean have been assessed. The proposals are for the construction of up to 180 dwellings on land that is currently used for agriculture.

The assessment has demonstrated that future residents will experience acceptable air quality, with pollutant concentrations well below the air quality objectives. The proposals will generate additional traffic on the local road network, but the assessment has shown that there will be no significant effects at any existing, sensitive receptor.

Overall, the operational air quality effects are judged to be 'not significant'.

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## Figures

# 1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed residential development of land at Carisbrook Road in Mitcheldean, Forest of Dean. The proposals are for the construction of up to 180 dwellings on land that is currently used for agriculture.

1.2 The location and setting of the proposed development are shown in Figure 1-1, along with the location of the monitoring sites operated by the Forest of Dean District Council (FDDC) in Mitcheldean in 2023[1].

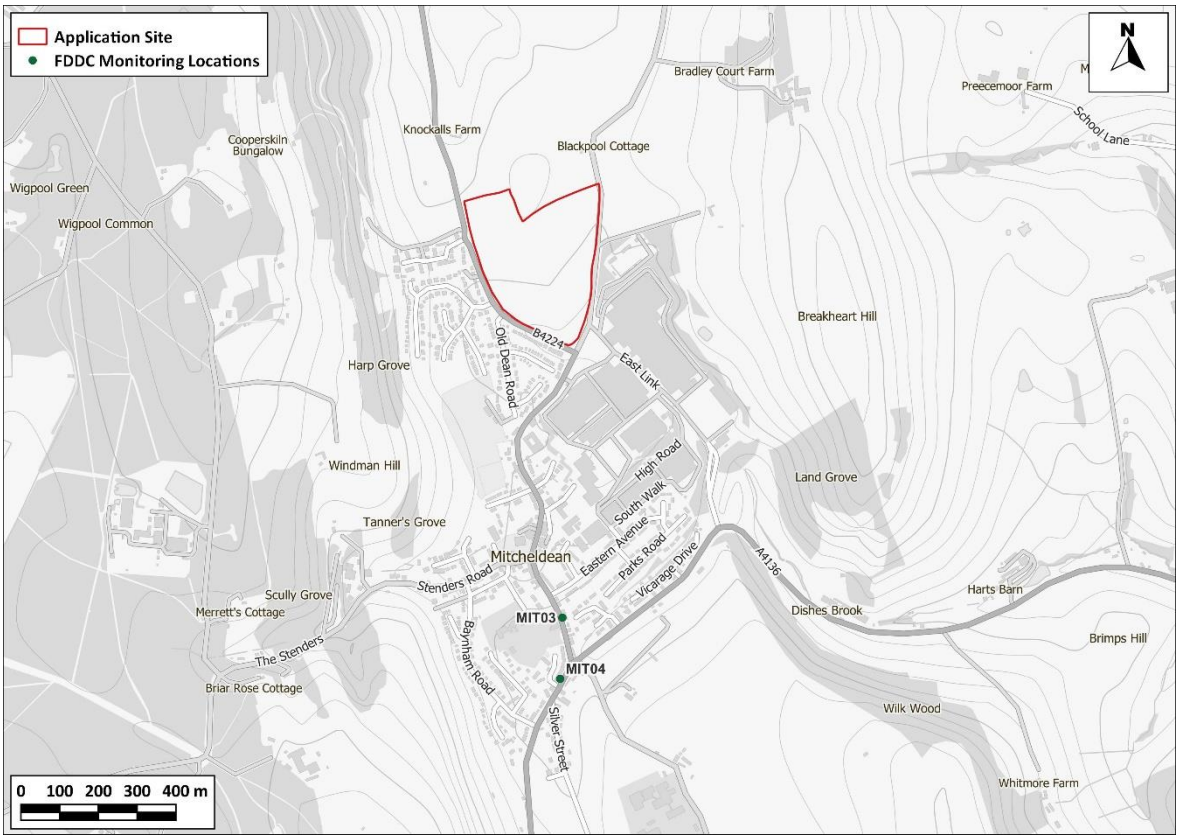


**Figure 1-1: Proposed Development Location**

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

1.3 The proposed development will generate additional traffic on local roads, which may impact on air quality at existing residential properties along the affected road network. The new residential properties will also be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to road traffic emissions are nitrogen dioxide ($NO_2$) and fine particulate matter ($PM_{10}$ and $PM_{2.5}$).

1.4 It is understood at this stage that the new homes will be provided with heat and hot water by individual boilers within each unit; there will be no centralised combustion plant and thus no significant local point sources of emissions within the proposed development.

[1] Latest year of monitoring data available at the time of the report.

1.5 This report describes existing local air quality conditions (base year 2023[1]), and the predicted air quality in the future assuming that the proposed development does, or does not, proceed. The assessment of traffic-related impacts focuses on 2027, which is the anticipated year of first occupation of any of the new homes.

# 2 Policy Context

2.1 All European legislation referred to in this report is written into UK law and remains in place.

## Air Quality Strategy 2007

2.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

## Air Quality Strategy 2023

2.3 The Air Quality Strategy: Framework for Local Authority Delivery 2023 (Defra, 2023a) sets out the strategic air quality framework for local authorities and other Air Quality Partners in England. It sets out their powers and responsibilities, and actions the Government expects them to take. It does not replace other air quality guidance documents relevant to local authorities.

## Clean Air Strategy 2019

2.4 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

## Reducing Emissions from Road Transport: Road to Zero Strategy

2.5 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

2.6 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The Government's 'Zero Emission Vehicle' (ZEV) mandate requires that 80% of new cars and 70% of new vans sold in Great Britain must be zero emission by 2030, increasing to 100% by 2035. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades,

likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

## Environment Act 2021

2.7 The UK's new legal framework for protection of the natural environment, the Environment Act (2021) passed into UK law in November 2021. The Act gives the Government the power to set long-term, legally binding environmental targets. It also establishes an Office for Environmental Protection (OEP), responsible for holding the Government to account and ensuring compliance with these targets.

2.8 The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 (SI 2023 No. 96) sets two new targets for future concentrations of $PM_{2.5}$. These targets are described in Paragraph 3.5.

## Environmental Improvement Plan 2023

2.9 Defra published its 25 Year Environment Plan in 2018 (Defra, 2018a). The Environment Act (2021) requires Defra to review this Plan at least every five years. The Environmental Improvement Plan 2023 (Defra, 2023b) is the first revision. This outlines the progress made since 2018 and adds detail to the goals defined in the 2018 Plan, including that of achieving clean air.

2.10 The Environmental Improvement Plan 2023 sets out the new air quality targets which have been set for concentrations of $PM_{2.5}$. These targets, which are described in more detail in Paragraph 3.5, include the long-term targets in the Statutory Instrument described in Paragraph 2.8, and interim targets to be achieved by 2028.

2.11 The 2023 Plan outlines the role of local authorities in helping it meet both its targets and existing commitments. It also outlines the respective roles of industry, agricultural sectors, and the DfT in providing the coordinated action required to meet both its new, and pre-existing targets and commitments.

## Planning Policy

### National Policies

2.12 The National Planning Policy Framework (NPPF) (2024) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

*"to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".*

2.13 To prevent unacceptable risks from air pollution, Paragraph 187 of the NPPF states that:

*"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans".*

2.14 Paragraph 198 states:

*"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".*

2.15 More specifically, on air quality, Paragraph 199 makes clear 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".*

2.16 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

*"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with 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".*

2.17 Regarding plan-making, the PPG states:

*"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".*

2.18 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*".

2.19 Regarding the need for an air quality assessment, the PPG states 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".*

2.20 The PPG sets out the information that may be required in an air quality assessment, making clear 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".*

2.21 The PPG also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It 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. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".*

## Local Transport Plan

2.22 Gloucestershire's Local Transport Plan 2020 – 2041 was adopted in March 2021 (Gloucestershire County Council, 2021) and sets out the strategic transport vision for the county to 2041. The Plan sets out the overarching and mode policies that support the spatial Connecting Places Strategies and the Transport Scenarios.

2.23 Within this, Policy LTP PD0.1, 'Reducing Transport Carbon Emissions and Adapting to Climate Change' refers to air quality:

*"GCC will work with its partners to reduce transport carbon emissions by 2045 and improve air quality in the county by addressing travel demand, promoting the use of sustainable modes of transport and the uptake of ultra low emission vehicles to tackle climate change. GCC will do this by implementing the following policy proposals…*

- *Make a positive contribution towards a step change in sustainable land use planning to enable a priority towards sustainable travel choices and reduce travel demand, while supporting digital connectivity to improve agile working.*
- *Developers are required to design and implement their development to deliver sustainable transport, with appropriate connectivity to the existing transport network, good access to public transport, and a high permeability to walk, cycle and be mobility friendly."*

2.24 In addition, Policy LTP PD0.2, 'Local Environmental Protection' states:

*"GCC will work with District Councils and other partners; to minimise the impact of transport on landscapes, townscapes, heritage assets and the wider historic environment; to protect and enhance the water environment, air quality, soils and agricultural resources; to reduce the risk of flooding and the levels of noise pollution; to achieve biodiversity net gain and conserve geodiversity and the historic environment, from traffic or improvements on the highway network. GCC will do this by implementing the following policy proposals…*

- *Ensure that developers or scheme promoters, through the planning process, undertake assessments to determine if their development or scheme will be subject to or create poor air quality or noise in excess of the thresholds as advised by Government and to commit to mitigating those effects that address traffic impacts on the natural environment and designated sites, in particular those within 200m of a main road."*

## Local Policies

2.25 The FDDC Core Strategy (Forest of Dean District Council, 2012) was adopted in February 2012, and contains one policy which relates to air quality. Core Policy CSP.1, 'Design and environmental protection', states:

*"The design and construction of new development must take into account important characteristics of the environment and conserve, preserve or otherwise respect them in a manner that maintains or enhances their contribution to the environment, including their wider context. New development should demonstrate an efficient use of resources…*

*In achieving the above, the following will be considered:…*

- *The potential for the development to cause pollution and any mitigation measures to avoid pollution or make environmental improvements where existing problems occur".*

2.26 FDDC is in the process of preparing a new Local Plan which will cover the period between 2021 and 2041. The Consultation Version of the Draft Local Plan (Forest of Dean District Council, 2024a) includes Policy LP.22, 'Site Conditions' which states:

*"Development proposals must demonstrate that they can be satisfactorily accommodated on the site proposed in respect of the following:*

*…3. The potential for the development to cause pollution on site or elsewhere taking account of any mitigation measures to avoid pollution or environmental improvements where existing problems occur*

*…*

*Development that is not able to be satisfactorily accommodated in respect of the above will not be permitted."*

## Air Quality Technical Guidance

2.27 FDDC has prepared Air Quality Technical Guidance (Forest of Dean District Council, 2015) in response to changes in national planning policy with the aim to improve air quality across the district and encourage emissions reductions to improve the environmental health of the population. This guidance has been followed when undertaking this assessment.

## Building Standards

2.28 Part F(1) of Schedule 1 of the Building Regulations 2010 as amended June 2022 (Ministry of Housing, Communities and Local Government, 2022) places a duty on building owners, or those responsible for relevant building work[2], to ensure adequate ventilation is provided to building occupants.

2.29 Approved Document F (HM Government, 2021a), which accompanies the Building Regulations, explains that care should be taken to minimise entry of external air pollutants. Specific steps should be taken to manage ventilation intakes where the building is near to a significant source of emissions, or if local ambient concentrations exceed values set in the Air Quality Standards Regulations 2010 (see Paragraph 3.9, later). These steps include maximising the distance between emission source and air intake, considering likely dispersion patterns, and considering the timing of pollution releases when designing the ventilation system.

2.30 Part S(1) of Schedule 1, and Regulation 44D, of the Building Regulations 2010 (Ministry of Housing, Communities and Local Government, 2022) define a requirement for the provision of infrastructure for charging electric vehicles. Precise requirements are explained further within Approved Document S (HM Government, 2021b) and depend on the overall number of parking spaces provided and the average financial cost of installation.

2.31 Compliance with the Building Regulations is not required for planning approval, but it is assumed that the Regulations will be complied with in the completed development.

[2] Building work is a legal term for work covered by the Building Regulations. With limited exemptions, the Regulations apply to all significant building work, including erecting or extending a building.

# Air Quality Action Plans

## National Air Quality Plan

2.32 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018b) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a Clean Air Zone (CAZ). There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the limit values that are the focus of the Air Quality Plan.

## Local Air Quality Action Plan

2.33 FDDC declared an AQMA for exceedances of the annual mean nitrogen dioxide objective in Lydney in 2010. An Air Quality Action Plan was prepared in 2015 setting out the proposed measures to improve air quality within the AQMA; the measures include a number aimed at promoting the uptake of sustainable travel options, improved traffic management within the AQMA, and the preparation and adoption of the Air Quality Technical Guidance.

2.34 The AQMA is over 16 km from the proposed development, and there have been no measured exceedances of the annual mean objective at any location within the District, including within the AQMA, since 2013.

# 3 Assessment Criteria

3.1 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are based on assessment of the effects of each pollutant on human health, including the effects on sensitive sub-groups. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002). The relevant air quality criteria for this assessment are provided in Table 3-1.

**Table 3-1: Air Quality Criteria for Nitrogen Dioxide, $PM_{10}$ and $PM_{2.5}$**

| Pollutant | Time Period | Value |
|---|---|---|
| Nitrogen Dioxide | 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 [a] |
| $PM_{2.5}$ | Annual Mean | 20 µg/m³ [b] |

[a] A proxy value of 32 µg/m³ as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean $PM_{10}$ objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean $PM_{10}$ objective are possible (Defra, 2022).

[b] There is no numerical $PM_{2.5}$ objective for local authorities (see Paragraph 3.4). Convention is to assess against the UK limit value which is currently 20 µg/m³.

3.2 The UK-wide objectives for nitrogen dioxide and $PM_{10}$ were to have been achieved by 2005 and 2004, respectively, and continue to apply in all future years thereafter. Measurements across the UK have shown that the 1-hour mean nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m³ (Defra, 2022). Measurements have also shown that the 24-hour mean $PM_{10}$ objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m³. The predicted annual mean $PM_{10}$ concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean $PM_{10}$ objective. Where predicted annual mean concentrations are below 32 µg/m³ it is unlikely that the 24-hour mean objective will be exceeded.

3.3 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2022). The annual mean objectives for nitrogen dioxide and $PM_{10}$ are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for $PM_{10}$ is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

3.4 For $PM_{2.5}$, the objective set by Defra for local authorities is to work toward reducing concentrations without setting any specific numerical value. In the absence of a numerical objective, it is convention to assess local air quality impacts against the limit value (see Paragraph 3.9), originally set at 25 µg/m³ and currently set at 20 µg/m³.

3.5 Defra has also set two new targets, and two new interim targets, for $PM_{2.5}$ concentrations in England. One set of targets focuses on absolute concentrations. The long-term target is to achieve an annual mean $PM_{2.5}$ concentration of 10 µg/m$^3$ by the end of 2040 (referred to as the annual mean concentration target or AMCT), with the interim target being a value of 12 µg/m$^3$ by the start of 2028[3]. The second set of targets relate to reducing overall population exposure to $PM_{2.5}$. By the end of 2040, overall population exposure to $PM_{2.5}$ should be reduced by 35% compared with 2018 levels (referred to as the population exposure reduction target or PERT), with the interim target being a reduction of 22% by the start of 2028 (Table 3-2).

**Table 3-2: Environment Act $PM_{2.5}$ Targets**

| Metric | Target | Target Year |
|---|---|---|
| AMCT | Interim target: 12 µg/m$^3$ | 2028 |
| | Legally binding target: 10 µg/m$^3$ | 2040 |
| PERT | Interim target: 22% reduction in exposure compared to 2018 | 2028 |
| | Legally binding target: 35% reduction in exposure compared to 2018 | 2040 |

3.6 In 2024 Defra published Interim Planning Guidance on the $PM_{2.5}$ targets (Defra, 2024). This states that:

*"The purpose of the targets is to improve air quality by reducing levels of $PM_{2.5}$ across the country, therefore improving public health. While achievement of the targets will be assessed at relevant monitoring sites, the targets apply to ambient (outdoor) air throughout England. Applicants and Local Planning Authorities should therefore consider the impact of developments on air quality in all ambient air, whether a monitor is present or not."*

3.7 In order to address the new targets, it is not sufficient to assess solely whether a scheme is likely to lead to an exceedance of a legal limit. Instead, developments need to implement appropriate mitigation measures from the design stage, ensuring the minimum amount of pollution is emitted and that exposure is minimised.

3.8 Pending publication of the new guidance, Defra advises applicants to provide evidence that they have identified key sources of air pollution within the scheme and taken appropriate action to minimise emissions of $PM_{2.5}$ and its precursors as far as possible. More detailed assessment is expected for development closer to populations and/or having higher emissions. Defra has posed two questions to be used as prompts to support the interim assessment process:

*"How has exposure to $PM_{2.5}$ been considered when selecting the development site?; and*

*What actions and/or mitigations have been considered to reduce $PM_{2.5}$ exposure for development users and nearby receptors (houses, hospitals, schools etc.) and to reduce emissions of $PM_{2.5}$ and its precursors?"*

3.9 European Union (EU) Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010)[4]. The limit values for nitrogen dioxide and $PM_{10}$ are the same numerical concentrations as the UK objectives, but achievement of the limit values is a national obligation rather than a local one and concentrations are reported to the nearest whole

[3] Meaning that it will be assessed using measurements from 2027. The 2040 target will be assessed using measurements from 2040. National targets are assessed against concentrations expressed to the nearest whole number, for example a concentration of 10.4 µg/m$^3$ would not exceed the 10 µg/m$^3$ target.
[4] As amended through The Air Quality Standards (Amendment) Regulations 2016 and The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

number. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU).

## Screening Criteria

3.10 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[5] recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality effects. The approach, as described in Appendix A1, first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 $m^2$ of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment.

3.11 The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. The screening thresholds (described in full in Appendix A1) outside an AQMA are a change in flows of more than 100 Heavy Duty Vehicles (HDVs) or 500 Light Duty Vehicles (LDVs) per day. Where these criteria are exceeded, a detailed assessment is likely to be required, although the guidance advises that "*the criteria provided are precautionary and should be treated as indicative*", and "*it may be appropriate to amend them on the basis of professional judgement*".

3.12 While these screening criteria are specifically intended to act as a trigger for a detailed assessment, they can also sometimes be used to identify the extent of the road network that requires assessment. Where the change in traffic on a given road link is less than the relevant screening threshold, it is unlikely that a significant effect would occur, and these links can be disregarded unless there are additional development-related emissions affecting receptors along the link.

[5] The IAQM is the professional body for air quality practitioners in the UK.

# 4 Assessment Approach

## Existing Conditions

4.1 Existing sources of emissions and baseline air quality conditions within the study area have been defined using a number of approaches:

- industrial sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2025a);
- local sources have been identified through examination of FDDC's Air Quality Review and Assessment reports;
- information on existing air quality has been obtained by collating the results of monitoring carried out by FDDC;
- background concentrations have been defined using Defra's 2018-based background maps (Defra, 2025b)[6]. These cover the whole of the UK on a 1x1 km grid; and
- whether or not there are any exceedances of the annual mean limit value for nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$ in the study area has been identified using Defra's Compliance data (2025c).

## Road Traffic Impacts

### Modelling Methodology

4.2 Concentrations have been predicted using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v12.1) (Defra, 2025b). Details of the model inputs and the model verification are provided in Appendix A2.

### Assessment Scenarios

4.3 Nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$ concentrations have been predicted for the following scenarios:

- base year 2023;
- the proposed year of first occupation of the proposed development (2027) without the development; and
- 2027 with the development.

### Traffic Data

4.4 Traffic data for the assessment have been provided by Prime Transport Planning Ltd, who undertook the Transport Assessment for the proposed development. Further details of the traffic data used in this assessment are provided in Appendix A2.

4.5 The first year of occupation of any part of the proposed development is 2027, however, completion of the development is not anticipated until 2029. The traffic data used in this assessment assumes a completely occupied development, and the assessment is thus based on 2029 baseline traffic flows and traffic generated by all 180 occupied residential dwellings. This provides a conservative assessment.

[6] The latest available version at the time of the assessment.

## Receptors

4.6 Concentrations of nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$ have been predicted at a number of locations both within, and close to, the proposed development. Receptors have been identified to represent a range of exposure, including worst-case locations (these being at the façades of the residential properties closest to the sources). When selecting receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested and where there is a combined effect of several road links, and close to those roads where the traffic increases as a result of the proposed development will be greatest.

4.7 Twenty-four existing residential properties have been identified as receptors for the assessment. Four additional receptor locations have been identified within the new development, which represent exposure to the adjacent road network. As the proposed development is only at the outline stage of planning and a detailed masterplan is not yet available, receptors within the development have been placed close to the site boundary nearest to the adjacent road network and site access road to represent a conservative assessment. Receptors have been modelled at a height of 1.5 m to represent ground-floor level exposure, and are described in Table 4-1 and shown in Figure 4-1.

4.8 Selected receptors may be representative of air quality conditions at a number of properties; consideration has been given to how many sensitive locations each modelled receptor represents when considering the impacts of the proposed development and the overall significance of effects.

4.9 In addition, concentrations have been modelled at the diffusion tube monitoring sites located on Hawker Hill (MIT03) and New Road (MIT04) in order to verify the model outputs (see Appendix A2 for the verification method).

**Table 4-1: Description of Receptor Locations**

| Receptor | Type | X Coordinate | Y Coordinate | Heights Modelled (m) [a] |
|---|---|---|---|---|
| **Existing Properties** | | | | |
| 1 | Residential | 366244.0 | 219310.7 | 1.5 |
| 2 | Residential | 366285.7 | 219187.5 | 1.5 |
| 3 | Residential | 366373.9 | 219137.7 | 1.5 |
| 4 | Residential | 366476.1 | 219087.5 | 1.5 |
| 5 | Residential | 366480.6 | 219066.0 | 1.5 |
| 6 | Residential | 366466.8 | 219023.8 | 1.5 |
| 7 | Residential | 366390.3 | 218908.8 | 1.5 |
| 8 | Residential | 366365.0 | 218891.0 | 1.5 |
| 9 | Residential | 366375.4 | 218865.5 | 1.5 |
| 10 | Residential | 366388.7 | 218749.2 | 1.5 |
| 11 | Residential | 366416.3 | 218720.0 | 1.5 |
| 12 | Residential | 366409.7 | 218642.1 | 1.5 |
| 13 | Residential | 366403.4 | 218570.4 | 1.5 |
| 14 | Residential | 366415.7 | 218487.3 | 1.5 |

| Receptor | Type | X Coordinate | Y Coordinate | Heights Modelled (m) [a] |
|---|---|---|---|---|
| 15 | Residential | 366455.1 | 218452.5 | 1.5 |
| 16 | Residential | 366479.0 | 218386.1 | 1.5 |
| 17 | Residential | 366472.6 | 218377.1 | 1.5 |
| 18 | Residential | 366490.8 | 218348.5 | 1.5 |
| 19 | Residential | 366494.1 | 218321.2 | 1.5 |
| 20 | Residential | 366482.8 | 218302.7 | 1.5 |
| 21 | Residential | 366502.2 | 218301.2 | 1.5 |
| 22 | Residential | 366479.4 | 218269.8 | 1.5 |
| 23 | Residential | 366545.6 | 218264.3 | 1.5 |
| 24 | Residential | 366587.1 | 218348.7 | 1.5 |
| **New Properties** | | | | |
| N1 | Residential | 366290.0 | 219250.0 | 1.5 |
| N2 | Residential | 366287.2 | 219256.8 | 1.5 |
| N3 | Residential | 366488.5 | 219105.8 | 1.5 |
| N4 | Residential | 366515.9 | 219125.3 | 1.5 |

[a] A height of 1.5 m is used to represent ground-floor level exposure.

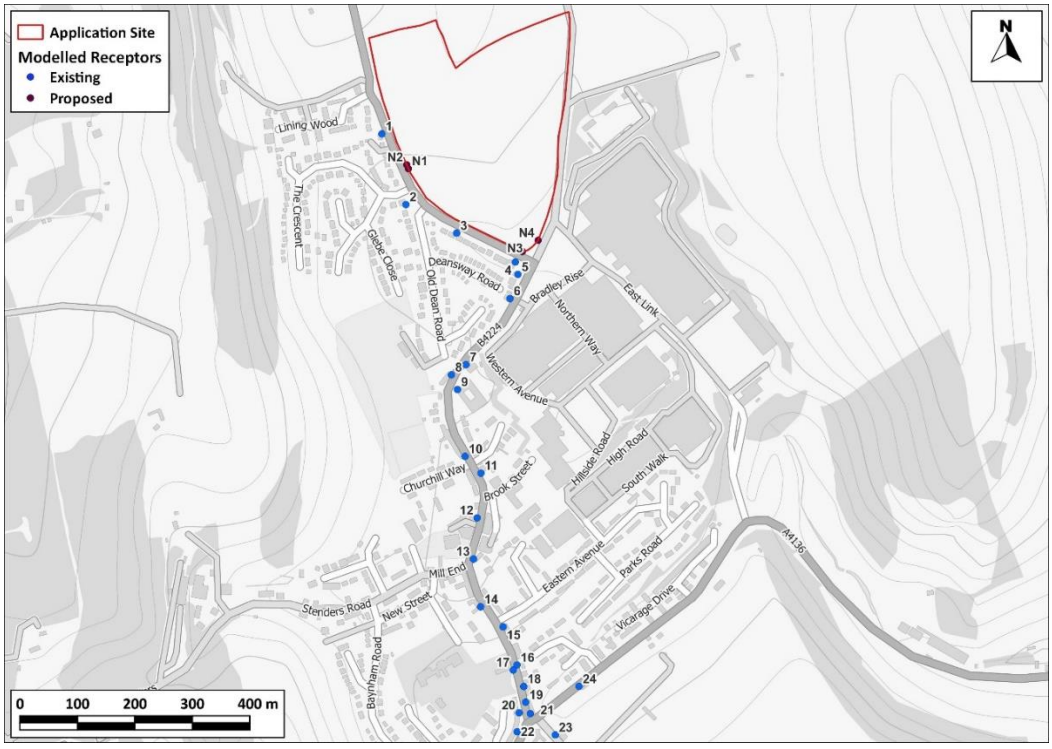


**Figure 4-1: Receptor Locations**

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

## Impact Description

4.10 The approach developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017) has been used in describing the modelled impacts. The approach identifies impacts at individual receptors based on the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective.

4.11 Table 4-2 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level (AQAL) has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

**Table 4-2: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]**

| Long-Term Average Concentration at Receptor In Assessment Year [b] | Change in Concentration Relative to AQAL [c] | | | | |
|---|---|---|---|---|---|
| | 0% | 1% | 2-5% | 6-10% | >10% |
| 75% or less of AQAL | Negligible | Negligible | Negligible | Slight | Moderate |
| 76-94% of AQAL | Negligible | Negligible | Slight | Moderate | Moderate |
| 95-102% of AQAL | Negligible | Slight | Moderate | Moderate | Substantial |
| 103-109% of AQAL | Negligible | Moderate | Moderate | Substantial | Substantial |
| 110% or more of AQAL | Negligible | Moderate | Substantial | Substantial | Substantial |

[a] Values are rounded to the nearest whole number.

[b] This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, limit or target value, GLA target or an Environment Agency 'Environmental Assessment Level (EAL)'.

## Uncertainty

4.12 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

4.13 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A2). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2023) concentrations.

4.14 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions. Historic versions of Defra's EFT tended to over-state emissions reductions into the future. However, analyses of the more recent versions of Defra's EFT carried out by AQC (2020a; 2020b) suggest that, on balance, these versions are unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice, the

balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by previous versions of the EFT, especially against a base year of 2016 or later. Whilst such an analysis has not been undertaken by AQC for EFT v12.1, it is considered that using EFT v12.1 for future-year forecasts in this report provides a robust assessment, given that the model has been verified against measurements made in 2023.

### Assumptions

4.15 It is necessary to make a number of assumptions when carrying out an air quality assessment; in order to account for some of the uncertainty in the approach, as described above, assumptions made have generally sought to reflect a realistic worst-case scenario. Key assumptions made in carrying out this assessment include:

- the proposed development is complete and fully occupied in 2027, and that baseline traffic flows in 2027 are the same as those in 2029. This will have overestimated the traffic emissions and hence the 2027 concentrations and impacts. In reality the development is unlikely to be fully occupied before 2029, thus it will not be generating its full traffic volumes until this year; and
- the Ross-on-Wye meteorological monitoring station appropriately represents conditions in the study area (this is discussed further in Appendix A2).

## Assessment of Significance

4.16 There is no official guidance in the UK in relation to development control on how to assess the significance of air quality impacts. The approach developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017) has therefore been used.

4.17 The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors; the experience of the consultants preparing the report is set out in Appendix A3. Full details of the EPUK/IAQM approach are provided in Appendix A1.

# 5 Baseline Conditions

## Relevant Features

5.1 The proposed development site is located to the north of the town of Mitcheldean, and is currently agricultural land. The site is bounded by the B4224 Carisbrook Road / Ross Road, Bradley Court Road and agricultural land. There are existing residential properties to the west of Carisbrook Road, adjacent to the site, and the Vantage Point Business Village lies to the southeast.

## Industrial Sources

5.2 No significant industrial sources have been identified that are likely to affect the proposed development, in terms of air quality.

## Local Air Quality Monitoring

5.3 FDDC operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Gradko International Ltd (using the 20% TEA in water method). Prior to 2023, these included one roadside site deployed in Mitcheldean (MIT01), at the roundabout joining New Road (A4136) and Hawker Hill, as shown in Figure 5-1. In 2023, FDDC decommissioned the MIT01 monitor, and commissioned two new monitoring sites in Mitcheldean, one near to where MIT01 was located (MIT04), and another on Hawker Hill (MIT03).

5.4 Annual mean results for the years 2018 to 2023[7] are summarised in Table 5-1. The monitoring data for MIT01 for 2018 to 2022 have been taken from FDDC's 2023 Annual Status Report (Forest of Dean District Council, 2023), whilst the monitoring data for 2023 have been taken from the 2024 Annual Status Report (Forest of Dean District Council, 2024b).

**Table 5-1: Summary of Annual Mean $NO_2$ Monitoring (µg/m$^3$)**

| Site ID | Location | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| MIT01 | The Merrin | 25.6 | 23.8 | 17.9 | 19.6 | 19.1 | - |
| MIT03 | 5 Hawker Hill | - | - | - | - | - | 22.3 |
| MIT04 | 20 The Merrin | - | - | - | - | - | 16.8 |
| **Objective** | | **40** | | | | | |

[7] While 2020 and 2021 results have been presented for completeness, they are not relied upon in any way as they are not representative of 'typical' air quality conditions due to the impact of the Covid-19 pandemic on traffic volumes and thus pollutant concentrations.

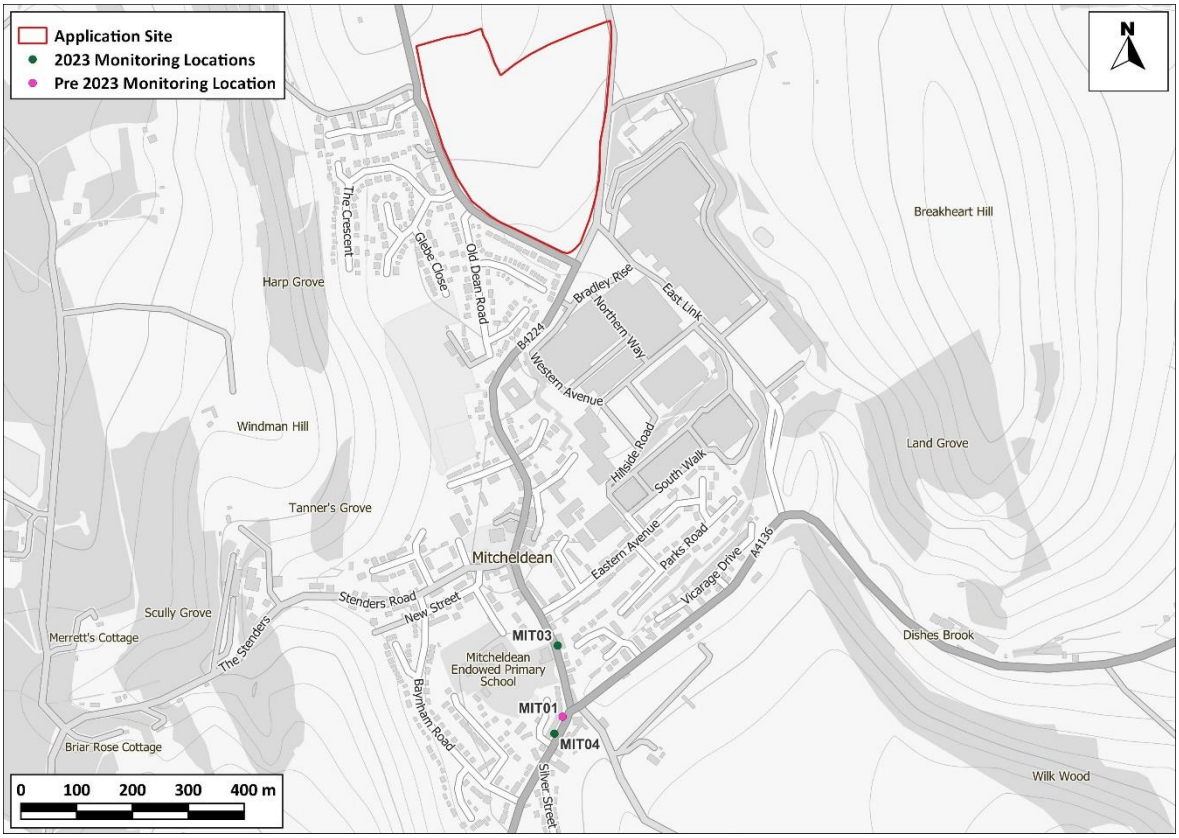


**Figure 5-1: Monitoring Locations**

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

5.5 Measured concentrations at all three sites have been well below the annual mean nitrogen dioxide objective in all years presented. Notwithstanding the impact of Covid-19 restrictions in 2020 and 2021 on concentrations, prior to its decommissioning, there is a clear trend of decreasing concentrations at MIT01.

5.6 No monitoring of $PM_{10}$ or $PM_{2.5}$ concentrations is undertaken in the Forest of Dean.

## Exceedances of Limit Value

5.7 Defra has not identified any exceedances of the annual mean or 1-hour mean limit values in 2023 in FDDC's area (Defra, 2025c). As such, there is considered to be no risk of a limit value exceedance in the vicinity of the proposed development by the time that it is operational.

## Background Concentrations

5.8 Estimated background concentrations in the study area are set out in Table 5-2 and are all well below the objectives. A range of values is presented as the study area covers multiple 1x1 km grid squares.

**Table 5-2: Estimated Annual Mean Background Pollutant Concentrations in 2023 and 2027 (µg/m³)**

| Year | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|
| **2023** | 5.0 – 5.7 | 12.2 – 12.9 | 7.8 [a] |
| **2027** | 4.5 – 5.1 | 11.9 – 12.6 | 7.6 [a] |
| **Objective** | **40** | **40** | **20** [b] |
| **AMCT** | **-** | **-** | **10** [c] |

[a] The value for all grid squares is the same when rounded.

[b] The 20 µg/m³ $PM_{2.5}$ objective is not in Regulations and there is no requirement for local authorities to meet it.

[c] To be met by 2040.

## Baseline Dispersion Model Results

5.9 Baseline concentrations of nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$ have been modelled at each of the existing receptor locations (see Table 4-1 and Figure 4-1 for receptor locations).

5.10 The results, which cover both the existing (2023) and future year (2027) baseline (Without Scheme), are set out in Table 5-3 for nitrogen dioxide and Table 5-4 for $PM_{10}$ and $PM_{2.5}$. The modelled road components of nitrogen oxides have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A2 for the verification methodology).

**Table 5-3: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m³) at Existing Receptors**

| Receptor | 2023 | 2027 Without Scheme |
|---|---|---|
| **1** | 7.4 | 6.0 |
| **2** | 6.6 | 5.5 |
| **3** | 7.7 | 6.2 |
| **4** | 9.2 | 7.2 |
| **5** | 9.7 | 7.5 |
| **6** | 11.1 | 8.4 |
| **7** | 13.1 | 9.8 |
| **8** | 14.5 | 10.7 |
| **9** | 11.3 | 8.6 |
| **10** | 18.6 | 13.3 |
| **11** | 15.4 | 11.2 |
| **12** | 16.4 | 11.8 |
| **13** | 13.6 | 10.1 |
| **14** | 22.4 | 15.7 |

| Receptor | 2023 | 2027 Without Scheme |
|---|---|---|
| **15** | 15.9 | 11.6 |
| **16** | 27.0 | 18.9 |
| **17** | 17.0 | 12.2 |
| **18** | 19.0 | 13.6 |
| **19** | 25.4 | 17.7 |
| **20** | 29.4 | 20.3 |
| **21** | 34.2 | 23.7 |
| **22** | 23.1 | 16.3 |
| **23** | 17.9 | 12.8 |
| **24** | 25.7 | 17.9 |
| **Objective** | **40** | |

**Table 5-4: Modelled Annual Mean Baseline Concentrations of $PM_{10}$ and $PM_{2.5}$ at Existing Receptors (µg/m³)**

| Receptor | $PM_{10}$ | | $PM_{2.5}$ | |
|---|---|---|---|---|
| | 2023 | 2027 Without Scheme | 2023 | 2027 Without Scheme |
| **1** | 13.1 | 12.8 | 7.9 | 7.7 |
| **2** | 13.0 | 12.7 | 7.9 | 7.7 |
| **3** | 13.1 | 12.8 | 7.9 | 7.7 |
| **4** | 13.2 | 12.9 | 8.0 | 7.8 |
| **5** | 13.3 | 13.0 | 8.0 | 7.8 |
| **6** | 13.4 | 13.1 | 8.1 | 7.9 |
| **7** | 12.9 | 12.6 | 8.2 | 7.9 |
| **8** | 13.0 | 12.7 | 8.3 | 8.0 |
| **9** | 12.7 | 12.4 | 8.1 | 7.9 |
| **10** | 13.4 | 13.1 | 8.5 | 8.2 |
| **11** | 13.1 | 12.8 | 8.3 | 8.1 |
| **12** | 13.2 | 12.9 | 8.3 | 8.1 |
| **13** | 12.9 | 12.6 | 8.2 | 8.0 |
| **14** | 13.8 | 13.4 | 8.6 | 8.4 |
| **15** | 13.1 | 12.8 | 8.3 | 8.1 |

| Receptor | $PM_{10}$ | | $PM_{2.5}$ | |
|---|---|---|---|---|
| | 2023 | 2027 Without Scheme | 2023 | 2027 Without Scheme |
| **16** | 14.0 | 13.7 | 8.8 | 8.5 |
| **17** | 13.1 | 12.8 | 8.3 | 8.1 |
| **18** | 13.3 | 13.0 | 8.4 | 8.1 |
| **19** | 13.8 | 13.5 | 8.7 | 8.4 |
| **20** | 14.0 | 13.7 | 8.8 | 8.5 |
| **21** | 14.5 | 14.2 | 9.0 | 8.8 |
| **22** | 13.6 | 13.3 | 8.6 | 8.3 |
| **23** | 13.3 | 13.0 | 8.4 | 8.1 |
| **24** | 14.1 | 13.8 | 8.8 | 8.6 |
| **Assessment Criterion** | **32** [a] | | **20** [b] | |
| **AMCT** | **-** | | **10** [c] | |

[a] While the annual mean $PM_{10}$ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean $PM_{10}$ objective is possible, as outlined in LAQM.TG22 (Defra, 2022). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean $PM_{10}$ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The 20 µg/m³ $PM_{2.5}$ objective is not in Regulations and there is no requirement for local authorities to meet it.

[c] To be met by 2040, and provided here for reference only.

5.11 The predicted annual mean concentrations of nitrogen dioxide, $PM_{10}$ and $PM_{2.5}$ are well below the objective in both 2023 and 2027 at all receptors. The annual mean nitrogen dioxide concentrations are also well below 60 µg/m³ at every receptor in both years; it is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded (see Paragraph 3.2). The annual mean $PM_{10}$ concentrations are well below 32 µg/m³ and it is, therefore, unlikely that the 24-hour mean $PM_{10}$ objective will be exceeded.

5.12 These results are consistent with the conclusions of FDDC in the outcome of its air quality review and assessment work in that it has concluded that there are no exceedances of the objectives in Mitcheldean.

# 6 Impact Assessment

## Impacts at Existing Receptors

6.1 The proposed development will generate traffic volumes that exceed the EPUK/IAQM screening thresholds on a number of local roads, thus a detailed assessment is required.

### Nitrogen Dioxide

6.2 Predicted annual mean concentrations of nitrogen dioxide in 2027 for existing receptors are set out in Table 6-1 for both the "Without Scheme" and "With Scheme" scenarios. The impact at each receptor is also described using the impact descriptors given in Table 4-2.

**Table 6-1: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2027 (µg/m³)**

| Receptor | Without Scheme | With Scheme | % Change [a] | Impact Descriptor |
|---|---|---|---|---|
| **1** | 6.0 | 6.1 | 0 | Negligible |
| **2** | 5.5 | 5.7 | 0 | Negligible |
| **3** | 6.2 | 6.4 | 1 | Negligible |
| **4** | 7.2 | 7.5 | 1 | Negligible |
| **5** | 7.5 | 7.8 | 1 | Negligible |
| **6** | 8.4 | 8.8 | 1 | Negligible |
| **7** | 9.8 | 10.2 | 1 | Negligible |
| **8** | 10.7 | 11.2 | 1 | Negligible |
| **9** | 8.6 | 9.0 | 1 | Negligible |
| **10** | 13.3 | 14.1 | 2 | Negligible |
| **11** | 11.2 | 11.8 | 1 | Negligible |
| **12** | 11.8 | 12.4 | 2 | Negligible |
| **13** | 10.1 | 10.5 | 1 | Negligible |
| **14** | 15.7 | 16.4 | 2 | Negligible |
| **15** | 11.6 | 12.0 | 1 | Negligible |
| **16** | 18.9 | 19.7 | 2 | Negligible |
| **17** | 12.2 | 12.6 | 1 | Negligible |
| **18** | 13.6 | 14.0 | 1 | Negligible |
| **19** | 17.7 | 18.3 | 1 | Negligible |
| **20** | 20.3 | 21.0 | 2 | Negligible |
| **21** | 23.7 | 24.3 | 1 | Negligible |

| Receptor | Without Scheme | With Scheme | % Change [a] | Impact Descriptor |
|---|---|---|---|---|
| **22** | 16.3 | 16.5 | 1 | Negligible |
| **23** | 12.8 | 12.9 | 0 | Negligible |
| **24** | 17.9 | 18.2 | 1 | Negligible |
| **Objective** | **40** | | - | - |

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

6.3 The annual mean nitrogen dioxide concentrations are well below the objective at all receptors, both with and without the proposed development. The change in concentrations ranges from 0% to 2% (when rounded) and the impacts are all described as *negligible*.

6.4 The annual mean nitrogen dioxide concentrations are well below 60 µg/m$^3$ at every receptor; it is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded (see Paragraph 3.2).

### $PM_{10}$ and $PM_{2.5}$

6.5 Predicted annual mean concentrations of $PM_{10}$ and $PM_{2.5}$ in 2027 for existing receptors are set out in Table 6-2 for both the "Without Scheme" and "With Scheme" scenarios. The impacts at each receptor are also described using the impact descriptors given in Table 4-2.

6.6 As explained in Paragraph 3.8, a different assessment approach is required to determine whether the proposed development complies with the requirement to deliver achievement of the AMCT and PERT. This is considered in Section 8, although the AMCT value is provided in Table 6-2 for reference.

**Table 6-2: Predicted Impacts on Annual Mean $PM_{10}$ and $PM_{2.5}$ Concentrations in 2027**

| Receptor | Annual Mean $PM_{10}$ (µg/m$^3$) | | | | Annual Mean $PM_{2.5}$ (µg/m$^3$) | | | |
|---|---|---|---|---|---|---|---|---|
| | Without Scheme | With Scheme | % Change [a] | Impact Descriptor | Without Scheme | With Scheme | % Change [a] | Impact Descriptor |
| **1** | 12.8 | 12.8 | 0 | Negligible | 7.7 | 7.7 | 0 | Negligible |
| **2** | 12.7 | 12.7 | 0 | Negligible | 7.7 | 7.7 | 0 | Negligible |
| **3** | 12.8 | 12.8 | 0 | Negligible | 7.7 | 7.7 | 0 | Negligible |
| **4** | 12.9 | 13.0 | 0 | Negligible | 7.8 | 7.8 | 0 | Negligible |
| **5** | 13.0 | 13.0 | 0 | Negligible | 7.8 | 7.8 | 0 | Negligible |
| **6** | 13.1 | 13.2 | 0 | Negligible | 7.9 | 7.9 | 0 | Negligible |
| **7** | 12.6 | 12.7 | 0 | Negligible | 7.9 | 8.0 | 0 | Negligible |
| **8** | 12.7 | 12.8 | 0 | Negligible | 8.0 | 8.1 | 0 | Negligible |
| **9** | 12.4 | 12.5 | 0 | Negligible | 7.9 | 7.9 | 0 | Negligible |
| **10** | 13.1 | 13.2 | 0 | Negligible | 8.2 | 8.3 | 0 | Negligible |

| Receptor | Annual Mean $PM_{10}$ (µg/m³) | | | | Annual Mean $PM_{2.5}$ (µg/m³) | | | |
|---|---|---|---|---|---|---|---|---|
| | Without Scheme | With Scheme | % Change [a] | Impact Descriptor | Without Scheme | With Scheme | % Change [a] | Impact Descriptor |
| **11** | 12.8 | 12.9 | 0 | Negligible | 8.1 | 8.1 | 0 | Negligible |
| **12** | 12.9 | 13.0 | 0 | Negligible | 8.1 | 8.1 | 0 | Negligible |
| **13** | 12.6 | 12.7 | 0 | Negligible | 8.0 | 8.0 | 0 | Negligible |
| **14** | 13.4 | 13.6 | 0 | Negligible | 8.4 | 8.4 | 0 | Negligible |
| **15** | 12.8 | 12.9 | 0 | Negligible | 8.1 | 8.1 | 0 | Negligible |
| **16** | 13.7 | 13.8 | 0 | Negligible | 8.5 | 8.6 | 0 | Negligible |
| **17** | 12.8 | 12.9 | 0 | Negligible | 8.1 | 8.1 | 0 | Negligible |
| **18** | 13.0 | 13.0 | 0 | Negligible | 8.1 | 8.2 | 0 | Negligible |
| **19** | 13.5 | 13.6 | 0 | Negligible | 8.4 | 8.5 | 0 | Negligible |
| **20** | 13.7 | 13.8 | 0 | Negligible | 8.5 | 8.6 | 0 | Negligible |
| **21** | 14.2 | 14.2 | 0 | Negligible | 8.8 | 8.8 | 0 | Negligible |
| **22** | 13.3 | 13.3 | 0 | Negligible | 8.3 | 8.3 | 0 | Negligible |
| **23** | 13.0 | 13.0 | 0 | Negligible | 8.1 | 8.2 | 0 | Negligible |
| **24** | 13.8 | 13.8 | 0 | Negligible | 8.6 | 8.6 | 0 | Negligible |
| **Criterion** | **32** [b] | | - | - | **20** [c] | | - | - |
| **AMCT** | - | | - | - | **10** [d] | | - | - |

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] While the annual mean $PM_{10}$ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean $PM_{10}$ objective is possible, as outlined in LAQM.TG22 (Defra, 2022). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean $PM_{10}$ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[c] The $PM_{2.5}$ objective is not in Regulations and there is no requirement for local authorities to meet it.

[d] To be met by 2040, and provided here for reference only.

6.7 The annual mean $PM_{10}$ and $PM_{2.5}$ concentrations are well below the relevant criteria at all receptors, with or without the proposed development. The predicted changes in concentrations are 0% (when rounded) and the impacts are all described as *negligible*.

6.8 Furthermore, as the annual mean $PM_{10}$ concentrations are well below 32 µg/m³ it is unlikely that the 24-hour mean $PM_{10}$ objective will be exceeded at any of the receptors.

## Impacts of Road Traffic Emissions on Future Residents of the Development

6.9 Predicted air quality conditions for future residents of the proposed development, taking account of emissions from the adjacent road network, are set out in Table 6-3 for Receptors N1 to N4 (see Table 4-1 and Figure 4-1 for receptor locations).

6.10 All of the values are well below the objectives. Air quality for future residents within the development will thus be acceptable.

**Table 6-3: Predicted Annual Mean Concentrations of Nitrogen Dioxide ($NO_2$), $PM_{10}$ and $PM_{2.5}$ in 2027 for New Receptors in the Proposed Development (µg/m³)**

| Receptor | $NO_2$ | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|
| **N1** | 7.5 | 13.0 | 7.8 |
| **N2** | 7.6 | 13.0 | 7.8 |
| **N3** | 8.7 | 13.1 | 7.9 |
| **N4** | 7.4 | 13.0 | 7.8 |
| **Objective / Criterion** | **40** | **32** [a] | **20** [b] |
| **AMCT** | - | - | **10** [c] |

[a] While the annual mean $PM_{10}$ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean $PM_{10}$ objective is possible, as outlined in LAQM.TG22 (Defra, 2022). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean $PM_{10}$ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The 20 µg/m³ $PM_{2.5}$ objective is not in Regulations and there is no requirement for local authorities to meet it.

[c] To be met by 2040, and provided here for reference only. As set out in Paragraph 3.8, the assessment to determine whether the proposed development complies with the requirement to deliver achievement of the AMCT and PERT is considered in Section 8.

## Significance of Operational Air Quality Effects

6.11 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A1, and takes account of the assessment that:

- pollutant concentrations at worst-case locations within the proposed development will all be well below the objectives, thus future residents will experience acceptable air quality; and
- pollutant concentrations at all of the selected worst-case existing receptors along the local road network will be well below the air quality objectives, and all of the impacts are predicted to be negligible.

# 7 Mitigation

## Good Design and Best Practice

7.1 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:

- setting back of the development buildings from the local road network by at least 10 m;
- electric vehicle charging provision at all of the new properties;
- provision of a detailed travel plan setting out measures to encourage sustainable means of transport (public, cycling and walking); and
- provision of pedestrian and cycle access to the new development, including cycle parking.

## Recommended Mitigation

7.2 The assessment has demonstrated that the overall air quality effect of the proposed development will be 'not significant'; it will not introduce any new exposure into areas of unacceptable air quality, nor will the development-generated traffic emissions have a significant effect on local air quality. It is, therefore, not considered appropriate to propose mitigation measures for this development.

7.3 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 (which is written into UK law).

# 8 Achieving Compliance with the $PM_{2.5}$ Targets

8.1 The annual mean $PM_{2.5}$ concentrations are below the AMCT target to be met by 2040 at all receptors, with or without the proposed development (Table 6-2 and Table 6-3).

8.2 Defra have set out in their Interim Planning Guidance (2024) two questions designed to consider whether a development supports the AMCT and PERT $PM_{2.5}$ targets. The first question is *"How has exposure to $PM_{2.5}$ been considered when selecting the development site?", whilst the* second question is *"What actions and/or mitigations have been considered to reduce $PM_{2.5}$ exposure for development users and nearby receptors (houses, hospitals, schools etc.) and to reduce emissions of $PM_{2.5}$ and its precursors?"*.

8.3 Based on information in the Transport Assessment, Travel Plan, Design and Access Statement, Landscape and Visual Impact Assessment and Sustainability Statement, exposure to $PM_{2.5}$ and ways to minimise $PM_{2.5}$ emissions have been considered in the following ways, some of which will be secured through Reserved Matters applications:

- emissions during the construction phase will be managed through the use of appropriate mitigation measures and set out within a Dust Management Plan or Construction Environmental Management Plan secured by condition;
- materials will be acquired from local sources and suppliers where possible, to reduce transportation impacts during construction;
- methods to improve resource efficiency during construction through reducing waste and energy, and optimising material use will be promoted;
- modern methods of construction on the Site, such as the use of prefabricated materials, will be fully explored and, where possible and appropriate to do so, will be used to minimise emissions from construction;
- a network of connected, traffic-free routes running through the green spaces will encourage physical activity and active travel for both existing residents of the local area and future residents;
- many of the streets within the development will be designed to have shared surfaces and low design speeds to smooth driving conditions and reduce the need for braking;
- the development is sited in a convenient location with good access to the public transport network, including bus stops within 100 m to facilitate sustainable transport modes, local centres of employment and education, and local amenities, resulting in reduced private car trips;
- new homes within the development will be set back behind new areas of public open space and landscaping, as well as the existing boundary hedgerows, trees and tree groups to reduce exposure to roadside emissions. The planting and landscaping strategy also introduce additional woodland and tree planting, hedgerows and wildflower meadows;
- the layout of the proposed development facilitates connection to an existing pedestrian route, and includes a shared footway and cycleway connection within the site to Carisbrook Road, benefitting both existing residents of the local area and future residents;
- the proposed development includes the provision of space for cycle parking in line with Policy requirements to facilitate active modes of transport;

- the application includes an Interim Travel Plan, which states that a Travel Plan Coordinator (TPC) will be appointed. The TPC will be responsible for promoting national sustainable transport events, such as national bike week and Living Street's series of walking events;
- residents will be provided with a Welcome Pack with information on the travel facilities in the local area, such as a pedestrian and cycle route map and detail on bus routes to promote sustainable modes of transport;
- travel notice boards will be set up in communal areas displaying information such as lists of sustainable travel websites and car clubs to reduce private vehicle trips;
- residents may be provided with discounts on bus tickets in order to encourage public transport, subject to discussions with Gloucestershire County Council and/or bus operators;
- car / lift sharing will be promoted throughout the development, either through the welcome packs, notice boards or social media. A Resident's committee or the TPC may also manage development-wide lift sharing, to minimise the number of sole-occupancy private vehicle trips;
- electric vehicle charging points will be installed across the development to encourage low emission vehicle use;
- the dwellings will be designed to facilitate the ability to work from home, whilst there is also the opportunity for the developer to promote home deliveries. These will reduce the need for residents to travel in the first instance;
- all dwellings will meet Building Regulations requirements for fabric efficiency, and incorporate energy efficiency measures and modern standards of insultation to minimise energy usage;
- the new dwellings will be designed to include energy efficient lighting design solutions, and have high ceilings to encourage stack ventilation to reduce energy demands;
- the orientation of the dwellings will be optimised at the detailed design stage to reduce energy demands; and
- the new homes will be installed with air source heat pumps, thus there are no combustion sources for heat, hot water and electricity.

8.4 It is considered that the development complies with the requirements to deliver achievement of the AMCT and PERT by 2040 as appropriate action has been taken to minimise emissions of $PM_{2.5}$ and its precursors as far as is reasonably practicable.

# 9 Conclusions

9.1 The assessment has considered the impacts of the proposed development on local air quality in terms of emissions from road traffic generated by the completed and occupied development. It has also identified the air quality conditions that future residents will experience.

9.2 Air quality conditions for future residents of the proposed development have been shown to be acceptable, with concentrations well below the air quality objectives throughout the site.

9.3 The assessment has demonstrated that pollutant concentrations will be well below the objectives at all existing receptors in 2027 with or without the proposed development, and that the emissions from the additional traffic generated by the proposed development will have a negligible impact on air quality conditions at all existing receptors along the local road network.

9.4 The overall operational air quality effects of the proposed development are judged to be 'not significant'.

## Policy Implications

9.5 Taking into account these conclusions, it is judged that the proposed development is consistent with Paragraph 198 of the NPPF, being appropriate for its location both in terms of its effects on the local air quality environment and the air quality conditions for future residents. It is also consistent with Paragraph 199, as it will not affect compliance with relevant limit values or national objectives.

9.6 It is considered that the development complies with the requirements to deliver achievement of the AMCT and PERT by 2040 as appropriate action has been taken to minimise emissions of $PM_{2.5}$ and its precursors.

9.7 The proposed development is also consistent with Core Policy CSP.1 of the existing Local Plan and Policy LP.22 of the emerging Plan, since air quality conditions at the site are acceptable, and the development will not have a significant effect on pollution.

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# 11 Glossary

| | |
|---|---|
| AADT | Annual Average Daily Traffic |
| ADMS-Roads | Atmospheric Dispersion Modelling System model for Roads |
| AMCT | Annual Mean Concentration Target (for $PM_{2.5}$) |
| AQAL | Air Quality Assessment Level |
| AQC | Air Quality Consultants |
| AQMA | Air Quality Management Area |
| AURN | Automatic Urban and Rural Network |
| CAZ | Clean Air Zone |
| Defra | Department for Environment, Food and Rural Affairs |
| DfT | Department for Transport |
| EFT | Emission Factor Toolkit |
| EPUK | Environmental Protection UK |
| EU | European Union |
| EV | Electric Vehicle |
| 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) |
| HMSO | His Majesty's Stationery Office |
| IAQM | Institute of Air Quality Management |
| JAQU | Joint Air Quality Unit |
| kph | Kilometres Per hour |
| LAQM | Local Air Quality Management |
| LDV | Light Duty Vehicles (<3.5 tonnes) |
| $\mu g/m^3$ | 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 |

| | |
|---|---|
| OEP | Office for Environmental Protection |
| 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 |
| OLEV | Office for Low Emission Vehicles |
| PERT | Population Exposure Reduction Target (for $PM_{2.5}$) |
| $PM_{10}$ | 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 |
| PPG | Planning Practice Guidance |
| Standards | A nationally defined set of concentrations for nine pollutants based on assessment of the effects of each pollutant on human health, including the effects on sensitive sub-groups |
| TEA | Triethanolamine – used to absorb nitrogen dioxide |

# 12 Appendices

# A1 EPUK & IAQM Planning for Air Quality Guidance

A1.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

## Air Quality as a Material Consideration

*"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:*

- the severity of the impacts on air quality;
- the air quality in the area surrounding the proposed development;
- the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and
- the positive benefits provided through other material considerations".

## Recommended Best Practice

A1.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

*"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".*

A1.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 $m^2$ of commercial floorspace;
- are carried out on land of 1 ha or more.

A1.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;

- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 $m^2$ of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
  - Spark ignition engine: 250 mgNOx/$Nm^3$;
  - Compression ignition engine: 400 mgNOx/$Nm^3$;
  - Gas turbine: 50 mgNOx/$Nm^3$.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/$Nm^3$ and 25 mgPM/$Nm^3$.

A1.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

*"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".*

A1.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

# Screening

## Impacts of the Local Area on the Development

*"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:*

- the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;
- the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;
- the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and
- the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".

## Impacts of the Development on the Local Area

A1.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 $m^2$ of floor space for all other uses or a site area greater than 1 ha.

A1.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or
- the development will have a centralised energy facility or other centralised combustion process.

A1.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;

- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

A1.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A1.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

*"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm$^3$.*

*In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.*

*Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".*

A1.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

*"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".*

A1.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

*"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".*

A1.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

## Assessment of Significance

A1.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

A1.16 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- 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 and, in such circumstances, several impacts that are described as 'slight' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A1.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A1.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A3.

# A2 Modelling Methodology

## Model Inputs

A2.1 Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable).

A2.2 Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 12.1) published by Defra (2025b). Model input parameters are summarised in Table A2-1 and, where considered necessary, discussed further below.

**Table A2-1: Summary of Model Inputs**

| Model Parameter | Value Used |
|---|---|
| Terrain Effects Modelled? | No |
| Variable Surface Roughness File Used? | No |
| Urban Canopy Flow Used? | No |
| Advanced Street Canyons Modelled? | Yes |
| Noise Barriers Modelled? | No |
| Meteorological Monitoring Site | Ross-on-Wye |
| Meteorological Data Year | 2023 |
| Dispersion Site Surface Roughness Length (m) | 0.3 |
| Dispersion Site Minimum MO Length (m) | 10 |
| Met Site Surface Roughness Length (m) | 0.5 |
| Met Site Minimum MO Length (m) | 10 |
| Gradients? | No |

A2.3 Annual Average Daily Traffic (AADT) flows and the proportions of HDVs have been provided by Prime Transport Planning Ltd who have undertaken the transport assessment work for the proposed development. Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits, and the proximity to a junction.

A2.4 The traffic data used in this assessment are summarised in Table A2-2. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2023).

**Table A2-2: Summary of Traffic Data used in the Assessment**

| Road Link | 2023 | | 2027 [a] (Without Scheme) | | 2027 [a] (With Scheme) | |
|---|---|---|---|---|---|---|
| | AADT | %HDV | AADT | %HDV | AADT | %HDV |
| B4224 Ross Road North of Site Access | 2,775 | 1.4 | 2,897 | 1.3 | 3,039 | 1.3 |
| B4224 Carisbrook Road Access | 0 | 0.0 | 0 | 0.0 | 706 | 0.0 |
| B4224 Ross Road South of Proposed Site Access | 2,775 | 1.4 | 2,897 | 1.3 | 3,463 | 1.1 |
| B4224 Ross Road South of Hollywell Road | 3,106 | 1.2 | 3,241 | 1.2 | 3,807 | 1.0 |
| B4224 Carisbrook Road to the West of Bradley Court Road | 3,199 | 1.2 | 3,329 | 1.2 | 3,884 | 1.0 |
| B4224 Bradley Court Road North of Carisbrook Road | 2,316 | 1.0 | 2,413 | 0.9 | 2,428 | 0.9 |
| B4224 Bradley Court Road South of B4224 Carisbrook Road | 5,294 | 1.1 | 5,521 | 1.1 | 6,061 | 1.0 |
| B4224 Hawker Hill North of A4136 mini roundabout | 7,189 | 2.5 | 7,501 | 2.4 | 8,046 | 2.3 |
| A4136 Gloucester Road to the West of Abenhall Road | 12,230 | 5.1 | 12,739 | 4.9 | 13,037 | 4.8 |
| A4136 New Road West of B4224 Hawker Hill mini roundabout | 11,804 | 5.0 | 12,306 | 4.8 | 12,553 | 4.7 |
| A4136 New Road East of B4224 Hawker Hill mini roundabout | 9,489 | 5.8 | 9,882 | 5.6 | 10,104 | 5.5 |
| Abenhall Road South of A4136 Gloucester Road | 4,432 | 3.4 | 4,622 | 3.2 | 4,698 | 3.2 |

[a] Future year traffic flows are based on 2029 data.

A2.5 Figure A2-1 shows the road network included within the model, along with the speed at which each link was modelled.

A2.6 For the purposes of modelling, it has been assumed that several sections of Hawker Hill / High Street (B4224) are street canyons formed by the adjacent buildings. This road has a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. These sections have, therefore, been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from local mapping. The modelled street canyons are shown in Figure A2-1.

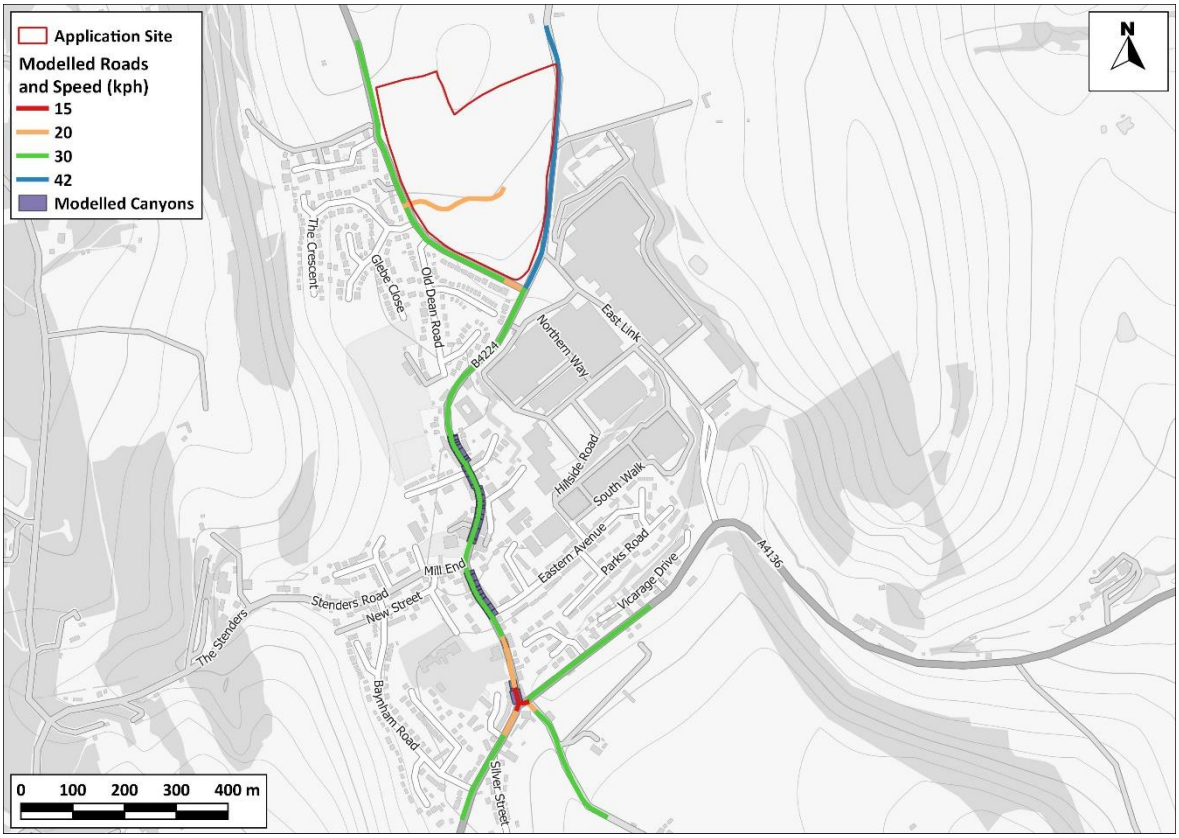


**Figure A2-1: Modelled Road Network & Speed and Canyon Locations**

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

A2.7 Hourly sequential meteorological data in sectors of 10 degrees from Ross-on-Wye for 2023 have been used in the model. The Ross-on-Wye meteorological monitoring station is located approximately 8 km to the northwest of the proposed development. Both the application site and the Ross-on-Wye meteorological monitoring station are located in the West Midlands where they will be influenced by the effects of inland meteorology over rural topography.

A2.8 The topography of the model domain is similar to that around the meteorological monitoring station and measurements from this site are considered to provide the most robust basis to predict meteorology within the model domain. A wind rose for the site for 2023 is provided in Figure A6-5. Raw data were provided by the Met Office and processed by AQC for use in ADMS.

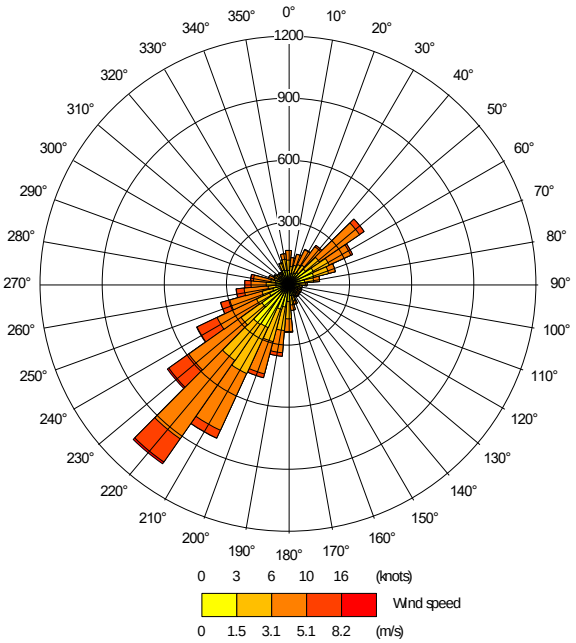


**Figure A2-2: 2023 Wind Rose for Ross-on-Wye**

# Model Verification

## Nitrogen Dioxide

A2.9 Evidence collected over many years has shown that, in most urban areas, dispersion modelling relying upon Defra's EFT has tended to systematically under-predict roadside nitrogen dioxide concentrations. To account for this, it is necessary to adjust the model against local measurements.

A2.10 Most nitrogen dioxide ($NO_2$) 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 annual mean NOx concentrations during 2023 at the MIT03 and MIT04 diffusion tube monitoring sites. Concentrations have been modelled at 2.8 m and 2.9 m, the height of the monitors, respectively.

A2.11 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured $NO_2$ concentrations and the predicted background $NO_2$ concentration using the NOx from $NO_2$ calculator (Version 8.1) available on the Defra LAQM Support website (Defra, 2025b).

A2.12 The unadjusted model has under predicted the road-NOx contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A2-3). The calculated adjustment factor of 2.9004 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A2.13 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background $NO_2$ concentration within the NOx to $NO_2$ calculator. Figure A2-4 compares final adjusted modelled total $NO_2$ at each of the monitoring sites to measured total $NO_2$, and shows a close agreement.

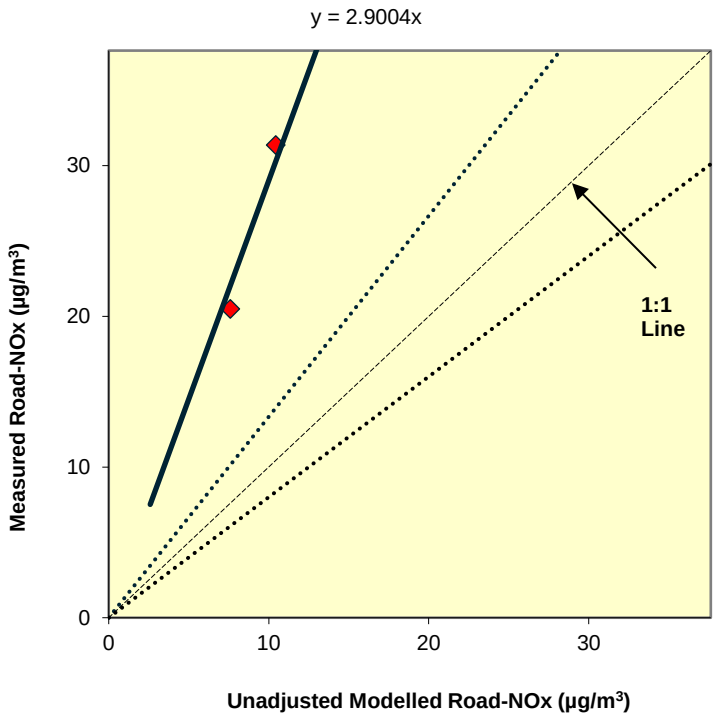


**Figure A2-3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.**

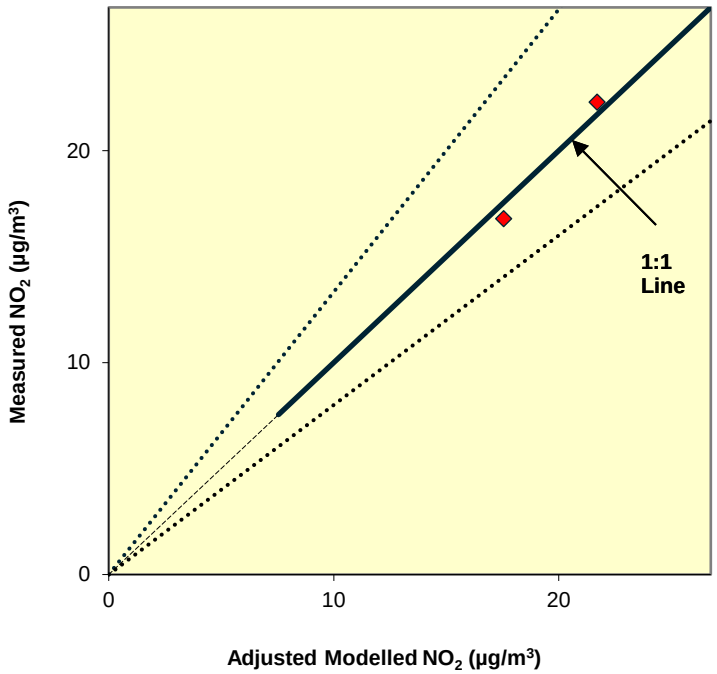


**Figure A2-4: Comparison of Measured Total $NO_2$ to Final Adjusted Modelled Total $NO_2$ Concentrations. The dashed lines show ± 25%.**

### $PM_{10}$ and $PM_{2.5}$

A2.14 The approach described above for NOx and nitrogen dioxide determines the road increment of concentrations by subtracting the predicted local background from the roadside measurements. This works well for NOx because the differences between roadside and background concentrations typically represent a large proportion of the total measured value. The same is not true for $PM_{10}$ and $PM_{2.5}$ concentrations, which are dominated by non-road emissions, even at the roadside. In practice, the influence of a local road on concentrations can often be smaller than the uncertainty in the mapped background concentration. As an example of this, 31% of all roadside and kerbside sites in London which measured $PM_{2.5}$ in 2019 with >75% data capture, recorded an annual mean concentration lower than the equivalent Defra mapped background value. Using measured background concentrations does not provide any significant benefit, owing largely to the spatial resolution of available measurements, but also because of measurement uncertainty. For example, hourly-mean $PM_{2.5}$ concentrations measured at roadside sites are often lower than those measured at nearby urban background sites, while concentrations at urban background sites are often lower than those measured at rural sites.

A2.15 For these reasons, it is not appropriate to calculate the annual mean road-increment to $PM_{10}$ and $PM_{2.5}$ concentrations by subtracting either the mapped background or a local measured background concentration. This, in turn, means that the approach to model adjustment which is described for NOx and $NO_2$ is not appropriate for $PM_{10}$ and $PM_{2.5}$. Historically, many studies have derived a model adjustment factor for NOx and applied this to $PM_{10}$ and $PM_{2.5}$. This is also not appropriate, since there is no reason to expect the same bias in emissions of NOx, $PM_{10}$ and $PM_{2.5}$.

A2.16 While there is very strong evidence that EFT-based models have consistently under-predicted road-NOx concentrations in urban areas, there is no equivalent evidence for $PM_{10}$ and $PM_{2.5}$. There is currently no strong basis for applying any adjustment to the model outputs. Predicted concentrations of $PM_{10}$ and $PM_{2.5}$ have thus not been adjusted.

## Post-processing

A2.17 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background $NO_2$, has been processed through the NOx to $NO_2$ calculator available on the Defra LAQM Support website (Defra, 2025b). The traffic mix within the calculator has been set to "All non-urban UK traffic", which is considered suitable for the study area. The calculator predicts the component of $NO_2$ based on the adjusted road-NOx and the background $NO_2$.

# A3 Professional Experience

## Dr Denise Evans, BSc (Hons) PhD MIEnvSc MIAQM

Dr Evans is a Technical Director with AQC, with more than 25 years' relevant experience. She has prepared air quality review and assessment reports for local authorities, and has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has extensive modelling experience, completing air quality and odour assessments to support applications for a variety of development sectors including residential, mixed use, urban regeneration, energy, commercial, industrial, and road schemes, assessing the effects of a range of pollutants against relevant standards for human and ecological receptors. Denise has acted as an Expert Witness and is a Member of the Institute of Air Quality Management.

## Dr Frances Marshall, MSci PhD MIEnvSc MIAQM

Dr Marshall is a Principal Consultant with AQC with ten years' relevant experience. Prior to joining AQC, she spent four years carrying out postgraduate research into atmospheric aerosols at the University of Bristol. Dr Marshall has experience preparing air quality assessments for a range of projects, including residential and commercial developments, road traffic schemes, energy centres, energy from waste schemes and numerous power generation schemes. She has experience in producing air quality assessments for EIA schemes, and has also assessed the impacts of Local Plans on designated ecological areas, prepared Annual Status Reports for Local Authorities, and undertaken diffusion tube monitoring studies. She is a Member of both the Institute of Air Quality Management and the Institution of Environmental Sciences.


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