Logika GROUP

Report

Land at Barrow Road, North Lincolnshire

Air Quality Assessment

For Strata Homes Limited

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Air Quality CONSULTANTS | PART OF Logika Group

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed residential development on land at Barrow Road in Barton-upon-Humber, North Lincolnshire. The proposed development involves the construction of 196 new homes and is described as follows:

"Full planning permission for 196 residential dwellings on land to the south of the A1077 Barrow Road, Barton-upon-Humber".

1.2 An air quality assessment for the proposed development has been requested by North Lincolnshire Council's in their consultation response to the planning application (planning reference: PA/2023/1607):

"…the proposed development site is situated along the A1077 (Barrow Road) which includes vehicle and HGV movements from nearby commercial activities. This department are also aware of the proposed Barton Relief Road… which will intersect the site and is a potential future source of air pollution for the proposed development… This department therefore request that the applicant provide further information in relation to air quality to demonstrate the site suitability in relation to air quality…"

1.3 The main air pollutants of concern related to road traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$). The location of the proposed development is shown in Figure 1-1.

1.4 The new homes within the proposed development will be provided with heat and hot water by individual natural gas-fired boilers within each dwelling; there will be no centralised combustion plant and thus no significant point sources of emissions within the proposed development. Dwellings will also be fitted with photovoltaic (PV) panels mounted at roof level and/or wastewater heat recovery systems where feasible.

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 2026. At the time of assessment, this was the anticipated year of first occupation of any of the new homes within the development. It is now anticipated that the earliest year of first occupation will be 2027; given that pollutant concentrations will continue to improve into the future, as a result of more stringent vehicle emissions standards and reduced background concentrations, utilising an earlier assessment year of 2026 provides a conservative assessment.

1.6 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with North Lincolnshire Council.

[1] To align with the most recent full calendar year of monitoring available from North Lincolnshire Council at the time of assessment.

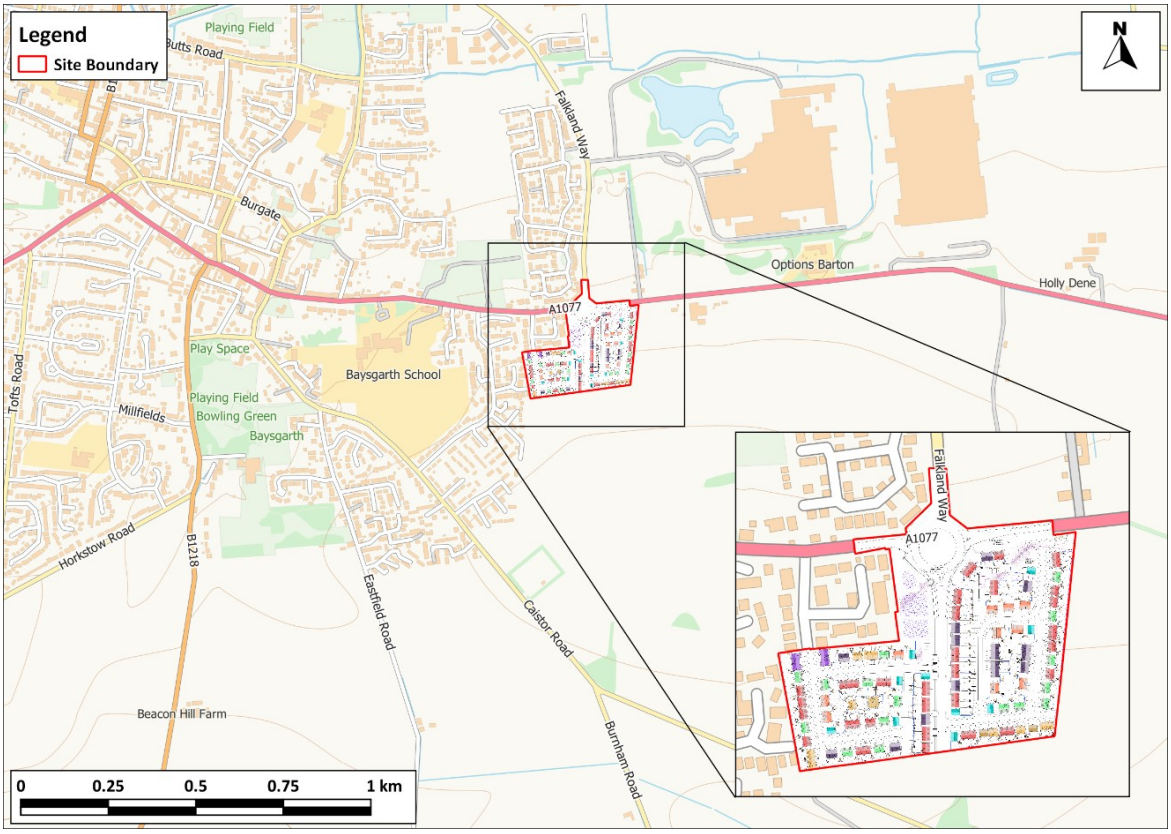

Figure 1-1: Proposed Development Location

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0. Contains data from Strata Homes Limited, drawing no. 22-CL3-SEGB-BR-01-PL rev. P.

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 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 UK Government, in partnership with the Governments of Scotland, Wales and Northern Ireland, 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 exhaust 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 (Statutory Instrument 2023 No. 96) sets two new targets for future concentrations of $PM_{2.5}$. These targets are described in Paragraph 3.4.

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 3.4, 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 The North Lincolnshire Council Local Transport Plan (LTP) 2011 – 2026 was published in 2011 and outlines the strategic approach to transport in North Lincolnshire over this period (North Lincolnshire Council, 2011a). The Plan states that the long-term vision for transport in North Lincolnshire is:

"A well maintained transport system that supports sustainable communities within a safe and prosperous environment and which contributes to the wider environmental, economic and social well being of the people who live and work in North Lincolnshire."

2.23 The Plan also outlines Local Transport Goals for North Lincolnshire, one of which relates to air quality and will act to improve air quality within North Lincolnshire:

"Local Transport Goal 2 - Reduce transport related carbon dioxide emissions and protect and enhance the natural and built environment through sustainable transport solutions."

Local Policies

Core Strategy

2.24 The North Lincolnshire Local Development Framework (LDF) is a suite of Development Plan Documents (DPDs) which set out the local planning policy for the area. The Core Strategy, which was adopted in June 2011 (North Lincolnshire Council, 2011b), sets out the long-term vision for North Lincolnshire and provides a blueprint for managing growth and development in the area up to 2026. The Core Strategy outlines the following 'Spatial Vision':

"By 2026, North Lincolnshire will be the north of England's Global Gateway. It will have a strong economy, thriving towns and villages, a protected world class environment and will be a place where people are proud to live."

2.25 To achieve this vision, North Lincolnshire Council have set ten 'Spatial Objectives', one of which relates to air quality:

"Spatial Objective 7: Efficient Use and Management of Resources

To ensure the efficient use of resources, maximising recycling of minerals and waste products, minimising pollution, maintaining and improving the air, soil and water quality, and employing sustainable building practices in new development."

2.26 Within the Core Strategy, 'Policy CS18: Sustainable Resource Use and Climate Change' relates to air quality and states:

"The council will actively promote development that utilises natural resources as efficiently and sustainably as possible. This will include:

[…]

10. Ensuring development and land use helps to protect people and the environment from unsafe, unhealthy and polluted environments, by protecting and improving the quality of the air, land and water."

2.27 North Lincolnshire Council is currently preparing a new Local Plan for North Lincolnshire which will eventually supersede the LDF plans.

Planning for Health and Wellbeing Supplementary Planning Document

2.28 North Lincolnshire Council published their Health and Wellbeing Supplementary Planning Document (SPD) in 2016 (North Lincolnshire Council, 2016). The SPD forms part of North Lincolnshire's LDF and it will be taken into account in making planning decisions for the area. The SPD contains information on how health and health inequalities can be positively impacted upon by good planning and provides guidance on ensuring that the health implications of any new development are considered.

2.29 Within the SPD, 'Policy 3 Well Designed Places' states:

"When considering the detail of development, proposals should…

…Seek to reduce noise and air pollution through ensuring planning applications include a Noise Impact Assessment and Air Quality Assessment in areas of concern."

Building Standards

2.30 Part F(1) of Schedule 1 of the Building Regulations 2010 as amended June 2022 (Ministry of Housing, Communities & 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.

2.31 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.

2.32 Part S(1) of Schedule 1, and Regulation 44D, of the Building Regulations 2010 (Ministry of Housing, Communities & 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.

2.33 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.

Air Quality Action Plans

National Air Quality Plan

2.34 Defra has produced an Air Quality Plan to tackle roadside NO_2 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 (or the Greater London Authority in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and

[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.

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

2.35 North Lincolnshire Council published the Air Quality Action Plan 2024-2029 in September 2024 (North Lincolnshire Council, 2024a) which outlines the actions that North Lincolnshire Council will deliver between 2024-2029 in order to reduce concentrations of air pollutants and exposure to air pollution.

2.36 None of the policies are especially relevant to this assessment, being focussed on locations outside of the assessment study area.

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 *taking account of practical considerations.* The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

3.2 The UK-wide objectives for NO_2 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 NO_2 objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m^3 (Defra, 2022). Therefore, 1-hour mean NO_2 concentrations will only be considered if the annual mean concentration is above this level. 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/m^3 (Defra, 2022). 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/m^3 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 LAQM Technical Guidance (Defra, 2022). The annual mean objectives for NO_2 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 NO_2 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/m^3 and currently set at 20 µg/m^3.

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 3-1).

[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.

Table 3-1: 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 EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for NO_2, PM_{10} and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010)[4]. The limit values for NO_2 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 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).

3.10 The relevant air quality criteria for this assessment are provided in Table 3-2.

[4] As amended through The Air Quality Standards (Amendment) Regulations 2016 and The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

Table 3-2: Air Quality Criteria for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Value
NO_2	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
PM_{10}	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
$PM_{2.5}$	Annual Mean	20 µg/m^3 [b]

[a] A proxy value of 32 µg/m^3 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/m^3.

Screening Criteria for Road Traffic Impact Assessments

3.11 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 impacts. 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.

3.12 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) inside an AQMA are a change in flows of more than 25 Heavy Duty Vehicles (HDVs) or 100 Light Duty Vehicles (LDVs) per day; outside of an AQMA the thresholds are 100 HDVs or 500 LDVs. 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*".

3.13 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 impact 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

Consultation

4.1 The assessment follows a methodology agreed with North Lincolnshire Council via email correspondence between Annie Ward (Air Quality Officer at North Lincolnshire Council) and Faye Wilder (Air Quality Consultants) in February 2024. Specifically, the following key points were agreed:

- there will be no centralised combustion plant within the proposed development and thus no significant point sources of emissions that require consideration;
- the proposed Barton Relief Road (planning reference: PA/2023/1981) will intersect the site from north to south and represents a potential source of air pollution to future residents of the proposed development. Thus, it has been requested by North Lincolnshire Council's Environmental Health department that the suitability of the site for its proposed residential use, in terms of air quality, is determined following guidance published by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017). The proposed development will also generate traffic flows on the local road network above the 500 AADT screening threshold, recommended for use outside of an AQMA. As such, and to address both of these aspects, detailed dispersion modelling will be undertaken to predict concentrations of NO_2, PM_{10}, and $PM_{2.5}$ at identified worst-case existing and introduced receptors. The overall significance of air quality effects will utilise the EPUK/IAQM guidance and will also include professional judgement; and
- background pollutant concentrations in the study area will be determined using the background maps published by Defra. Existing local air quality will also be identified using information and monitoring data available from North Lincolnshire Council.

4.2 It should be noted that the Barton Relief Road has been granted full planning permission and will be delivered by North Lincolnshire Council prior to construction of the proposed development commencing. As such, the relief road has been taken into account in both future year assessment scenarios, and the construction of the link road will have no effect on future residents of the proposed development.

Study Area

4.3 The study area for the assessment has been identified using professional judgement, focussing on the areas where impacts are anticipated to be greatest. It includes the proposed development site itself and all of the roads along which the development will lead to a potentially significant change in traffic flows.

4.4 Specifically, the assessment has focussed on the A1077 Barrow Road, both east and west of the new access road to the proposed development, the site access road itself (i.e., forming part of the new Barton Relief road), Falkland Way, A1077 Market Place / Holydyke, Whitecross Street both north and south of the A1077, Hungate and the B1218 Holydyke.

4.5 Figure 1-1 in Section 1 of this report effectively shows the study area.

Receptors

4.6 Concentrations of NO_2, 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-six existing residential properties have been identified as receptors for the assessment. Seven additional receptor locations have been identified within the new development, which represent future exposure to local pollution sources. These locations are described in Table 4-1 and shown in Figure 4-1 and Figure 4-2. In addition, concentrations have been modelled at the diffusion tube monitor '17' located adjacent to the A1077 Holydyke, in order to verify the model outputs (see Appendix A3 for verification method).

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.

Table 4-1: Description of Receptor Locations

Receptor ID	Type	X Coordinate	Y Coordinate	Heights Modelled (m) [a]
Existing Properties				
1	Residential	504137.5	421713.2	1.5
2	Residential	504146.4	421742.0	1.5
3	Residential	504058.7	421726.4	1.5
4	Residential	503995.2	421728.4	1.5
5	School	503746.4	421734.1	1.5
6	Residential	503591.8	421758.3	1.5
7	Residential	503510.5	421755.9	1.5
8	Residential	503475.6	421758.7	1.5
9	Residential	503355.5	421771.8	1.5
10	Residential	503334.1	421775.5	1.5
11	Residential	503289.1	421774.4	1.5
12	Residential	503287.1	421792.2	4.5
13	Residential	503146.8	421851.1	1.5
14	Residential	503087.4	421897.8	1.5
15	Residential	503078.5	421885.7	1.5
16	Residential	503046.9	421906.0	1.5
17	Residential	503013.1	421925.9	1.5
18	Residential	502896.6	422027.0	1.5
19	Residential	502883.8	422036.6	1.5
20	Residential	502864.4	422052.9	1.5

Receptor ID	Type	X Coordinate	Y Coordinate	Heights Modelled (m) [a]
21	Residential	502857.9	422066.6	1.5
22	Residential	502831.1	422064.0	1.5
23	Residential	502831.1	422033.8	1.5
24	Residential	502798.6	422015.2	1.5
25	Residential	502736.5	421998.2	1.5
26	Residential	502721.9	421968.0	1.5
New Properties				
A	Residential	504250.9	421715.3	1.5
B	Residential	504239.4	421705.9	1.5
C	Residential	504220.5	421675.2	1.5
D	Residential	504217.3	421593.6	1.5
E	Residential	504193.6	421572.2	1.5
F	Residential	504216.9	421515.2	1.5
G	Residential	504193.4	421492.1	1.5

[a] Heights of 1.5 m and 4.5 m have been modelled to represent ground- and first-floor level exposure, respectively, as appropriate.

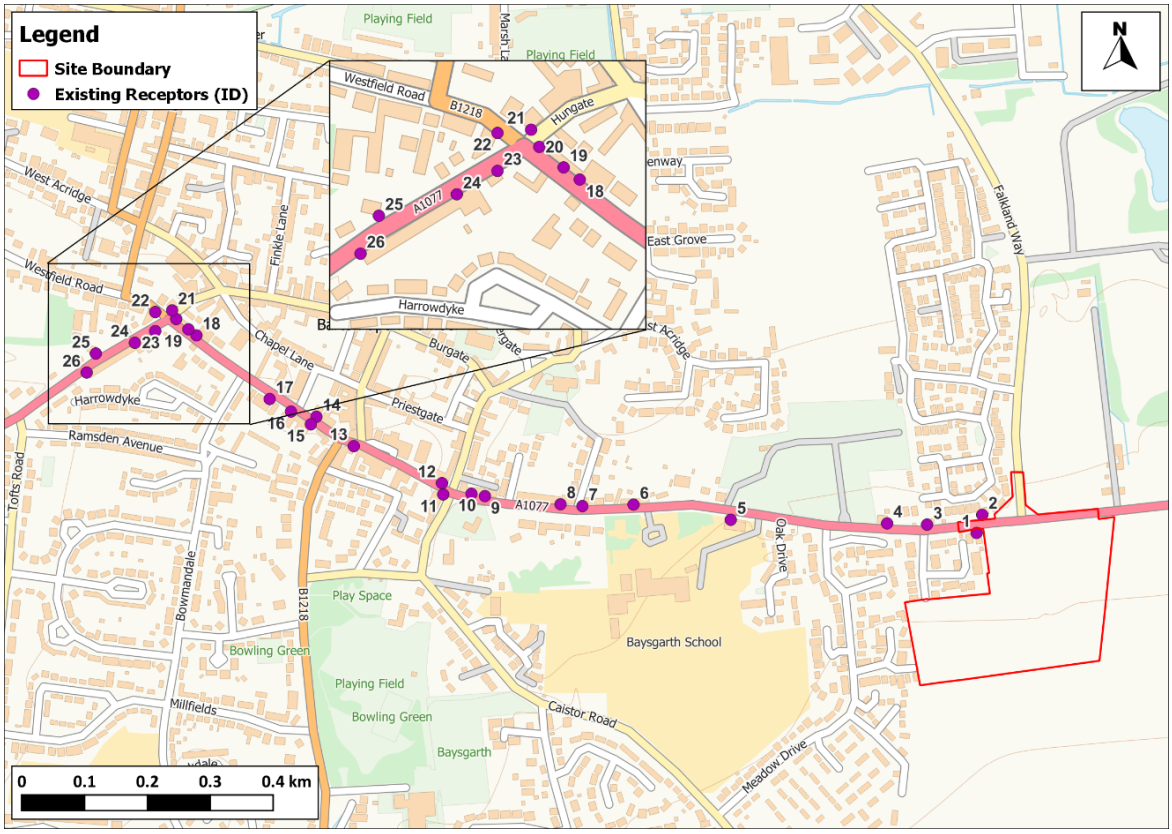

Figure 4-1: Existing Receptor Locations

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

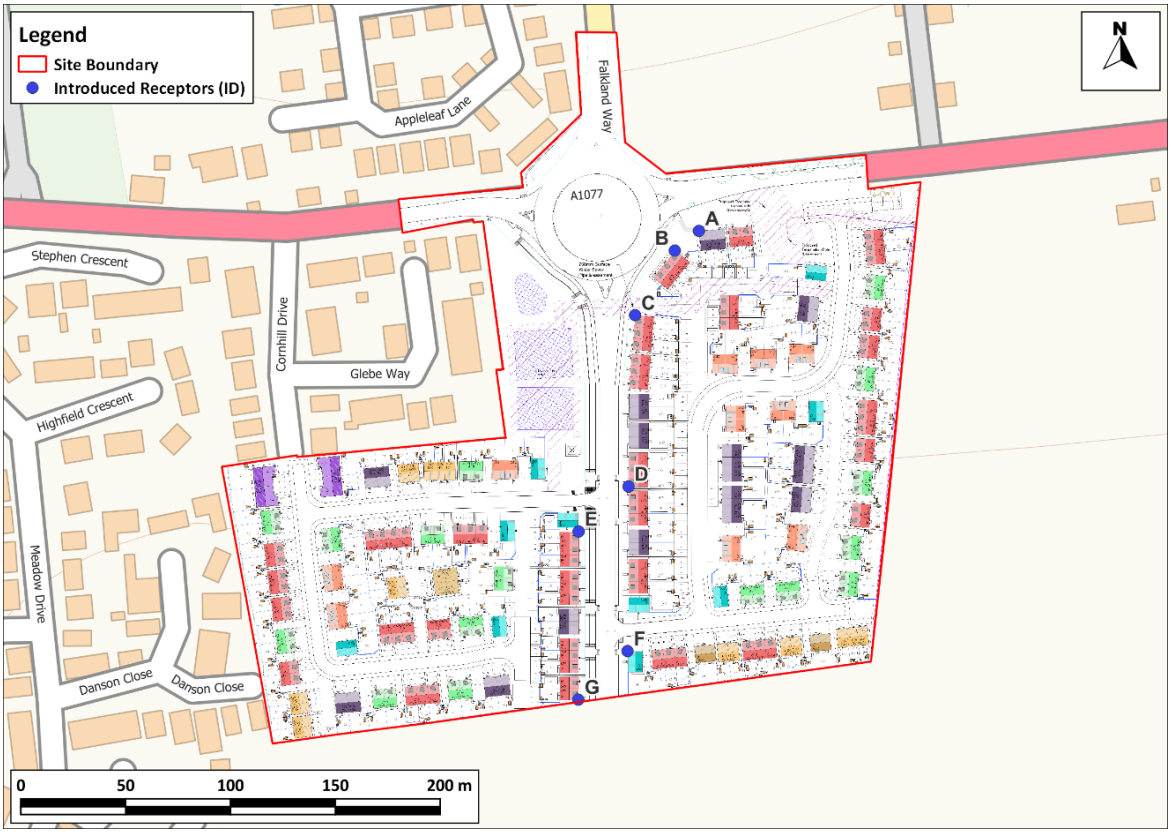

Figure 4-2: Introduced Receptor Locations

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0. Contains data from Strata Homes Limited, drawing no. 22-CL3-SEGB-BR-01-PL rev. P.

Existing Conditions

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

- industrial and waste management 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 North Lincolnshire Council's Air Quality Review and Assessment reports;
- information on existing air quality has been obtained by collating the results of monitoring carried out by North Lincolnshire Council;
- background concentrations have been defined using Defra's 2021-based background maps (Defra, 2025b). These cover the whole of the UK on a 1x1 km grid. The background annual mean NO_2 maps have been calibrated against concurrent measurements (AQC, 2025). The calibration factor has also been applied to future year backgrounds. Mapped background concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted; and
- whether or not there are any exceedances of the annual mean limit value for NO_2, PM_{10} and $PM_{2.5}$ in the study area has been identified using Defra's Compliance data (2025c).

Road Traffic Impacts

Screening

4.10 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 3.11 and detailed further in Appendix A1. Where impacts can be screened out there is no need to progress to a more detailed assessment. The following sections describe the approach to dispersion modelling of road traffic emissions, which has been required for this project.

Modelling Methodology

4.11 Concentrations have been predicted using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emissions Factors Toolkit (EFT) (v13.0) (Defra, 2025b). Details of the model inputs and the model verification are provided in Appendix A3.

Assessment Scenarios

4.12 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ concentrations have been predicted for the following scenarios:

- base year 2023 (to align with the most recent full calendar year of monitoring available from North Lincolnshire Council at the time of assessment);
- future baseline (2026), including the Barton Relief Road but excluding the proposed development ("2026 Without Proposed Development"); and
- future (2026) with development scenario ("2026 With Proposed Development").

Impact Description

4.13 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. 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 or 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

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
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 Proposed Development" concentration where there is a decrease in pollutant concentration and the "With Proposed Development" 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

4.14 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.

4.15 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A3). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2023) concentrations.

4.16 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 v13.0, it is considered that using EFT v13.0 for future-year forecasts in this report provides a robust assessment, given that the model has been verified against measurements made in 2023.

4.17 Forecasts of future-year concentrations are usually based on measurements made during a recent year. They then take account of projected changes over time to factors such as the composition of the vehicle fleet and the uptake of other new technologies, as well as population increases etc. In early 2020, activity in the UK was disrupted by the Covid-19 pandemic. As a result, concentrations of traffic-related air pollutants fell appreciably in the short term (Defra Air Quality Expert Group, 2020). Forecasts in this assessment have been based on post-pandemic years and are therefore considered to be representative of the 'new normal'.

Assumptions

4.18 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 and include:

- the assumption that the proposed development is complete and fully operational in 2026. This will have overestimated the traffic emissions, and hence the "2026 With Proposed Development"

concentrations and impacts, as the proposed development is unlikely to be occupied until 2027 at the earliest; and

- that the Humberside meteorological monitoring station appropriately represents conditions in the study area (this is discussed further in Appendix A3).

Assessment of Significance

4.19 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. 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 A2. Full details of the EPUK/IAQM approach are provided in Appendix A1.

5 Baseline Conditions

Relevant Features

5.1 The proposed development is located approximately 2.7 km to the west of Barton-upon-Humber town centre. The site is bound by agricultural land to the south and east, by residential properties to the west, and the A1077 Barrow Road to the north. It lies directly opposite the junction with Falkland Way. The site currently consists of arable land.

Industrial Sources

5.2 Wren Kitchens Limited, located north of Barrow Road, recorded emissions to air (non-methane volatile organic compounds) between 2019 and 2022; it should be noted that there were no recorded emissions in 2023 (Defra, 2025a). Notwithstanding this, given the site is over 340 m from the proposed development, and that the proposed development is upwind for the majority of the time (the predominant wind direction is from the southwest, as shown in Figure A3-3), any emissions from the Wren Kitchens Limited facility are unlikely to affect the proposed development.

Local Air Quality Monitoring

5.3 North Lincolnshire Council operates six automatic monitoring stations within its area; however, none of these are located within close proximity to the proposed development. The Council also operates a number of NO_2 monitoring sites using diffusion tubes prepared and analysed by SOCOTEC (Didcot) (using the 50% TEA in acetone method). There is one diffusion tube located within the study area, this being site '17' deployed adjacent to the A1077 Holydyke, approximately 1.1 km to the west of the proposed development.

5.4 Annual mean NO_2 concentrations recorded at this monitoring site for the years 2019 to 2023 are summarised in Table 5-1. The monitoring location with respect to the proposed development is shown in Figure 5-1. Data have been taken from North Lincolnshire Council's 2024 Air Quality Annual Status Report (ASR) (North Lincolnshire Council, 2024b).

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

Table 5-1: Summary of Annual Mean NO_2 Monitoring (2019-2023) (µg/m^3)

Site ID	Site Type	Location	2019	2020	2021	2022	2023
17	Suburban	Holydyke Barton	21.0	17.6	20.9	22.3	18.5
Objective			**40**				

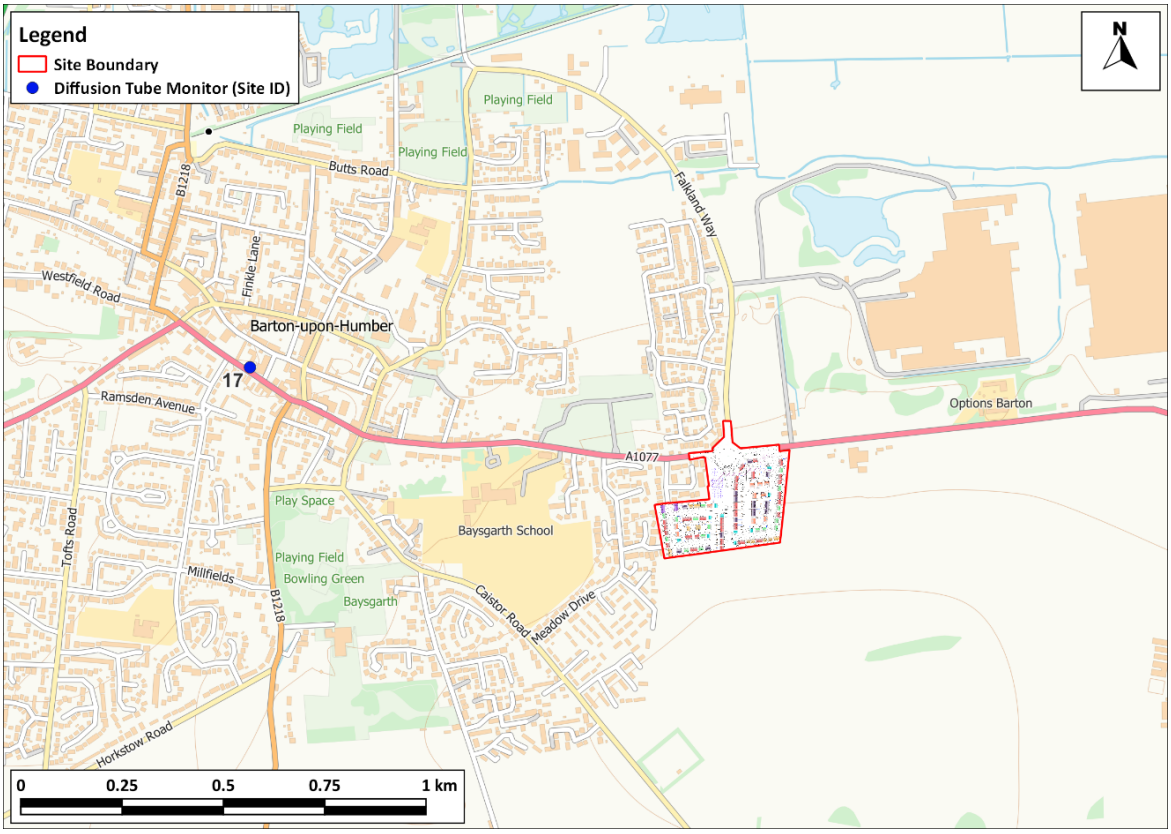

Figure 5-1: Monitoring Location and the Proposed Development

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0. Contains data from Strata Homes Limited, drawing no. 22-CL3-SEGB-BR-01-PL rev. P.

5.6 Measured annual mean NO_2 concentrations have remained well below the objective in recent years. Additionally, as the annual mean NO_2 concentrations have remained below 60 µg/m^3, it is unlikely that the 1-hour mean NO_2 objective will have been exceeded. This is consistent with the conclusions of North Lincolnshire Council in their latest ASR (North Lincolnshire Council, 2024b); there have been no measured exceedances of the 1-hour mean NO_2 objective in the Council's administrative area in recent years.

5.7 As discussed in Paragraph 5.3, there are no automatic monitoring sites located within the study area. Nonetheless, with regards to annual mean PM_{10} and $PM_{2.5}$ concentrations, North Lincolnshire Council has concluded that there have been no recorded exceedances of the objectives within its administrative area in recent years. The 24-hour mean PM_{10} objective was exceeded at industrial monitor 'CM3 TEOM/BAM' in 2022 (North Lincolnshire Council, 2024b); however, this site is located greater than 14.5 km to the southwest of the proposed development, in Scunthorpe, downwind of industrial activities. The 24-hour mean PM_{10} objective has not been exceeded at any of the other automatic monitoring stations in recent years.

Exceedances of Limit Value

5.8 Defra has not identified any exceedances of the limit values in 2023 in North Lincolnshire Council's area (Defra, 2025c). As such, there is not considered to be a risk of a limit value exceedance in the vicinity of the proposed development by the time that it is operational.

Background Concentrations

5.9 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 2026 (µg/m³)

Year	NO_2	PM_{10}	$PM_{2.5}$
2023	8.3 – 9.6	12.6 – 14.4	6.3 – 6.6
2026	7.0 – 7.8	12.3 – 14.2	6.1 – 6.4
Objective	**40**	**40**	**20** [a]
AMCT	**-**	**-**	**10** [b]

[a] The 20 µg/m³ $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

[b] To be met by 2040.

Baseline Dispersion Model Results

5.10 Baseline concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations (see Figure 4-1 and Table 4-1 for receptor locations). The results, which cover both the existing (2023) and future year baseline (2026 Without Proposed Development), are set out in Table 5-3 for NO_2 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 A3 for the verification methodology).

Table 5-3: Modelled Annual Mean Baseline Concentrations of NO_2 at Existing Receptors (µg/m³)

Receptor ID	2023	2026 Without Proposed Development
1	14.6	13.2
2	16.6	14.8
3	17.8	14.4
4	18.8	14.9
5	14.3	11.4
6	20.3	16.1
7	20.2	16.0
8	18.9	14.9
9	23.7	18.6
10	23.8	18.7
11	19.5	15.4
12	13.9	11.1

Receptor ID	2023	2026 Without Proposed Development
13	18.9	15.0
14	19.8	15.7
15	16.1	12.8
16	15.6	12.5
17	15.0	12.0
18	25.8	20.3
19	27.5	21.6
20	28.0	22.0
21	23.3	18.3
22	22.5	17.7
23	22.3	17.5
24	20.6	16.2
25	20.6	16.3
26	20.3	16.0
Objective	**40**	

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

Receptor ID	PM_{10}		$PM_{2.5}$	
	2023	2026 Without Proposed Development	2023	2026 Without Proposed Development
1	14.8	14.7	6.6	6.4
2	15.0	14.8	6.7	6.5
3	15.1	14.9	6.7	6.5
4	13.3	13.0	6.9	6.7
5	13.0	12.7	6.7	6.5
6	13.5	13.2	7.0	6.7
7	13.4	13.2	7.0	6.7
8	13.3	13.0	6.9	6.7
9	13.5	13.2	7.0	6.8
10	13.5	13.2	7.0	6.8

Receptor ID	PM_{10}		$PM_{2.5}$	
	2023	2026 Without Proposed Development	2023	2026 Without Proposed Development
11	13.2	13.0	6.9	6.6
12	12.9	12.6	6.7	6.5
13	13.3	13.1	6.9	6.7
14	13.4	13.1	7.0	6.7
15	13.1	12.8	6.8	6.6
16	13.1	12.8	6.8	6.5
17	13.0	12.8	6.8	6.5
18	14.0	13.7	7.2	6.9
19	14.0	13.7	7.2	6.9
20	14.1	13.8	7.2	6.9
21	13.8	13.5	7.0	6.8
22	13.7	13.4	7.0	6.8
23	13.7	13.4	7.0	6.7
24	13.7	13.4	7.0	6.7
25	14.1	13.8	7.1	6.8
26	14.1	13.8	7.1	6.8
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, which was to be met by 2020, 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 NO_2 are below the objective in both 2023 and 2026 at all receptors. The annual mean NO_2 concentrations are also below 60 µg/m³ at every receptor in both 2023 and 2026; it is, therefore, unlikely that the 1-hour mean NO_2 objective will be exceeded (see Paragraph 3.2).

5.12 The predicted annual mean concentrations of PM_{10} and $PM_{2.5}$ are well below the respective objectives in both 2023 and 2026 at all receptors. The annual mean PM_{10} concentrations are also below 32 µg/m³ at all receptors in both years and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

6 Impact Assessment

Impacts of the Proposed Development 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.

NO_2

6.2 Predicted annual mean concentrations of NO_2 in 2026 (the anticipated year of first occupation of the proposed development) for existing receptors are set out in Table 6-1 for both the "Without Proposed Development" and "With Proposed Development" 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 NO_2 Concentrations in 2026 (µg/m³)

Receptor ID	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor
1	13.2	13.5	1	Negligible
2	14.8	15.2	1	Negligible
3	14.4	14.8	1	Negligible
4	14.9	15.4	1	Negligible
5	11.4	11.6	1	Negligible
6	16.1	16.5	1	Negligible
7	16.0	16.5	1	Negligible
8	14.9	15.4	1	Negligible
9	18.6	19.2	1	Negligible
10	18.7	19.2	1	Negligible
11	15.4	15.7	1	Negligible
12	11.1	11.3	0	Negligible
13	15.0	15.4	1	Negligible
14	15.7	16.1	1	Negligible
15	12.8	13.1	1	Negligible
16	12.5	12.7	1	Negligible
17	12.0	12.2	1	Negligible
18	20.3	20.8	1	Negligible
19	21.6	22.1	1	Negligible
20	22.0	22.5	1	Negligible
21	18.3	18.6	1	Negligible

Receptor ID	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor
22	17.7	17.9	1	Negligible
23	17.5	17.8	1	Negligible
24	16.2	16.5	1	Negligible
25	16.3	16.6	1	Negligible
26	16.0	16.3	1	Negligible
Objective	**40**		-	-

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

6.3 The predicted annual mean NO_2 concentrations are well below the objective at all receptors both without and with the proposed development. The percentage changes in concentrations relative to the annual mean objective (when rounded) range between zero and 1%, corresponding to a *negligible* impact at all receptors.

6.4 Furthermore, as the predicted annual mean NO_2 concentrations are well below 60 µg/m^3 at all receptors both without and with the proposed development, it is unlikely that the 1-hour mean NO_2 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 2026 for existing receptors are set out in Table 6-2 for both the "Without Proposed Development" and "With Proposed Development" 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 2026 (µg/m^3)

Receptor	Annual Mean PM_{10}				Annual Mean $PM_{2.5}$			
	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor
1	14.7	14.7	0	Negligible	6.4	6.4	0	Negligible
2	14.8	14.8	0	Negligible	6.5	6.5	0	Negligible
3	14.9	14.9	0	Negligible	6.5	6.5	0	Negligible
4	13.0	13.1	0	Negligible	6.7	6.7	0	Negligible
5	12.7	12.7	0	Negligible	6.5	6.5	0	Negligible

Receptor	Annual Mean PM_{10}				Annual Mean $PM_{2.5}$			
	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor	Without Proposed Development	With Proposed Development	% Change [a]	Impact Descriptor
6	13.2	13.2	0	Negligible	6.7	6.8	0	Negligible
7	13.2	13.2	0	Negligible	6.7	6.8	0	Negligible
8	13.0	13.1	0	Negligible	6.7	6.7	0	Negligible
9	13.2	13.3	0	Negligible	6.8	6.8	0	Negligible
10	13.2	13.3	0	Negligible	6.8	6.8	0	Negligible
11	13.0	13.0	0	Negligible	6.6	6.6	0	Negligible
12	12.6	12.6	0	Negligible	6.5	6.5	0	Negligible
13	13.1	13.1	0	Negligible	6.7	6.7	0	Negligible
14	13.1	13.2	0	Negligible	6.7	6.7	0	Negligible
15	12.8	12.9	0	Negligible	6.6	6.6	0	Negligible
16	12.8	12.8	0	Negligible	6.5	6.6	0	Negligible
17	12.8	12.8	0	Negligible	6.5	6.5	0	Negligible
18	13.7	13.7	0	Negligible	6.9	6.9	0	Negligible
19	13.7	13.8	0	Negligible	6.9	6.9	0	Negligible
20	13.8	13.8	0	Negligible	6.9	7.0	0	Negligible
21	13.5	13.5	0	Negligible	6.8	6.8	0	Negligible
22	13.4	13.4	0	Negligible	6.8	6.8	0	Negligible
23	13.4	13.4	0	Negligible	6.7	6.8	0	Negligible
24	13.4	13.4	0	Negligible	6.7	6.7	0	Negligible
25	13.8	13.8	0	Negligible	6.8	6.9	0	Negligible
26	13.8	13.8	0	Negligible	6.8	6.8	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, which was to be met by 2020, 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, both without or with the proposed development. The percentage changes in concentrations relative to the applicable criteria (when rounded) are zero, corresponding to a *negligible* impact at all receptors.

6.8 Furthermore, as the predicted annual mean PM_{10} concentrations are below 32 µg/m^3 at all receptors both without and with the proposed development, it is unlikely that the 24-hour mean PM_{10} objective will be exceeded (see Paragraph 3.2).

Impacts of Existing Sources 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 A to G (see Table 4-1 and Figure 4-2 for receptor locations). Concentrations throughout the site are well below the relevant objectives. Air quality for future residents within the development will thus be acceptable.

Table 6-3: Predicted Annual Mean Concentrations of NO_2, PM_{10} and $PM_{2.5}$ in 2026 for New Receptors in the Proposed Development (µg/m^3)

Receptor ID	NO_2	PM_{10}	$PM_{2.5}$
A	12.7	14.6	6.4
B	12.6	14.6	6.4
C	10.1	14.4	6.3
D	8.4	14.3	6.2
E	8.0	14.2	6.2
F	8.1	14.3	6.2
G	7.7	14.2	6.2
Objective / Criterion	**40**	**32** [a]	**20** [b]
AMCT	**-**	**-**	**10** [c]

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 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/m^3 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, which was to be met by 2020, 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

6.10 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 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*; and
- 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.

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 (Moorcroft and Barrowcliffe et al, 2017). The proposed development incorporates the following good design and best practice measures:

- electric vehicle charging points for every new home;
- provision of a dedicated cycle parking space for every new home;
- provision of a detailed travel plan setting out measures to encourage sustainable means of transport (public transport, cycling and walking) via improved infrastructure and layouts to improve accessibility and safety;
- provision of pedestrian and cycle access to the new development; and
- use of PV panels and/or waste water heat recovery systems to reduce energy demand on the gas-fired boiler within each dwelling, where possible.

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 impact 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 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.

8.2 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 The proposed development is located in an area where concentrations are predicted to be well below the AMCT (see Table 6-3), and the assessment has concluded that the operation of the proposed development will not have a significant impact upon local air quality; as such, no further mitigation is required to reduce emissions of $PM_{2.5}$.

8.4 The design measures set out in Section 7, which include the promotion of sustainable means of transport, and the provision of PV panels and/or waste water heat recovery systems to reduce the demand on gas fired boilers, will help to further reduce emissions of $PM_{2.5}$ and its precursors.

8.5 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 2026, both without and with the proposed development, and that the emissions from the additional traffic generated by the proposed development will have a negligible impact. This represents a conservative assessment, as the proposed development is unlikely to be occupied until 2027 at the earliest.

9.4 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.

9.5 The proposed development is also consistent with Policy CS18 of North Lincolnshire Council's Core Strategy, as it will not have a significant detrimental effect on air quality. Additionally, the proposed development is consistent with North Lincolnshire Council's Health and Wellbeing SPD as an air quality assessment has been undertaken.

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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
CAZ	Clean Air Zone
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DPD	Development Plan Document
EFT	Emissions Factors 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)
HGV	Heavy Goods Vehicle
HMSO	Her Majesty's Stationery Office
IAQM	Institute of Air Quality Management
JAQU	Joint Air Quality Unit
kph	Kilometres Per hour
LAQM	Local Air Quality Management
LDF	Local Development Framework
LDV	Light Duty Vehicles (<3.5 tonnes)
LTP	Local Transport Plan
$\mu g/m^3$	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
PV	Photovoltaic
SPD	Supplementary Planning Document
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
TEMPro	Trip End Model Presentation Program
ZEV	Zero Emission Vehicle

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 A2.

A2 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.

Samantha Sarlo, MChem (Hons) AMIEnvSc AMIAQM

Mrs Sarlo is a Principal Consultant with AQC, having joined the company in November 2017. She has carried out assessments of air quality impacts for a range of projects, including EIA schemes, residential, commercial and mixed-use schemes, energy centres and power generation schemes. Mrs Sarlo has also prepared construction dust risk assessments, Air Quality Neutral assessments, local authority Annual Status Reports (ASRs) and odour assessments. She has carried out numerous passive nitrogen dioxide monitoring surveys, and construction dust monitoring, at sites across Greater London.

A3 Modelling Methodology

Model Inputs

A3.1 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). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 13.0) published by Defra (2025b). Model input parameters are summarised in Table A3-1 and, where considered necessary, discussed further below.

Table A3-1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	No
Variable Surface Roughness File Used?	Yes – 12km x 12km Cartesian grid at 50m resolution
Urban Canopy Flow Used?	No
Advanced Street Canyons Modelled?	No
Noise Barriers Modelled?	No
Meteorological Monitoring Site	Humberside
Meteorological Data Year	2023
Dispersion Site Surface Roughness Length (m)	N/A (variable surface roughness file used)
Dispersion Site Minimum MO Length (m)	10
Met Site Surface Roughness Length (m)	0.2
Met Site Minimum MO Length (m)	1
Gradients?	No

A3.2 AADT flows and the proportions of HDVs have been provided by Local Transport Projects, who have undertaken the transport assessment work for the proposed development. This has been supplemented with data from the interactive web-based map provided by DfT (2025) for Whitecross Street (both north and south of the A1077 Barrow Road). The obtained 2023 AADT flows have been factored forwards to the assessment year of 2026 using the growth factor 1.021 derived using the TEMPro System v8.1 (DfT, 2023).

A3.3 Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A3-2. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2024).

A3.4 Figure A3-1 and Figure A3-2 show the road network included within the model, along with the speed at which each link was modelled. It should be noted that both future year scenarios take account of the Barton Relief Road, which was granted planning permission and will be delivered by North Lincolnshire Council prior to construction of the proposed development commencing.

Table A3-2: Summary of Traffic Data used in the Assessment

Road Link	2023		2026 (Without Proposed Development)		2026 (With Proposed Development)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
A1077 (east of Falkland Way)	9,730	2.5	10,267	2.5	10,423	2.4
Falkland Way	7,653	4.3	7,865	4.3	7,935	4.3
A1077 (west of Falkland Way)	12,888	4.2	13,243	4.2	14,138	4.0
A1077 (west of B1218 Holydyke / Hungate mini roundabout)	16,681	3.0	17,142	3.0	17,896	2.9
B1218 Holydyke	7,193	1.2	7,391	1.2	7,391	1.2
Hungate	2,413	1.5	2,480	1.5	2,480	1.5
A1077 (east of B1218 Holydyke / Hungate mini roundabout)	13,808	3.5	14,189	3.5	14,943	3.3
Barton Relief Road	-	-	268	2.2	1,391	0.4
Whitecross Street (both north and south of the A1077 Barrow Road)	3,097	0.5	3,162	0.5	3,162	0.5

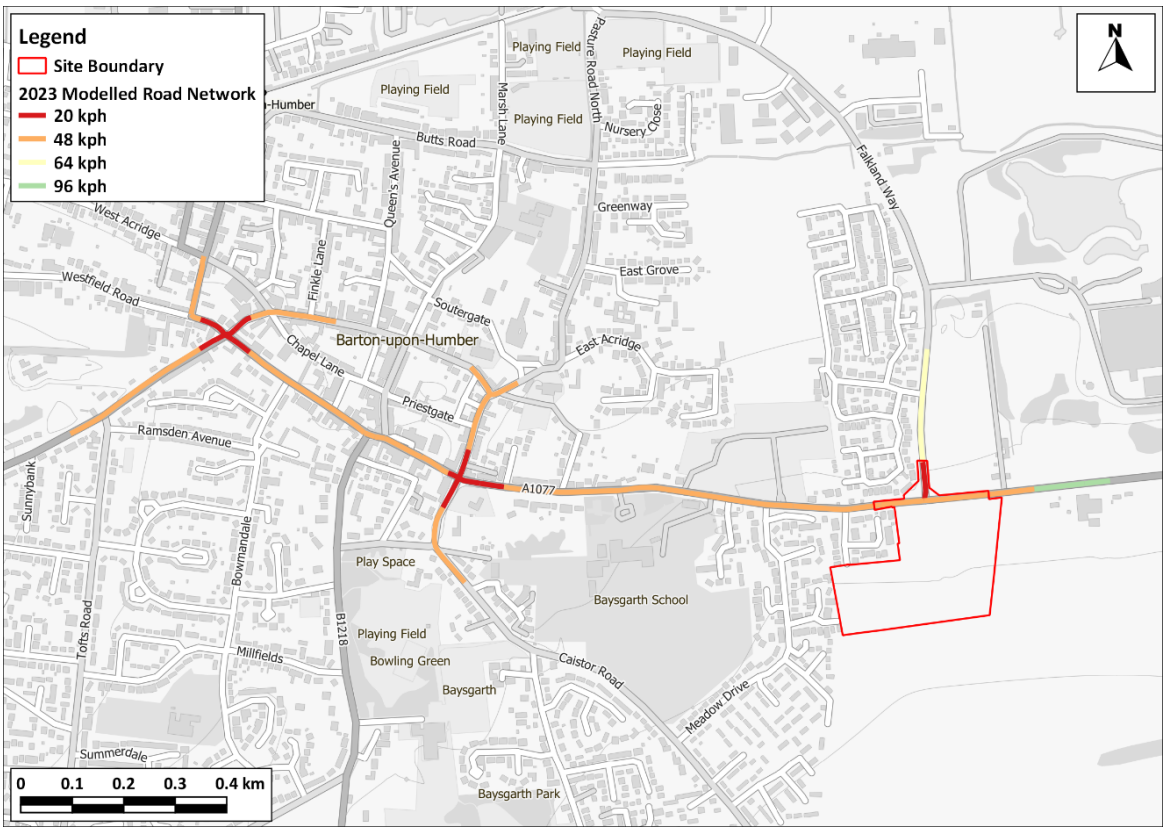

Figure A3-1: 2023 Baseline Modelled Road Network & Speeds

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

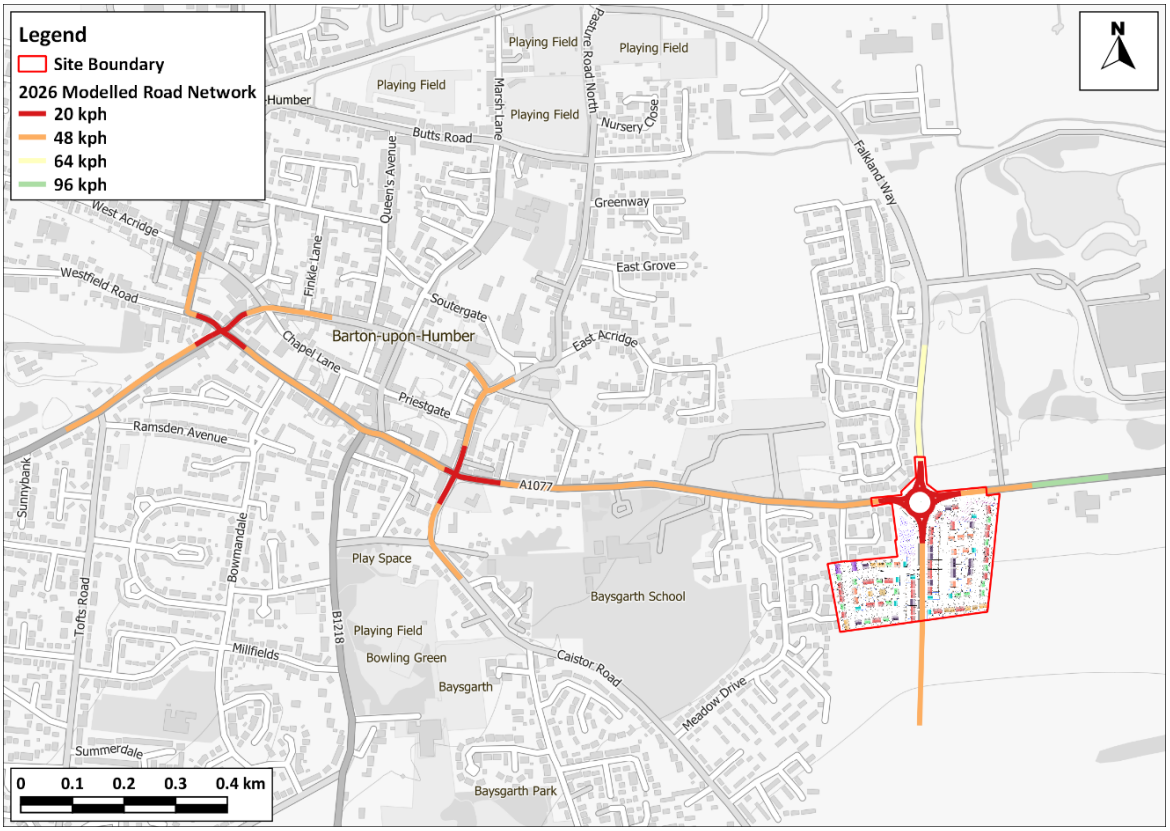

Figure A3-2: 2026 Modelled Road Network & Speeds

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0. Contains data from Strata Homes Limited, drawing no. 22-CL3-SEGB-BR-01-PL rev. P.

A3.5 Hourly sequential meteorological data in sectors of 10 degrees from Humberside Airport for 2023 have been used in the model. The Humberside Airport meteorological monitoring station is located approximately 13 km to the southeast of the proposed development. Both the proposed development and the Humberside meteorological monitoring station are located in the northeast of England where they will be influenced by the effects of coastal meteorology. 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 the year 2023 is provided in Figure A3-3. Raw data were provided by the Met Office and processed by AQC for use in ADMS.

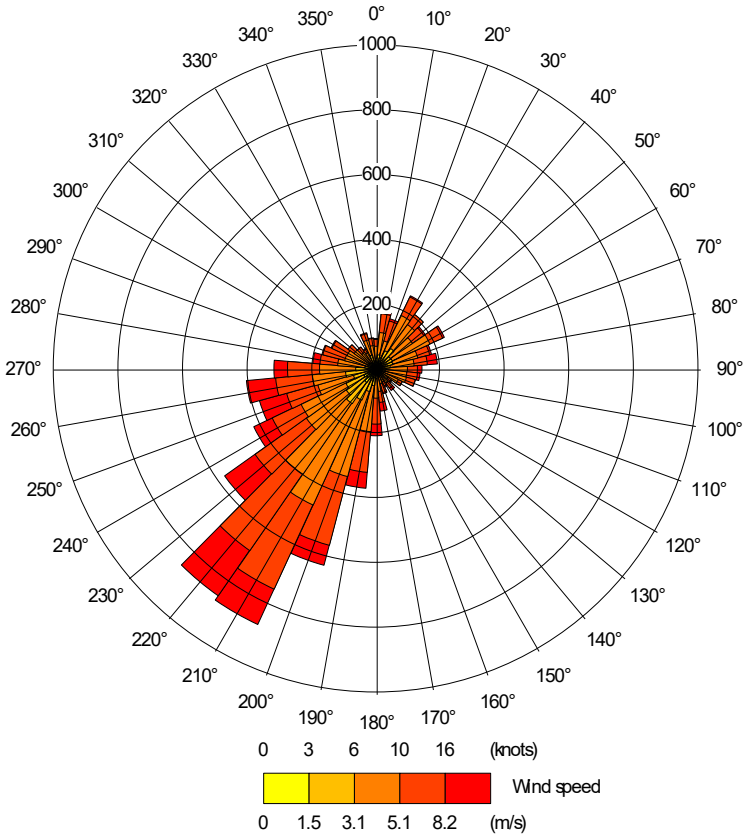

Figure A3-3: 2023 Wind Rose for Humberside Airport Meteorological Monitoring Station

Model Verification

NO_2

A3.6 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 NO_2 concentrations. To account for this, it is necessary to adjust the model against local measurements. The model has been run to predict annual mean NO_2 concentrations during 2023 at diffusion tube monitoring site '17' located adjacent to the A1077 Holydyke, approximately 1 km to the west of the proposed development. Concentrations have been modelled at 2.0 m, representing the height of the monitor. This site has been selected given its location within the study area.

A3.7 Most NO_2 is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2).

A3.8 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 concentration and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 9.1) available on the Defra LAQM Support website (Defra, 2025b).

A3.9 An adjustment factor has been determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total NO_2 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 (Defra, 2025b).

A3.10 The data used to calculate the adjustment factor are provided below:

- Measured NO_2: 18.5 µg/m^3
- Background NO_2: 9.0 µg/m^3
- 'Measured' road-NOx (using NOx from NO_2 calculator): 20.8 µg/m^3
- Modelled road-NOx: 4.9 µg/m^3
- Road-NOx adjustment factor: 20.8 / 4.9 = 4.253[6]

A3.11 The factor implies that the unadjusted model is under-predicting the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

PM_{10} and $PM_{2.5}$

A3.12 The approach described above for NOx and NO_2 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.

A3.13 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 $PM_{2.5}$.

A3.14 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

A3.15 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 other urban UK traffic", which

[6] Based on un-rounded values.

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.

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