

Mansfield Local Plan Review Review

Air Quality Assessment
Mansfield District Council

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Quality information

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V5	14/08/2026	Updates to incorporate latest policy	AS	Anna Savage	Air Quality Technical Director

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1. Executive Summary

- 1.1 Mansfield District Council (MDC) has commissioned AECOM Limited (AECOM) to prepare an air quality assessment to inform the preparation and evidence base for their Local Plan Review 2023-2043.
- 1.2 As part of this work, AECOM has prepared this report which includes the following:
- Review of current air quality in MDC;
 - Review of relevant legislation and air quality planning policy;
 - Review of sensitive locations both residential and ecological;
 - Review of traffic flows and emissions across the district to visualise areas of high risk within the district for each of the following traffic scenarios;
 - 2023 Baseline;
 - 2043 'Do Minimum' (DM): a future assessment year which includes the influence of forecast growth and strategic planned development without impacts from the MDC Local Plan Review in place; and
 - 2043 'Do Something' (DS): future assessment year which builds on the DM scenario and includes impacts of the MDC Local Plan Review as well as other Local Plans from neighbouring areas.
 - Review of indoor air quality at locations that may be influenced by Proposed Development sites, including those impacts associated with climate change and qualitative identification of adaptation requirements.
 - Modelling assessment of nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}) concentrations and comparison against UK Air Quality Strategy (AQS) standards at discrete high-risk areas for each of the listed traffic scenarios.

2. Introduction

- 2.1 Mansfield District Council (MDC) has commissioned AECOM Limited (AECOM) to prepare an air quality assessment to inform the preparation and evidence base for their Local Plan Review.
- 2.2 This report has been prepared to provide an overview of air quality in the Mansfield District, including with respect to current legislation and relevant policy, recent trends in monitoring data and a screening and modelling assessment concerning the potential impacts of the Local Plan Review.
- 2.3 Traffic data and emissions for the entire district with and without the Local Plan Review's proposed level of growth have been screened to consider the impacts of the Local Plan Review on air quality across the district. Three discrete areas have been subject to a dispersion modelling study on the basis of the screening exercise. The report outlines the methodology used, and the results of the modelled pollutant (NO₂, PM₁₀, PM_{2.5}) concentrations at selected sensitive human health receptors within the Local Plan Review.
- 2.4 Both outdoor and indoor receptors are considered in this assessment, including screening of carbon effects on indoor receptors.

Mansfield District

- 2.5 The Mansfield District covers an area of approximately 33 square miles (77.7 km²) and is located in the County of Nottinghamshire. It is one of seven districts within the county and lies within the East Midlands Region. According to the Office for National Statistics, the district had a population of 113,138 in 2024. (Ref 1)
- 2.6 The core of the district is predominantly urban comprising of built-up areas of Mansfield and Mansfield Woodhouse along with parts of Clipstone and Rainworth to the east. The north of the district is more rural, containing the town of Market Warsop along with several surrounding villages. Several key routes run through Mansfield, including the A60, A38 and A617.

Air Quality Management Areas

- 2.7 The requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act 2021 (Ref 2), places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether the air quality objectives (AQOs) are likely to be achieved (see Table 1) (Ref 3). Where an exceedance is considered likely through monitoring or modelling, the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.
- 2.8 There have been no exceedances of the relevant AQOs in recent years, therefore MDC does not have any declared AQMA's nor is it preparing any.

3. Policy Context

Legislation

Air Quality Standards Regulations 2010

- 3.1 The principal air quality legislation within the United Kingdom is the Air Quality Standards Regulations 2010 (Ref 4) including amendments made in 2016 (Ref 5) and by 'The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (Ref 6). These regulations are derived from EU law, specifically the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (the 'Air Quality Directive') (Ref 7). Following the UK's exit from the European Union, these regulations are classified as 'assimilated law' pursuant to the EU (Withdrawal) Act 2018 (Ref 8) (as amended in 2023 (Ref 9)). This means that relevant directives previously applied directly or indirectly to the UK are still relevant to the environmental assessment within this report. However, the EU will no longer have a role in enforcement, this having passed to the UK Government and the relevant Secretary of State.
- 3.2 The limit values (LVs) for pollutants defined within these regulations are legally-binding on the UK Government and have been set for the protection of human health and of vegetation. They are considered to apply everywhere (with the exception of the carriageway and central reservation of roads and any locations where the public do not have access).

Environment Act 2021

- 3.3 The Environment Act 2021 (Ref 2) amends the Environment Act 1995 and sets a new course for the UK's environmental policy post-Brexit. It includes provisions to establish a set of statutory environmental principles to guide future legislation and policy decisions and ensure environmental governance through an environmental watchdog, the Office for Environmental Protection (OEP).
- 3.4 The Environment Act defines a Local Air Quality Management (LAQM) regime, under which local authorities bear the responsibility to monitor ambient air quality in their areas regularly against set Air Quality Objectives (AQOs). If they identify that the AQOs are unlikely to be met within the specified timescale, they must then designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) aimed at ensuring the objectives are eventually met. The AQOs and standards of relevance to this study are provided in Table 1.
- 3.5 Under Part IV of the Act, the government is mandated to develop a National Air Quality Strategy (AQS) which contains clear standards, objectives, and measures to improve ambient air quality, and to publish a report reviewing the AQS every five years (as a minimum and with yearly updates to Parliament), in the form of the Environmental Improvement Plan.
- 3.6 The Environment Act 2021 includes a proposal that the government set a range of new environmental targets including new targets for fine particulate matter (PM_{2.5}) to be met by 2040. Following through on these requirements, the Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 (Ref 10) came into effect, setting these targets into legislation. The targets are provided in Table 1.

National Air Quality Policy

Environmental Improvement Plan 2025

- 3.7 The 25-Year Environment Plan, originally published in January 2018, and updated in 2023, sets out the actions the UK Government will take to help the natural world regain and retain good health (Ref 11).
- 3.8 The latest revision of the Environmental Improvement Plan (EIP) was published in December 2025 (Ref 12). The plan outlines several actions that are being taken to improve air quality, most notably by supporting local authorities, facilitating the rollout of Clean Air Zones, supporting the transition away from petrol and diesel cars, regulating domestic burners, and regulating agricultural emissions. The emphasis is on the transition to zero emission vehicles and regulation of burning to reduce PM_{2.5} emissions.

- 3.9 The 2025 EIP includes interim targets for PM_{2.5} to achieve the targets set out in The Environmental Targets (Fine Particulate Matter) Regulations 2023 ten years ahead of the legal deadline (by 2030).

Clean Air Strategy

- 3.10 In 2019, the UK government released its Clean Air Strategy 2019 (Department for Food, Environment and Rural Affairs, 2019) as part of its 25-year Environment Plan (Ref 13).
- 3.11 Local air quality management focus in recent years has primarily related to nitrogen dioxide (NO₂), and its principal source in the UK, road traffic. However, the 2019 Strategy broadens the focus to other areas, including domestic emissions from wood burning stoves and from agriculture. This shift in emphasis is part of a goal to reduce the levels of fine particulate matter (PM_{2.5}) in the air to below the World Health Organisation (WHO) guideline level; lower than the current UK objective.

UK Air Quality Strategy

- 3.12 An AQS as required by the Environment Act 2021 was published in April 2023 (Ref 3). It sets out the actions the government expects local authorities to take in support of achieving the new national PM_{2.5} targets, by reducing emissions from sources within their control.
- 3.13 The AQS contains a summary of all relevant air quality standards (limit values, AQOs, and targets) The standards for the pollutants of relevance to this assessment are displayed in Table 1.
- 3.14 The 2023 Air Quality Strategy and the EIP collectively signal a shift from compliance-based management towards proactive emission reduction and exposure minimisation. In the coming years, local authorities are expected to play a more active role in delivering these outcomes by integrating air quality, climate, and health objectives within spatial planning. The introduction of legally binding PM_{2.5} targets—together with interim exposure-reduction goals, places stronger emphasis on tackling diffuse sources such as domestic combustion, construction activity, and non-exhaust vehicle emissions. For MDC, this evolving policy direction is likely to strengthen the case for Local Plan Review policies that go beyond minimum statutory requirements, for example through the promotion of low-emission development, active travel, electrification of transport, and integration with the Council's Climate Change Strategy and Delivery Plan (2022) (Ref 14). Embedding these principles will help future-proof the Local Plan against forthcoming national air-quality and net-zero obligations.

Table 1. UK AQS Standards and Objectives

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances/Target
NO ₂	Annual Mean	40 µg/m ³	None
	Hourly Mean	200 µg/m ³	18 times per year
NO _x	Annual Mean	30 µg/m ³	None
PM ₁₀	Annual Mean	40 µg/m ³	None
	24-Hour Mean	50 µg/m ³	35 times per year
PM _{2.5}	Annual Mean	20 µg/m ³	None
		10 µg/m ³	Interim target by 2030
		10 µg/m ³	Legal target by 2040
	Exposure reduction compared to 2018	30%	Interim target by 2030
		35%	Legal target by 2040

PM_{2.5} Targets: Interim Planning Guidance

3.15 Interim Planning Guidance was published in October 2024 (Ref 15) pending publication of new guidance on the planning implications of the new PM_{2.5} targets, which has not yet been published. The guidance moves away from an exceedance-based approach and towards a minimisation of pollution approach. It recommends key sources of air pollution schemes submitted for planning applications are identified, and appropriate action to minimise emissions of PM_{2.5} and its precursors are implemented as far as possible using the following prompts:

- How has exposure to PM_{2.5} been considered when selecting the development site?
- 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?

WHO Guideline Values

3.16 The World Health Organisation (WHO) guideline values (Ref 16) are shown in Table 2. These are not legally binding standards but identify the levels of air quality necessary to protect public health worldwide. Interim targets are also provided by the WHO to guide reductions towards achieving levels.

Table 2. WHO Guidelines

Pollutant	Averaging Period	WHO Guideline (µg/m ³)	Not to be Exceeded More Than
NO ₂	Annual	10	N/A
	Daily	25	3 days
PM ₁₀	Annual	15	N/A
	Daily	45	3 days
PM _{2.5}	Annual	5	N/A
	Daily	15	3 days

3.17 Further review of WHO guidelines is ongoing internationally, but no additional changes have been adopted in UK domestic policy at this stage.

National Planning Policy

National Planning Policy Framework (current)

3.18 The National Planning Policy Framework (NPPF) sets out the Government's environmental, economic and social principles for land use planning in England and the expectations for how these are to be applied. The current version of the NPPF (Ref 17) was published in December 2024 by the Ministry of Housing, Communities and Local Government (MHCLG) and is referred to as the 2024 revision despite minor corrections being applied in early 2025. It replaces all previous versions, including the original 2012 Framework and subsequent revisions in July 2018, February 2019, July 2021, and updates in September and December 2023. The adopted 2024 version does not introduce any new policies specifically relating to air quality.

3.19 The most relevant provisions on air quality are found in paragraphs 110, 187, 198, 199 and 201 of the 2024 NPPF. These paragraphs advise that planning policies and decisions should contribute to, and enhance, the natural and local environment by preventing or avoiding unacceptable risks from pollution, including air pollution. In particular, they emphasise the importance of considering the cumulative impacts of development on air quality, especially in Air Quality Management Areas (AQMAs) and Clean Air Zones

(CAZs). They also highlight the need to ensure consistency with relevant Air Quality Action Plans. The key NPPF paragraphs most relevant to an air quality assessment are provided in Table 3.

Table 3. Relevant NPPF requirements relevant to the air quality assessment

Relevant NPPF paragraph reference	Requirement of the NPPF
Paragraph 187	Planning policies and decisions should contribute to and enhance the natural and local environment by: e. preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of... air... pollution. Development should, wherever possible, help to improve local environmental conditions such as air... quality.
Paragraph 199	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.

National Planning Policy Framework (emerging)

- 3.20 A revised version of the NPPF is anticipated to be published in summer 2026 but at time of writing remains unpublished. A draft version for consultation (Ref 18) was published in December 2025.
- 3.21 Air quality is primarily considered within policy P3: living conditions and pollution. Policy P3 states:
1. *Development proposals should:*
 - a. *Be appropriate for their 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 which could arise from the development;*
 - b. *Provide healthy living conditions for occupiers and users in terms of... avoiding exposure to levels of air... pollution which could have an unacceptable adverse effect on health and wellbeing; and*
 - c. *Not give rise to, or contribute to... unacceptable levels of air... pollution on or beyond the site.*
 2. *Within this context development proposals should:*
 - a. *Mitigate the effect of existing pollution on the site where necessary to secure acceptable conditions for occupiers and users and, where possible, take opportunities to reduce pollution affecting the wider area (such as through traffic and travel management or improved external lighting). In doing so consideration should be given to the cumulative effect of pollution from multiple sources, and to whether the intended occupiers or users may be particularly vulnerable to its effects, such as children and older people;*
 - b. *Sustain and contribute to compliance with relevant limit values or national objectives and targets for air pollutants including PM_{2.5}, taking into account the presence of Air Quality Management Areas and NO₂ Clean Air Plans. Where a development proposal falls within or could affect an Air Quality Management Area or Clean Air Plan (Including any Clean Air Zone), it should be consistent with the objectives of these plans and the local air quality action plan;*
- 3.22 Air quality is also mentioned within policy P1: planning for clean and safe places. Policy P1 states:
1. *To support efforts to avoid and mitigate risks from natural and man-made hazards, minimise levels of pollution and create clean, liveable and safe places for people to live, work and visit, development plans should:*

c. Consider any wider opportunities to reduce air... pollution, and contribute to compliance with national and local environmental targets and objectives, through the spatial strategy and policies for specific parts of the plan area (such as by identifying opportunities for strategic nature-based solutions)

- 3.23 The draft NPPF is not considered to diverge widely from the adopted version in air quality terms. However, the trend towards more holistic, health-based consideration of air quality, and away from a compliance-based process that is seen in related strategy described above is also present here.

Planning Practice Guidance

- 3.24 The National Planning Practice Guidance (NPPG) for Air Quality was published on March 2014 by the MHCLG and updated as of November 2019 to provide more in-depth guidance to the NPPF (Ref 19).
- 3.25 The NPPG notes that air quality assessments should include the following information (paragraph 5):
- The existing air quality in the study area (existing baseline);
 - The future air quality without the Proposed Development in place (future baseline); and
 - The future air quality with the Proposed Development in place (with mitigation).
- 3.26 Paragraph 7 states 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, assessments are likely to be location specific.
- 3.27 The NPPGs for Climate Change (Ref 20) and for Renewable and low carbon energy (Ref 21) do not specifically mention air quality. However, air pollutants are co-emitted with greenhouse gases upon the burning of fuel, so mitigation for these reasons is likely to have co-benefits for air quality. The NPPG for climate change also includes some 'win-win' examples of climate adaptation that may result in air quality co-benefits, including by maximising cooling through natural ventilation in buildings, and through the provision of green infrastructure.

National Climate Change Policy

- 3.28 As described in UK Climate Projections 2018 (UKCP18) (Ref 22) and subsequent Met Office publications (Ref 23), summers are projected to become hotter and drier, while winters become warmer and wetter. Weather extremes such as heatwaves, droughts, flooding and periods of elevated wildfire risk are expected to become more frequent and intense. These climate changes affect formation, transport and removal of air pollutants across the UK (Ref 24) and should be considered when evaluating future air quality conditions.

Regional Policy

East Midlands Combined County Authority – The Transport Strategy

- 3.29 The East Midlands Combined County Authority (EMCCA) is responsible for developing a single long term transport strategy in the form of a region wide Local Transport Plan (LTP, Ref 25). The four constituent authorities involved are; Derby City, Derbyshire, Nottingham City and Nottinghamshire County Council, who consulted together between November 2025 and February 2026 on the emerging vision of "The Mayors Transport Plan". Once adopted the LTP will replace the current adopted plan described below.

Nottinghamshire Local Transport Plan

- 3.30 Nottinghamshire County Council published the Nottinghamshire Local Transport Plan (LTP) in April 2011 (Ref 26), which is the current adopted transport strategy for the whole of the county of Nottinghamshire, including Mansfield, for the fifteen-year period between April 2011 and March 2026. The delivery and future development of transport planning functions are now overseen by EMCCA, who are delivering the new LTP as described above.
- 3.31 The LTP seeks to achieve the following goals:

“provide a reliable, resilient transport system which supports a thriving economy and growth whilst encouraging sustainable and healthy travel

improve access to key services, particularly enabling employment and training opportunities, and

minimise the impacts of transport on people’s lives, maximise opportunities to improve the environment and help tackle carbon emissions.”

- 3.32 The LTP also details objectives of relevance to air quality such as how NCC aim to reduce the adverse effects of congestion on people by improving traffic management and encourage a modal shift in alternatives to private car usage. The LTP also includes objectives relating to the promotion of cycling and walking instead of short car journeys to encourage healthy sustainable travel.

Bus Service Improvement Plan

- 3.33 In addition to the Transport Strategy, EMCCA and NCC have committed to the development and delivery of a regional Bus Service Improvement Plan (BSIP) (Ref 27) and a Nottinghamshire specific BSIP (Ref 28). These documents set out measures to enhance bus services, increase patronage, and improve accessibility at both a regional and a constituent level. The BSIPs are developed in line with the National Bus Strategy and will support the delivery of improved public transport connectivity, which is relevant to air quality through the potential to reduce reliance on private vehicle use.

Air Quality Strategy for Nottingham and Nottinghamshire

- 3.34 There are five declared AQMAs in Nottinghamshire which have been declared for the exceedances of the annual mean NO₂ objective. MDC does not have any declared AQMAs, nor does it have an Air Quality Strategy solely for this district, however the Council’s work is closely aligned to the strategy for Nottingham and Nottinghamshire, 2020-2030 (Ref 29).
- 3.35 The strategy aims to establish steps which can be taken by regional local authorities to improve air quality. The Nottingham and Nottinghamshire Air Quality Oversight Group (NNAQOG) regularly review and update on the progress made to date in the county.
- 3.36 The strategic aims of the strategy will be delivered through the following actions:
- Objective 1: Place Making and Development for Good Air Quality
 - Objective 2: Enable the Shift to Zero and Low Emission Transport to Reduce Emissions
 - Objective 3: Reduce, Minimise and Prevent Emissions from Industrial, Commercial, Agricultural and Domestic Sources and Activity
 - Objective 4: Engagement and Communication for Behaviour Change

East Midlands Retrofit Strategy

- 3.37 In 2025 EMCCA published a Retrofit Strategy (Ref 30), which sets out measures to make homes warmer, healthier and greener. This programme to retrofit buildings will result in lower air quality pollutant emissions from buildings, whether by insulating measures reducing the usage of gas boilers while still maintaining appropriate living temperatures, or zero emission heat pumps replacing gas boilers entirely. There is also an action to develop a programme targeting coal users that includes fitting of air quality monitors to demonstrate the negative impact this causes and through education to reduce coal use.

Local Policy

Ashfield and Mansfield Local Area Energy Plan (July 2026)

- 3.38 The Ashfield and Mansfield Local Area Energy Plan (LAEP)(Ref 31) provides a comprehensive, data-driven roadmap for achieving a just, resilient, and affordable transition to net zero. This document is due to be formally published later this year.

- 3.39 Commissioned by the East Midlands Combined County Authority (EMCCA) and prepared by Mott MacDonald in partnership with IES, the plan integrates technical modelling, spatial analysis, economic appraisal, and stakeholder engagement to identify how the districts of Ashfield & Mansfield can most effectively decarbonise the local energy system while delivering wider social and economic benefits. The LAEP contributes to a joined-up regional approach that aligns local action with national policy objectives and the EMCCA's 2050 net zero ambition.

Towards 2030 – A Strategy for Mansfield Our Plan Refresh 2024

- 3.40 MDC's Strategy was updated in 2024 (Ref 32) and sets out the strategic vision for Mansfield. 'Our Environment' is one of five key priority areas described. Air quality is not specifically mentioned, but the overarching ambition of '*our communities are protected and benefit from measures to tackle the impact of climate change*' also encompasses air quality co-benefits.

Mansfield District Local Plan 2013 - 2033 (2020)

- 3.41 The adopted Mansfield District Local Plan (Ref 33) contains the following policies of relevance to air quality:

Policy NE3 Pollution and land instability

1. *Development proposals will be supported where they are sited, designed and constructed to avoid adversely impacting on human health and wellbeing, amenity and the natural environment through unacceptable levels of soil, air, light, water or noise pollution or land instability.*
2. *Development proposed to be located where such unacceptable levels of pollution or land instability already exist will only be supported in exceptional circumstances and it can be satisfactorily demonstrated that the risks of adverse impacts have been fully assessed and mitigated to an acceptable level.*
3. *Development proposals for remediating and mitigating existing occurrences of despoiled, degraded, derelict, potentially contaminated and unstable land or for reducing air, water, light or noise pollution will be supported.*

Policy P7 Amenity

1. *Proposals for development will be designed and constructed to avoid and minimise impacts on the amenity of both existing and future users, alone and in combination, within the development and close to it. As such, development proposals will be expected to:*
 - a. not have a significant adverse effect on the living conditions of existing and new residents and future occupiers of the proposed development through loss of privacy, excessive overshadowing or overbearing impact; and*
 - b. not generate a level of activity, noise, light, air quality, odour, vibration or other pollution which cannot be mitigated to an appropriate standard.*

- 3.42 Policies IN2: green infrastructure, IN8: protecting and improving the sustainable transport network and P5: climate change and new development can also reasonably be expected to have co-benefits for air quality.

- 3.43 The 2033 vision for Mansfield discusses two key objectives related to green infrastructure across the district, which can also be expected to have further co-benefits for air quality. These are:

Objective 7

Improve the health and wellbeing of the district's population and reduce health inequalities by ensuring residents and visitors have better opportunities to take exercise through convenient access to a range of good quality green space, green corridors, trails, leisure and community facilities and the countryside through appropriately designed places and well-planned green infrastructure.

Objective 8

Ensure new development minimises, and is resilient to, the adverse impacts of climate change by adopting measures to appropriately address renewable and low carbon energy generation, flood mitigation, green infrastructure, resource and waste management.

- 3.44 These policies are maintained in the Local Plan Review.

Mansfield Local Plan- Air Quality Impact Assessment, Junction Effects (2018)

- 3.45 The Air Quality Impact Assessment published in 2018 by MDC (Ref 34) considered three key junctions using detailed dispersion modelling (Debdale Lane / Abbott Road junction; Chesterfield Road North Pleasley from the Mansfield ring road (MARR) route to the Landmark Centre; and Nottingham Road / Sainsbury's junction (Mansfield District Council, 2018). The assessment determined the air quality impacts due to the implementation of the then-proposed Local Plan allocations.
- 3.46 The results of the assessment predicted with the Local Plan in place, concentrations of NO₂, PM₁₀ and PM_{2.5} at sensitive receptors would remain well below the National Air Quality Objective Value of 40 µg/m³, where the impact of the local plan is described as "Negligible" and "Slight" at almost all locations.
- 3.47 The cumulative effects of the Lindhurst and Penniment Farm Developments were also found to be Not Significant, with only one, non-sensitive, receptor experiencing a moderate adverse impact for NO₂.

Climate Change Strategy and Delivery Plan (2022)

- 3.48 The Climate Change Strategy and Delivery Plan (Ref 14) aims to deliver climate mitigation and adaptation to create actions which can minimise or cease harmful emissions caused by human behaviour to the environment, and to adapt to the predicted or actual impacts of climate change and extreme weather events.
- 3.49 The Council agreed to declare a climate emergency across Mansfield District in 2019 which aspires to reduce carbon emissions by 40% in 2030 and to make Mansfield carbon neutral by 2040.
- 3.50 The Climate Change Strategy and Delivery Plan considers seven themes to achieve these goals. These are: business and economy, natural environment, buildings and infrastructure, waste and circular economy, energy generation, travel and transport, and carbon neutral council.
- 3.51 In particular, efforts to improve the natural environment by building green infrastructure, to reduce greenhouse gas emissions from buildings, and from travel and transport, are likely to have positive co-benefits on local air quality as well as regional greenhouse gas emissions.

Other Relevant Policy, Standards and Guidance

- 3.52 There is currently no statutory guidance on the method by which an air quality assessment should be undertaken. Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) (Ref 35) have published their own guidance for carrying out air quality assessments for development control. This guidance document has been followed in this air quality assessment.
- 3.53 The Department for Environment, Food and Rural Affairs (Defra) provides and maintains guidance and tools to support local authorities in carrying out their duties with respect to LAQM (Ref 36). Although not statutory guidance for assessment purposes, this assessment is carried out in line with the guiding principles for air quality assessments and with the calculation methods and MS Excel based tools as set out in LAQM.TG22.
- 3.54 Best practice and advice / guidance contained within documents from Natural England (Ref 37), the IAQM (Ref 38), and the Chartered Institute of Ecology and Environmental Management (CIEEM) (Ref 39) have been used to inform screening for ecological impacts.

4. Baseline

- 4.1 Under the requirements of Part IV of the Environment Act (Ref 2), MDC has carried out a review and assessment of local air quality.

Monitoring Data

- 4.2 MDC does not undertake any automatic monitoring for NO₂ within the district. There are currently 16 non-automatic diffusion tube monitoring locations within the district, which are listed in Table 4. The monitoring data shows that there have been no exceedances of the annual mean NO₂ AQO in recent monitoring years. However, annual mean concentration at the receptors exceed the WHO guideline of 10 µg/m³. This is common for locations in the UK, with the WHO guideline being extremely challenging to reach for urban locations.
- 4.3 The NO₂ concentrations generally show a decline since 2022. A slight increase has been observed between 2021 and 2022 in some locations, but this is likely due to the release of restrictions on activity during the COVID-19 lockdown which led to higher traffic flows across the country.

Table 4. MDC NO₂ Monitoring Data

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (N)	Site Type	Annual Mean NO ₂ Concentration (µg/m ³)				
				2021	2022	2023	2024	2025
DL	452515	362508	Roadside	28.7	27.7	26.2	25.5	25.0
FT1	457199	362697	Roadside	20.1	19.2	20.0	17.1	17.1
LLS	454421	362860	Roadside	20.8	22.0	20.4	20.2	19.2
NR	453842	360174	Roadside	23.5	26.1	25.4	26.4	26.3
OML	455834	362101	Roadside	23.0	22.6	22.0	21.5	20.1
SS	456928	367423	Roadside	16.0	16.5	15.1	14.0	13.9
SRE	458513	358623	Roadside	14.0	15.2	14.8	14.5	14.5
WT	456663	368019	Roadside	20.4	20.7	18.6	18.0	17.9
PR	453709	363105	Roadside	-	-	25.9	25.6	25.2
AR	451892	362443	Roadside	-	-	26.1	25.3	24.6
CRN1	450980	363716	Roadside	-	-	17.9	17.7	17.7
CRS	453349	361915	Roadside	-	-	20.2	19.2	19.2
FT2	456251	362135	Roadside	-	-	20.7	21.1	19.4
HL	452429	360052	Roadside	-	-	19.4	18.4	18.6
RS	453269	361308	Roadside	-	-	21.0	20.0	20.6
P1	450817	364042	Roadside	-	-	-	30.3	29.6
SRW	455716	360016	Roadside	-	-	-	-	14.5

- 4.4 Starting in 2025, MDC commenced automatic monitoring of PM₁₀ and PM_{2.5}. The results are presented in Table 5.

Table 5. MDC PM₁₀ and PM_{2.5} Monitoring Data

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (N)	Site Type	Annual Mean PM ₁₀ Concentration (µg/m ³)	Annual Mean PM _{2.5} Concentration (µg/m ³)
ML (Mansfield Ladybrook)	453051	361199	Urban Background	13.2	8.5

Background Data

- 4.5 Background concentrations of nitrogen oxides (NO_x), PM₁₀ and PM_{2.5} for 2023 (the model baseline year) and 2040 (the furthest projection year available, here representing the assessment year of 2043) were sourced from Defra's 2021-based 1x1km background maps (Ref 40).
- 4.6 Contributions from explicitly modelled source sectors were removed from the background concentrations reported in Table 6, in accordance with Defra guidance (Ref 41). This is to avoid the double counting of directly modelled contributions as outlined in point 7.538 of LAQM.TG22. Contributions from sources are broken down into two categories, in-square and out of square, in-square contributions originate from sources within the 1x1km grid square and out of square contributions originate from outside the grid square. For this assessment, in-square motorway, trunk A roads, and primary A roads have been removed from the background concentrations.
- 4.7 Predicted background concentrations for all pollutants are well below the relevant air quality standards in both 2023 and 2040. Concentrations are predicted to decline year on year between 2023 and 2040 due to anticipated improvements in vehicle fleet emissions and reductions in emissions from other sources.

Table 6. Defra Mapped Background Pollutant Concentrations across MDC for 2023 and 2040

Statistic	2023 Annual Mean Concentrations (µg/m ³)			2040 Annual Mean Concentrations (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
Minimum	6.0	11.0	6.1	4.1	10.0	5.2
Maximum	13.0	14.8	7.3	10.2	13.8	6.2
Mean	7.9	12.7	6.7	5.4	11.7	5.8

Note: Concentrations exclude contributions from the following sources: Motorway_in, Trunk_A_Rd_in and Primary_A_Rd_in

- 4.8 A comparison could not be made between the NO₂ Defra backgrounds and local monitoring, because neither MDC, nor neighbouring Ashfield District Council, maintain any NO₂ background monitors. A comparison could not be made between the PM₁₀ and PM_{2.5} Defra backgrounds and local monitoring, because MDC's monitoring of those pollutants did not start until 2025.

5. Methodology

Summary

- 5.1 This section presents the steps and methodology used to assess the air quality in the study area for each of the following traffic scenarios:
- 2023 Baseline;
 - 2043 'Do Minimum' (DM): a future assessment year which includes the influence of forecast growth and strategic planned development without impacts from the MDC Local Plan Review in place; and
 - 2043 'Do Something' (DS): future assessment year which builds on the DM scenario and includes impacts of the MDC Local Plan Review as well as other Local Plans from neighbouring areas.
- 5.2 The following sources of information and data have been used to form the basis of the air quality assessment:
- Defra's current 2021-based Air Quality Background Concentration Maps (Ref 40);
 - Defra's Vehicle Emissions Factors Toolkit (EFT) v14.1 (Ref 42);
 - Air quality monitoring data from 2021 to 2025 for MDC
 - Traffic flow and speed data provided by SYSTRA for 2023 and 2043.
- 5.3 The modelling assessment was conducted following the methodology in Chapter 7 Section 4 "Dispersion Modelling of Emissions" within Defra's LAQM.TG,22 Technical Guidance (Ref 36) and Land-Use Planning and Development Control: Planning for Air Quality Technical Guidance (Ref 35).

Traffic Data, Emissions and Screening

- 5.4 Traffic data were provided by MDC's transport consultant SYSTRA for an extensive road network across the Mansfield District.
- 5.5 The traffic data provided included information on two-directional Annual Average Daily Traffic (AADT) flows, percentage of heavy goods vehicles (HGVs), and average speed for the scenarios outlined in paragraph 5.1.
- 5.6 Road traffic emissions of nitrogen oxides (NO_x) were derived using the latest version of Defra's EFT (v14.1) at the time of assessment and the associated guidance and tools.
- 5.7 The EFT provides fleet projections and emission rates for 2021 through to 2050 for England (not London), London, Northern Ireland, Scotland and Wales. Specifically, the EFT has been used to provide emission rates as g/km/s from the total traffic for NO_x, PM₁₀, PM_{2.5}. In the case of PM₁₀ and PM_{2.5} the emission rates include tyre and brake wear, and road abrasion emission sources as well as the tailpipe emissions.
- 5.8 The three areas with the largest changes in emissions due to the proposed development in Local Plan Review (i.e. the change between the DM and the DS scenario) were identified for further modelling. These were: the south of Market Warsop, the A617 and Pleasley to the west of Mansfield, and the A6117 and surrounding areas to the south east of Mansfield. Details and figures are provided in Chapter 6.
- 5.9 Emissions and concentrations for the '2043 With Mitigation Local Plan' scenario have not been calculated as part of this work. Mitigation proposed includes measures to promote mode shift to active travel and public transport, and highway measures designed to improve connectivity and reduce congestion. These measures would produce co-benefits to air quality (via reduced car trips and reduced congestion). Therefore, the modelled scenario (with no mitigations) represents a reasonable worst-case analysis and it would be expected that with mitigation the impacts described would be the same or smaller as presented here.

Receptors

- 5.10 A desk-top review using aerial mapping cross-checked with OS mapping was conducted to select representative locations where people are likely to be present, such as residential properties, schools or medical centres. Due to the location of the screened in areas, a small amount of the receptors lie just outside of MDC's jurisdiction within neighbouring districts.
- 5.11 The locations of the chosen sensitive receptors relevant to human health are included in Figures 7-9 in Appendix C and Table 7. Receptors were chosen within and close to the areas identified for further assessment at the screening stage. Existing receptors are denoted by "R" followed by a number and then followed by the area while proposed receptors as part of Local Plan Review developments are denoted by "P," followed by a number and then followed by the area.
- 5.12 These receptors have been chosen as they are representative of selected locations within the area and provide the worst case annual mean concentration at relevant exposure. In total, 61 receptors were selected comprising both existing receptors and proposed receptors as part of Local Plan Review developments.
- 5.13 Receptors were modelled at the lowest point to represent worst case residential exposure, at ground floor level, at a height of 1.5 metres above ground.

Table 7. Human Receptor Locations in Study Area

Receptor ID	Location Description	Receptor Type	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
South of Market Warsop					
R1	High Street	Residential	456475	367655	1.5
R2	Church Street	Residential	456684	368029	1.5
R3	Mansfield Road	Residential	456113	367207	1.5
R4	Mansfield Road	Residential	456314	367548	1.5
R5	Burns Lane	Residential	456756	367974	1.5
R6	Mansfield Road	Residential	456258	367379	1.5
R7	Mansfield Road	Residential	455976	366842	1.5
R8	High Street	Residential	456574	367837	1.5
R9	Birklands Primary and Nursery School	School	456784	367955	1.5
P1	Land off Mansfield Road (A60)	Proposed Residential	456039	367056	1.5
P2	Land South East of Mansfield Road, Market Warsop	Proposed Residential	456029	366977	1.5
P3	Sookholme Lane / Sookholme Drive	Proposed Residential	456038	367301	1.5
The A617 and Pleasley					
R10	Moorhaigh Lane	Residential	450279	363253	1.5
R11	Chesterfield Road North (A617)	Residential	450967	363731	1.5

Receptor ID	Location Description	Receptor Type	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
R12	Chesterfield Road	Residential	450592	364248	1.5
R13	Chesterfield Road North (A6191)	Residential	451471	363390	1.5
R14	Water Lane	Residential	451421	362380	1.5
R15	Water Lane	Residential	450635	363719	1.5
R16	Newboundmill Lane	Residential	450193	364060	1.5
R17	Chesterfield Road North (A6191)	Residential	451322	363470	1.5
R18	Newboundmill Lane	Residential	449815	363443	1.5
R19	Abbott Road	Residential	451730	362239	1.5
R20	Abbott Road	Residential	451695	362042	1.5
R21	Chesterfield Road North (A6191)	Residential	450815	364041	1.5
R22	Magnolia House Residential Care Home	Care Home	451243	363463	1.5
P4	Pleasley Hill Farm	Proposed Residential	451156	362582	1.5
P5	Pleasley Hill Farm	Proposed Residential	451335	362424	1.5
P6	Pleasley Hill Farm	Proposed Residential	451184	363330	1.5
P7	Penniment Farm (Housing)	Proposed Residential	451259	361860	1.5
P8	Land at Rosebrook Primary School	Proposed Residential	451710	361962	1.5
P9	Abbott Road	Proposed Residential	451321	361387	1.5
P10	Fields Farm, Abbott Road	Proposed Residential	451311	361375	1.5
The A6117 southeast of Mansfield					
R23	Winster Way	Residential	457075	360245	1.5
R24	Eckington Walk	Residential	456989	360857	1.5
R25	Somersby Court	Residential	456597	360088	1.5
R26	Oak Tree Lane	Residential	456433	360350	1.5
R27	Eakring Road	Residential	456351	361217	1.5

Receptor ID	Location Description	Receptor Type	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
R28	Wingfield Road	Residential	456319	359730	1.5
R29	Whatton Court	Residential	456160	359107	1.5
R30	Chatsworth Drive	Residential	455904	359003	1.5
R31	Black Scotch Lane	Residential	455484	358745	1.5
R32	Chatsworth Drive	Residential	455980	359138	1.5
R33	Lichfield Lane	Residential	454892	358908	1.5
R34	Nottingham Road	Residential	454371	358511	1.5
R35	Robin Down Lane	Residential	454654	358753	1.5
R36	West Notts College Derby Road Campus	School	454101	358582	1.5
R37	St Peters Church of England Primary and Nursery School	School	456006	358954	1.5
R38	Oak Tree Primary and Nursery School	School	456892	360688	1.5
R39	Eakring Road	Residential	456456	361223	1.5
R40	Eakring Road	Residential	456848	361230	1.5
R41	Oak Tree Lane	Residential	456505	360081	1.5
R42	St Patrick's Roman Catholic Primary and Nursery School	School	456389	360513	1.5
P11	Land at Berry Hill (Lindhurst)	Proposed Residential	457108	358733	1.5
P12	Land at Berry Hill (Lindhurst)	Proposed Residential	456668	358588	1.5
P13	Land at Berry Hill (Lindhurst)	Proposed Residential	456185	358459	1.5
P14	Land at Berry Hill (Lindhurst)	Proposed Residential	455810	358303	1.5
P15	Land at Berry Hill (Lindhurst)	Proposed Residential	455169	358258	1.5
P16	Land at Berry Hill (Lindhurst)	Proposed Residential	454599	358245	1.5
P17	Land off Jubilee Way	Proposed Residential	457046	360669	1.5

Receptor ID	Location Description	Receptor Type	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
P18	Bellamy Road	Proposed Residential	456135	359148	1.5
P19	Forest Edge, 19 Oak Tree Lane	Proposed Residential	456427	360901	1.5

Model Setup

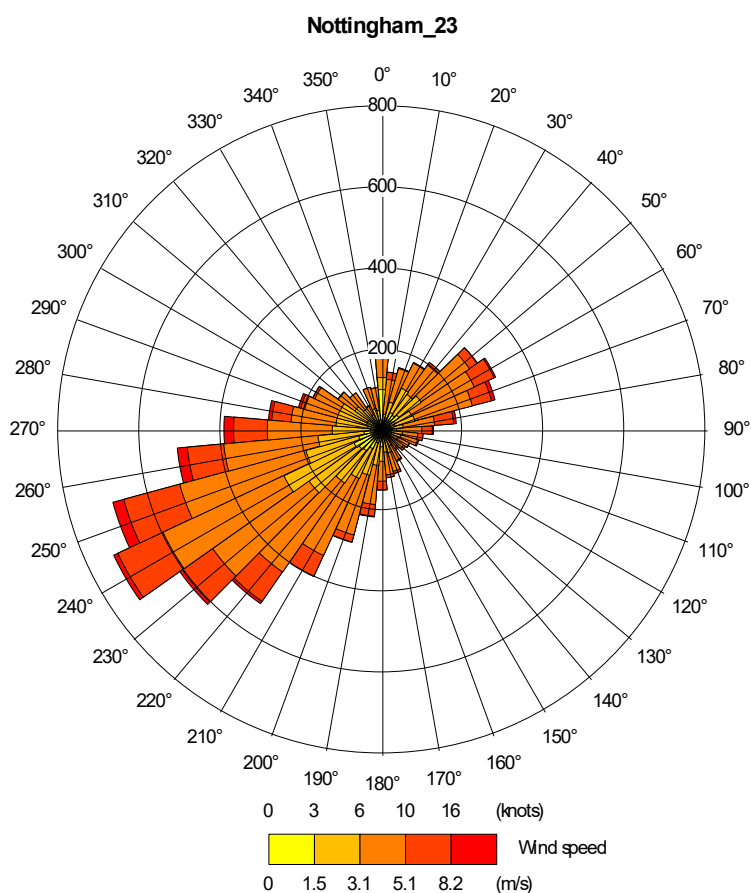
- 5.14 Detailed dispersion modelling was undertaken using the current version of ADMS-Roads (v5.1.0.2) to model concentrations of NO_x and particulates (PM₁₀ and PM_{2.5}) using the parameters in Table 8. For the 2023 scenario, 2023 emissions and background maps were used. For the 2043 scenarios, 2043 traffic data and 2043 emission factors (derived from the EFT as described above) were used, however due to limitations of the tools, 2040 background concentrations and supporting tools were applied as this is the furthest projection year available.
- 5.15 To accurately represent the impacts of congestion at sensitive receptors, congestion has been considered within the model using the guidance outlined in LAQM.TG(22). Queues have been added to the model based on professional judgement and have modelled speeds of 10 kph or 20 kph depending on typical traffic patterns and average queue length.
- 5.16 Other model inputs are described in Table 8.

Table 8. General ADMS-Roads model conditions

Variables	ADMS-Roads Model Input
Surface roughness at source	0.75 m
Surface roughness at Meteorological Site	0.3 m
Minimum Monin-Obukhov length for stable conditions	30 m
Terrain types, Canyon	Flat, no canyon
Receptor location	x, y coordinates determined by GIS, z = 1.5 m for human receptors.
Emissions	NO _x , PM ₁₀ and PM _{2.5} – Defra's EFT v14.1
Meteorological data	1 year (2023) hourly sequential data from Nottingham (Watnall) meteorological station.
Receptors	Selected receptors
Model output	Long-term (annual) mean NO _x , PM ₁₀ and PM _{2.5} concentrations.

Meteorological conditions

- 5.17 One year (2023) of hourly sequential observation data from Nottingham (Watnall) meteorological station was used in this assessment to correspond with the baseline traffic data and monitoring data used for model verification. The station is the nearest to the study area and is located approximately 16.7km away. It is considered suitably representative of the study area. Figure 1 is a wind rose displaying the meteorological data used, it shows that the dominant direction of wind was from the south-west, as is typical for the UK.

Figure 1. Wind Rose, Watnall Meteorological Data, 2023

Verification

- 5.18 Model verification is the process by which the performance of the model is assessed to identify any discrepancies between modelled and measured concentrations at air quality monitoring sites within the study area. It is necessary to perform a comparison of the modelled results versus monitoring results at relevant locations as model validation studies undertaken by developers are unlikely to have been undertaken in the study area being considered.
- 5.19 As noted in LAQM.TG.22 (Ref 36), “*the predicted results from a dispersion model may differ from measured concentrations for a large number of reasons:*”
- *Estimates of background concentrations;*
 - *Meteorological data uncertainties;*
 - *Uncertainties in source activity data such as traffic flows and emissions factors;*
 - *Model input parameters such as roughness length, minimum Monin-Obukhov; and overall model limitations; and*
 - *Uncertainties associated with monitoring data, including locations.*

Model verification is the process by which these and other uncertainties are investigated and, where possible, minimised.”

- 5.20 Modelled predictions were made for annual mean NO₂ concentrations at local authority monitoring sites for modelling areas where suitable monitoring was undertaken, in order to compare monitored and modelled NO₂ concentrations. The comparison of model outputs was made to 2023 monitoring data to correspond with the baseline year of assessment, traffic data and meteorological data.

- 5.21 From these sites, only those representative of modelled sensitive receptor locations and with sufficient data capture for 2023 were considered suitable for the purposes of model verification. Technical details of the verification procedure are in Appendix A.

Indoor Air Quality

- 5.22 Indoor Air Quality assessments are undertaken by identifying sources of air pollution at early stages of the design process in order to subsequently determine the amount of air pollution that needs to be removed and diluted by ventilation.
- 5.23 Local pollutant concentration data has been qualitatively assessed using the following sources:
- Defra-mapped background data;
 - Local air quality monitoring data;
 - Information of large combustion sources, i.e. Combined Heat and Power (CHP) / boilers (as provided by MDC's planning team); and
 - Results of the detailed modelling undertaken.
- 5.24 A high-level review has been undertaken, which includes identification of climate change hazards and information in relevant Local Plan Review policies, to recommend appropriate mitigation against the potential constraints and risks on the site in terms of indoor air quality, including those associated with climate change. Relevant literature has been referenced as appropriate to help visualise the effects of such mitigation.

6. Screening Results

Screening- Change in Traffic Flows

- 6.1 Roads where the difference in two-way traffic flows along road links as a result of the implementation of the Local Plan Review (DS-DM) exceeds 1,000 annual average daily traffic (AADT) are shown in Figure 2 which can be viewed in Appendix C.
- 6.2 Figure 2 shows that as a result of the planned development, many roads in the district exceed this level. The largest increase in total vehicles is 3,894 along Eakring Road (Link ID "48069_54013"). Eakring Road will become a key access road for one of the new large-scale planned developments in southeast Mansfield.
- 6.3 For a proportional assessment of human health impacts, the emissions changes brought about by these changes in traffic flows were calculated in order to identify the locations of worst case emissions changes for further assessment.
- 6.4 Considering ecological screening, the Birklands and Bilhaugh SAC is just outside the MDC boundary. Traffic changes in this area fall below 1,000 AADT and therefore air quality impacts on this site are screened out.

Screening- Change in NO_x Emissions

- 6.5 The 2043 traffic data both with (DS) and without (DM) the Local Plan Review developments in place were processed through EFT v14.1 (Ref 43) to review of the anticipated NO_x emissions from roads within MDC.
- 6.6 A comparison has been made for the change in NO_x emission rates (DS scenario minus DM scenario) across all of the modelled road links where traffic data is available in MDC to illustrate how NO_x emissions are anticipated to change with implementation of the Local Plan Review. The results are shown in Figure 3 in Appendix C. The largest changes in emissions occur at the following locations:
 1. A60, Mansfield Road (Link ID "53936_56039")- a key access road into Market Warsop.
 2. A new access road for one of the new large-scale planned developments (Link ID "48000_56019") in southeast Mansfield.
 3. A new access road for one of the new large-scale planned developments (Link ID "56020_56021") in Pleasley.
 4. B6033, Ravensdale Road (Link ID "53989_53990")- a busy roundabout in central Mansfield.

Screening- Change in PM₁₀ Emissions

- 6.7 An equivalent process for PM₁₀ has been carried out. The results are shown in Figure 4 which can be viewed in Appendix C. The largest changes in emissions occur at the following locations:
 1. A new access road for one of the new large-scale planned developments (Link ID "48000_56019") in southeast Mansfield.
 2. A new access road for one of the new large-scale planned developments (Link ID "56020_56021") in Pleasley.
 3. Eakring Road (Link ID "54358_56018")- a key access road for one of the new large-scale planned development in southeast Mansfield.
 4. A new access road for one of the new large-scale planned developments (Link ID "50997_50998") in southeast Mansfield.

Screening- Change in PM_{2.5} Emissions

- 6.8 An equivalent process for PM_{2.5} has been carried out. The results are shown in Figure 5 which can be viewed in Appendix C. The largest changes in emissions occur at the following locations:
1. A new access road for one of the new large-scale planned developments (Link ID “48000_56019”) in southeast Mansfield
 2. A new access road for one of the new large-scale planned developments (Link ID “56020_56021”) in Pleasley.
 3. Eakring Road (Link ID “54358_56018”)- a key access road for one of the new large-scale planned development in southeast Mansfield.
 4. A new access road for one of the new large-scale planned developments (Link ID “50997_50998”) in southeast Mansfield.

Conclusions

- 6.9 Based on the findings from the changes in traffic flows and NO_x, PM₁₀ and PM_{2.5} emissions screening, the following areas have been identified for further assessment using professional judgement to determine potential worst-case impacts:
1. Market Warsop. Chosen due to large increases in traffic/emissions along the A60 and Mansfield/Church St.
 2. Pleasley. Chosen due to large increases in traffic/emissions along the A617.
 3. Southeast Mansfield. Chosen due to large increases in traffic/emissions along Eakring Road (Link ID “54358_56018”) and several new access roads for large scale new developments (Link ID “50997_50998 and Link ID “48000_56019”).
- 6.10 Modelling to identify ecological impacts is screened out.

7. Detailed Dispersion Modelling Results

2023 Baseline

- 7.1 Modelled results at sensitive receptors within each modelled area are presented in Table 12 in Appendix B. Proposed receptors are new receptors, which will be created as part of LP developments and are denoted by “P” in modelled results and significance tables in Appendix B. These receptors only have a modelled result reported for the DS (with Local Plan) scenario, as they do not exist in the DM (without Local Plan) or baseline scenarios.
- 7.2 There were no exceedances of the annual mean NO₂ AQS objective of 40 µg/m³ at any modelled receptors in the 2023 baseline. The highest predicted NO₂ concentration was at R1, High Street, in Market Warsop, with a modelled annual mean concentration of 29.1 µg/m³. There were also no modelled exceedances of the PM₁₀ AQS objective of 40 µg/m³. The highest predicted PM₁₀ concentration was at R1, High Street, in Market Warsop, with a modelled annual mean concentration of 18.6 µg/m³.
- 7.3 Modelled PM_{2.5} concentrations at all receptors are below the current PM_{2.5} standard of 20 µg/m³ in 2023 baseline. However, the highest predicted annual mean PM_{2.5} concentration for the 2023 baseline was 10.8 µg/m³ at receptor R1, which is above the relevant target of 10 µg/m³ to be achieved by 2030.
- 7.4 All modelled concentrations are above the WHO Guidelines, recognising that these guidelines are extremely stringent and will be very difficult to achieve in urban areas. However, this does indicate that there are health impacts due to air pollution at the current baseline.

2043 Local Plan Review Development Impacts

Predicted concentrations at all modelled human health receptors are presented in Table 13 and the significance of the impacts from the local plan are also summarised in

- 7.5 Table 14, both in Appendix B.
- 7.6 All selected human health receptors in the study areas were estimated to have annual mean NO₂ concentrations well below the air quality standard of 40 µg/m³ in both future scenarios - DM and DS (with and without the Local Plan). The highest concentration was observed at P18 in the DS scenario with an annual mean NO₂ concentration of 8.1 µg/m³.
- 7.7 Modelled PM₁₀ and PM_{2.5} annual mean concentrations in 2043 are predicted to be below the relevant air quality standards. The highest modelled annual mean PM₁₀ concentration with the Local Plan Review Developments was 17.6 µg/m³ at receptor P15. The highest modelled PM_{2.5} concentration with the Local Plan Developments was 8.9 µg/m³ at receptor R1, High Street, in Market Warsop, which is below the AQS target of 10 µg/m³ to be achieved by 2040.
- 7.8 When comparing the modelled results to the IAQM significance criteria, the change in annual mean NO₂, PM₁₀, and PM_{2.5} concentrations between the DM and DS scenarios due to the Local Plan Review Developments is predicted to be slight adverse for PM_{2.5} at R1, due to an increase in predicted PM_{2.5} concentrations from 8.6 µg/m³ to 8.9 µg/m³, and negligible at all other modelled receptors and for all other pollutants.
- 7.9 All modelled concentrations are above the WHO Guidelines, recognising that these guidelines are extremely stringent and will be very difficult to achieve in urban areas. However, this does indicate that there remain health impacts due to air pollution in the assessment year.
- 7.10 Overall, the effect of the Local Plan Review Developments on air pollution at existing receptors is considered **not significant**. The sites of the proposed receptors are considered suitable in terms of air quality, and air quality is not considered a barrier to their development.

8. Indoor Air Quality and Climate Change

Introduction

- 8.1 Air quality modelling undertaken as part of the wider Local Plan Review Air Quality Assessment indicates the proposed development allocations are not expected to result in significant exceedances of relevant air quality objectives. Nevertheless, climate change is an important consideration as changing climatic conditions may influence future air quality and the exposure of residents to pollutants within both existing and future housing developments.
- 8.2 The following section describes the relationship between climate change and air quality, outlining how future climatic conditions may influence both outdoor and indoor air quality within the Mansfield area. The analysis focuses on indoor air quality, potential implications for residential development, and resulting consequences for building occupants.

How Climate Change Influences Air Quality

- 8.3 Climate change can affect air quality both directly and indirectly.
- 8.4 Direct influences are physical changes in climatic conditions that affect the generation, transport and behaviour of pollutants. These influences include changes in temperature, humidity, precipitation patterns, pH of natural waters, atmospheric circulation and derived physical climate hazards such as wildfires or flooding.
- 8.5 Indirect influences arise from behavioural and technological responses to climate change. Examples include changes in building ventilation practices during hotter weather, increased reliance on cooling technologies, and the design of energy-efficient buildings which may influence the accumulation and removal of pollutants indoors.
- 8.6 Current and future projections of climate variables that may influence local air quality have been collated for the Mansfield area from UKCP18 and a summary of the potential implications for air quality made (Table 9).

Table 9. Current and Baseline Climate for Mansfield (10th and 90th percentile in brackets, 50th percentile in bold)

Climate Variable	Baseline (1981-2010)	RCP8.5 (2041-2070) (10 th to 90 th percentile)	Potential Air Quality Impact
Temperature			
Mean annual air temperature at 1.5 m (°C)	9.5	11.6 (10.7 to 12.6)	Higher temperatures can increase the volatilisation of volatile organic compounds (VOCs), accelerating atmospheric chemical reactions involved in the formation of ground-level ozone (O ₃) and secondary particulate matter. A behavioural response to warmer conditions may include increased window opening and natural ventilation rates within buildings, potentially increasing the indoor concentration of outdoor pollutants such as Nitrogen Dioxide (NO ₂), Particulate Matter (PM ₁₀ and PM _{2.5}). Elevated temperatures may therefore contribute to poorer air quality and increased exposure to O ₃ and fine particulates.
Absolute maximum summer air temperature at 1.5 m (°C)	34.0	38.4 (37.3 to 39.6)	
Met Office heatwave events each year (count)	0.5	3.6 (2.1 to 4.9)	
Rainfall			
Mean annual rainfall (mm)	734	725 (669 to 785)	Rainfall helps remove particulate matter from the atmosphere. A reduction in annual long-term rainfall

Climate Variable	Baseline (1981-2010)	RCP8.5 (2041-2070) (10 th to 90 th percentile)	Potential Air Quality Impact
Mean summer rainfall (mm)	61.4	50.8 (37.7 to 63.1)	may reduce this effect, potentially increasing airborne PM ₁₀ and PM _{2.5} concentrations. Drier summers may increase dust generation, soil particle resuspension and particulate matter concentrations. Reduced rainfall can also increase drought and wildfire risk, creating additional sources of PM _{2.5} and PM ₁₀ .
Mean winter rainfall (mm)	61.7	68.0 (60.0 to 77.6)	Increased winter rainfall may improve removal of airborne particulates through wet deposition but may also contribute to flooding and damp conditions, affecting indoor air quality through increased mould growth.
Number of rain days (days exceeding 1 mm per day) (days/year)	125	141 (122 to 144)	A higher number of rainy days may lead to lower concentrations of airborne pollutants, as rainfall removes particulate matter and other contaminants from the atmosphere.
Other			
Relative humidity at 1.5m (%)	81.2	77.8 (74.0 to 81.7)	Projected decreases in relative humidity may contribute to drier surface conditions and increased dust resuspension. However, humidity exerts a complex influence on particulate matter concentrations through its effects on particle growth and atmospheric removal processes. Furthermore, increases in rainy days may enhance the removal of PM _{2.5} and PM ₁₀ from the atmosphere through wet deposition. While lower average humidity could reduce some moisture-related indoor air quality risks, flooding and associated indoor dampness may still increase the risk of mould growth within buildings (Ref 43).
Met Office fire danger (days/year)	13.3	39.3 (33.1 to 64.8)	Increased wildfire risk may lead to episodic increases in PM _{2.5} and PM ₁₀ concentrations, potentially affecting local and regional air quality. Wildfire smoke can travel significant distances and is a recognised source of fine particulate pollution.
Soil moisture (% change)	0.0	-6.3 (-13.5 to -2.1)	Reduced soil moisture can increase susceptibility to dust generation and the resuspension of particulate matter. Drier soils may also contribute to increased wildfire risk, impacting air quality. Increased drought frequency and duration can dry soils and other exposed surfaces, increasing the generation and resuspension of dust and particulate matter.
Standardised Precipitation Index (SPI) drought (proportion of time, %)	7.5	9.7 (7.6 to 17.9)	Reduced soil moisture and vegetation cover may also increase susceptibility to wind-driven erosion, while prolonged dry periods can reduce the frequency of rainfall events that would otherwise suppress dust emissions and remove airborne particles through wet deposition. In addition, drought conditions may elevate wildfire risk. Collectively, these factors may contribute to increased PM ₁₀ and PM _{2.5} concentrations.
Wind speed	The Met Office has projected an increase in near surface wind speeds over the UK for the second half of the 21st century for the winter season when more significant impacts of wind are experienced.		Increased wind speeds may improve atmospheric mixing and pollutant dispersion, reducing the accumulation of traffic- and combustion-related pollutants such as NO ₂ , PM ₁₀ and PM _{2.5} . Enhanced ventilation of the atmosphere can reduce the frequency

Climate Variable	Baseline (1981-2010)	RCP8.5 (2041-2070) (10 th to 90 th percentile)	Potential Air Quality Impact
	However, the increase in wind speeds is modest compared to natural variability from month to month and season to season, so confidence is low.		and duration of local episodes of poor air quality associated with stagnant weather conditions. However, stronger winds may also increase the resuspension of dust and deposited particulate matter from urban surfaces, contributing to elevated PM ₁₀ and PM _{2.5} concentrations and potentially offsetting some of the benefits of increased pollutant dispersion (Ref 44).
Note: Climate projections presented in this Table have been extracted from UKCP18 for the 12 km grid cell considered most representative of the Mansfield area. Future projections are presented for the 2041-2070 period under Representative Concentration Pathway 8.5 (RCP8.5). Representative Concentration Pathways (RCPs) are scenarios used to explore how the climate may respond to different future greenhouse gas concentration pathways. RCP8.5 represents a plausible high-emissions future and is used here to illustrate the potential upper range of climate change impacts on air quality and indoor environmental conditions in Mansfield. However, note that SSP5-8.5 (RCP8.5) is no longer thought to be a plausible scenario (Ref 45). The scenario is intended to support climate risk identification and should not be interpreted as a prediction of future climate conditions.			

Direct Influences

8.7 The changing climate can directly influence local air quality through the following categories of interaction:

- Generation of pollutants
- Transport and dispersal of pollutants
- Overheating and thermal comfort
- Moisture ingress and flooding

Generation of pollutants

- 8.8 Many pollutants commonly used as indicators of air quality are directly affected by temperature and precipitation, which influences changes in both natural and anthropogenic emission of key pollutants and their precursors (Ref 46).
- 8.9 Concentrations of O₃, PM₁₀ and PM_{2.5}, NO₂ and other secondary pollutants have been shown to increase during periods of elevated temperature (Ref 46). O₃ is particularly sensitive to temperature, as hotter conditions can increase emissions of precursors such as biogenic volatile organic compounds (bVOCs), whilst lower soil moisture conditions may influence emissions of nitrogen oxides (NO_x) from soils. Wildfires may also contribute to increased concentrations of particulate matter and O₃ precursors, resulting in additional air quality impacts (Ref 46).
- 8.10 Higher temperatures can also increase the volatilisation of VOCs emitted from building materials, furnishings, cleaning products and other household sources. Indoor concentrations of these pollutants may therefore increase during warmer periods, particularly where ventilation is limited (Ref 47).
- 8.11 Additionally, drier conditions with an increased risk of drought can increase dust generation, soil particle resuspension and particulate matter concentrations. As more frequent and intense heatwaves are projected to occur within the UK, episodes of elevated air pollution may become more common (Ref 46).

Transport and Dispersal of Pollutants

- 8.12 The transport and dispersal of pollutants is also strongly influenced by atmospheric conditions.
- 8.13 Climate change impacts on temperature, storms and atmospheric circulation patterns may affect the dispersal of pollutant dispersion through changes in wind speed, wind direction and atmospheric stability. Changes in precipitation may also affect the removal of pollutants through wet deposition (Ref 24).

- 8.14 Heatwaves and higher temperatures are frequently associated with high-pressure weather systems, which often result in lower wind speeds and reduced atmospheric mixing. Under these conditions there is greater stagnation of air masses and reduced dispersal of pollutants, allowing concentrations of NO₂ and PM to increase around emission sources including roads and industry (Ref 24).
- 8.15 A climate change-driven increase in stagnant weather conditions may therefore reduce atmospheric mixing and increase pollutant concentrations within urban areas. Changes in outdoor air quality may subsequently influence indoor air quality through pollutant infiltration into buildings through natural and mechanical ventilation pathways.

Overheating and Thermal Comfort

- 8.16 One of the most significant links between air quality and climate change relates to the increasing risk of overheating in buildings.
- 8.17 Rising summer temperatures and more frequent heatwaves are expected to increase overheating risk within both existing and future homes. While the relative impact will depend on future emissions scenarios, Zhao et al. (Ref 48) found that heat stress conditions are likely to become increasingly common across Central and Western Europe under future climate change scenarios. As indicated in Table 9, maximum temperatures may reach up to 38.4 °C by the period 2041-2070, alongside an increase in the frequency of heatwave events. These changes are expected to increase the likelihood of overheating within residential buildings across the Mansfield area.
- 8.18 Overheating is often considered a thermal comfort issue; however, it may also influence how buildings are occupied and operated. Measures implemented to reduce overheating, including changes to ventilation practices or increased reliance on cooling technologies, may influence indoor air quality and are discussed further under indirect climate change influences.

Moisture Ingress and Flooding

- 8.19 Climate change is expected to increase the likelihood and intensity of flooding impacts due to increases in winter precipitation and more intense rainfall events. The continued expansion and development of urban areas may exacerbate flood risk through development on floodplains and reductions in permeable green space, which plays an important role in managing surface water runoff (Ref 49).
- 8.20 Flooding can directly affect indoor air quality through increased dampness and mould growth within buildings. Exposure to mould spores may increase respiratory health risks for occupants and reduce indoor environmental quality (Ref 50).
- 8.21 Indoor air quality can also deteriorate during post-flood recovery activities through the introduction of substances into the indoor environment, including VOCs from cleaning products and carbon monoxide (CO) from generators used for pumping water or powering remediation activities (Ref 50).

Indirect Influences

- 8.22 The indirect influence of climate change on air quality primarily results from changes in human behaviour and the measures implemented to adapt to future climatic conditions.
- 8.23 Outdoor pollutant concentrations may be affected by the increasing adoption of low-carbon technologies such as electric vehicles or renewable energy systems, which have the potential to reduce emissions from transport and combustion sources (Ref 24). Indoor pollutant concentrations may also be affected by changes in how buildings are occupied, ventilated and cooled in response to rising temperatures.
- 8.24 Increasing temperatures and more frequent heatwaves are expected to increase demand for natural ventilation within residential and commercial buildings. Window opening behaviour in residential environments is strongly linked to indoor and outdoor air temperatures and is likely to increase during warmer periods as occupants seek to maintain thermal comfort. Whilst increased ventilation can improve indoor thermal comfort, it can also increase the infiltration of outdoor pollutants, such as NO₂ and PM levels, particularly in properties located close to busy roads or other local emission sources (Ref 24).
- 8.25 Rising temperatures may also increase reliance on cooling technologies and mechanical ventilation systems. These measures can reduce overheating and improve occupant comfort, although indoor air quality outcomes depend on system design, operation and maintenance. The UK Health Security Agency

(Ref 24) identifies a need for further research into how climate adaptation measures and behavioural change may influence future exposure to air pollution.

- 8.26 Future residential development is also likely to incorporate higher standards of insulation and airtightness to support energy efficiency and decarbonisation objectives. Whilst reducing energy demand, these measures can alter ventilation rates and influence the movement and accumulation of pollutants indoors. Furthermore, the adoption of lower emission building materials and heating systems may help reduce indoor pollutant emissions at source (Ref 51; Ref 52). Research into indoor air quality has highlighted the need to balance building energy performance with effective ventilation to maintain healthy indoor environments (Ref 47).
- 8.27 The interaction between climate adaptation, building performance, ventilation practices and occupant behaviour remains an area of ongoing research. A better understanding is required of how behavioural responses to future climate conditions may influence personal exposure to air pollution and indoor environmental quality (Ref 24).

Climate Change Air Quality Risk Summary for Mansfield

- 8.28 Based on the evidence presented above, climate change has the potential to influence indoor air quality within Mansfield through a range of interconnected physical and behavioural pathways. The following climate-related indoor air quality risks have been identified for consideration within future Local Plan Review policy and the design of future development:
- Increased concentrations of O₃, PM₁₀, PM_{2.5}, NO₂ and other secondary pollutants during periods of elevated temperatures and prolonged heatwave conditions.
 - Reduced dispersal of pollutants during periods of hot, stagnant weather, resulting in increased pollutant concentrations around existing emission sources, including roads and industry.
 - Increased overheating within residential buildings, resulting in higher indoor temperatures and reduced thermal comfort.
 - Changes in ventilation behaviour during warmer weather, increasing the infiltration of outdoor pollutants into indoor environments.
 - Increased dampness and mould growth associated with flooding, moisture ingress and prolonged wet conditions, with potential implications for indoor environmental quality and occupant health.
 - Increased particulate matter concentrations associated with drought conditions, dust generation and a greater likelihood of wildfire events.
 - Potential accumulation of indoor pollutants and excess moisture within increasingly energy-efficient and airtight buildings where ventilation is not appropriately considered as part of building design.
 - Potential exposure to CO and other pollutants during post-flood recovery activities associated with the use of combustion-powered equipment and cleaning products.

Adaptation Measures

- 8.29 Considering the risks identified above, the following adaptation measures are recommended for consideration as part of future development and Local Plan Review policy.

Indoor Air Quality and Ventilation

- 8.30 Measures that support good indoor air quality can help reduce and improve the resilience to future climatic conditions:
- Locate ventilation inlets away from outdoor pollution sources where practicable.
 - Incorporate mechanical ventilation and filtration systems where natural ventilation alone may not provide acceptable indoor air quality.
 - Promote the use of low-VOC construction materials and finishes.

- Consider ventilation requirements alongside energy efficiency and building airtightness objectives.
- Design buildings to minimise the accumulation of indoor pollutants and excess moisture.

Overheating Adaptation

8.31 Measures to reduce overheating can support both thermal comfort and indoor environmental quality.

- Incorporate passive cooling measures through building orientation and solar shading.
- Promote urban greening and tree planting to reduce local temperatures and provide shading.
- Incorporate green roofs and other forms of green infrastructure, where appropriate, to reduce urban heat island effects.
- Paint external walls lighter colours on new buildings.
- Utilise external shading measures, such as awnings, shutters or solar controlled devices to reduce solar gain.
- Replace carpets with wooden floors or tiles.
- Consider overheating and indoor air quality requirements together when developing ventilation strategies (such a use of ceiling fans and air-conditioning).

Flood Resilience

8.32 Measures that reduce dampness and support recovery following flood events can help maintain indoor environmental quality.

- Design buildings to minimise moisture ingress during flood events.
- Select materials that facilitate drying and recovery following flooding.
- Reduce reliance on combustion-powered equipment during flood recovery where alternatives are available.
- Consider indoor air quality implications during flood response and remediation activities.
- Avoid high-VOC materials and products during building repair and reinstatement works.

Challenges and Limitations

8.33 Whilst understanding of the relationship between climate change and air quality has improved considerably in recent years, significant uncertainties remain.

8.34 Evidence gaps continue to exist in relation to indoor pollutant generation, airflow and pollutant accumulation within buildings, indoor air chemistry, and how building occupants may respond to future climatic conditions (Ref 47). A better understanding is also required of how behavioural changes driven by climate change may influence personal exposure to air pollution or overheating (Ref 24).

8.35 Despite these uncertainties, there is strong evidence that climate change has the potential to influence indoor environmental quality through changes in temperature, ventilation, flooding risk and occupant behaviour. These factors should therefore be considered as part of future development and planning decisions.

9. Conclusions

2023 Baseline

- 9.1 This report presents the baseline results of the air quality assessment for screened in areas of interest for a baseline year of 2023, as well as the impacts of implementation of the Local Plan Review in 2043 at key sensitive receptors.
- 9.2 Based on the modelling presented herein, there were no exceedances of the current annual mean standards for NO₂, PM₁₀, or PM_{2.5} in the 2023 baseline year at any sensitive receptor. This is in line with relevant MDC monitoring data.
- 9.3 One modelled receptor, R1, was predicted a PM_{2.5} concentration of 10.8 µg/m³. This is above the relevant target of 10 µg/m³ to be achieved by 2030 suggesting that reductions in emissions from current conditions will be required to meet this target.

2043 Local Plan Review

- 9.4 The air quality assessment for 2043 indicates that NO₂, PM₁₀, and PM_{2.5} concentrations across all selected receptors are well below the relevant annual mean air quality standards, both with and without the Local Plan Review developments in place. The future year concentrations are lower than the baseline year because background pollutant concentrations and vehicle fleet emissions are expected to improve as a result of fleet turnover (including due to tighter emission standards for new vehicles and an increasing uptake in electric vehicles). It is noted that the future modelling undertaken is indicative only as Defra backgrounds have only been projected to 2040 and the predicted fleet composition is based on current understanding of projections, however, based on current expectations of future trends, this is likely to be worst case.
- 9.5 The impact of the Local Plan Review on NO₂ concentrations at all receptors is negligible to slight adverse, with maximum changes in annual mean concentrations of NO₂ of +0.3 µg/m³, of PM₁₀ of +0.5 µg/m³ and of PM_{2.5} of 0.3 µg/m³.
- 9.6 In summary, the implementation of the Local Plan Review does not result in exceedances of air quality standards for NO₂, PM₁₀, or PM_{2.5} at any of the selected receptors. While there are slight increases in pollutant concentrations, these changes are minor and are not predicted to significantly affect air quality in the district in 2043.

Indoor Air Quality and Climate Change

- 9.7 Climate change is expected to influence indoor air quality within Mansfield through a range of interconnected physical and behavioural pathways. Rising temperatures, more frequent heatwaves, changes in pollutant dispersion, and an increased likelihood of flooding may affect both outdoor and indoor air quality conditions over the Local Plan Review period.
- 9.8 The most significant indoor air quality risks identified for Mansfield relate to increased overheating within buildings, changes in ventilation behaviour during warmer weather, increased dampness and mould growth associated with flooding and moisture ingress, and the potential accumulation of pollutants within increasingly energy-efficient and airtight buildings where ventilation is not appropriately considered.
- 9.9 Despite these potential climate-related risks, pollutant concentrations are likely to change in future due to transport decarbonisation, with substantial reductions in road-transport emissions anticipated through the uptake of electric vehicles (Ref 53) as has been demonstrated in the modelling carried out for this assessment. Outdoor PM and NO_x concentrations are therefore expected to decline, reducing one of the key sources of indoor air pollution associated with outdoor air infiltration. The electrification of heat is also expected to provide air quality benefits through reductions in pollutants associated with fossil fuel heating systems (Ref 13).
- 9.10 As Mansfield plans for future growth, there is an opportunity to consider indoor air quality alongside climate adaptation and decarbonisation objectives. Measures that address overheating, ventilation,

flooding and building performance can help support healthy indoor environments and improve resilience to future climate conditions.

2043 Recommendations

- 9.11 On the basis of the modelling carried out, Mansfield is anticipated to comply with the AQS objectives. Therefore, it is not considered essential that any mitigation be put in place, or any amendments be made to local plan policy.
- 9.12 However, recognising that health impacts due to air quality do remain, the emerging NPPF and the interim PM_{2.5} target for planning guidance provide the opportunity to deliver further air quality improvements.
- 9.13 As noted in paragraph 9.9, there will be substantial reductions in road transport emissions (including PM_{2.5}) due to the anticipated uptake of electric vehicles across the district. It is important to recognise that reductions in tailpipe emissions from EV uptake will be offset slightly due to the inherent design features of electric vehicles compared to conventional vehicles. Electric vehicles are typically much heavier than conventional vehicles (due to their large batteries) and are also reliant on regenerative braking to recharge the battery and extend the driving range. Consequently, this could result in increased braking and tyre wear, as well as road wear, which would result in increased PM_{2.5} emissions. Overall, the net change in emissions relating to increased EV uptake will still be positive but this should be considered in future policy decisions.
- 9.14 Construction dust management plans are required as part of an Environmental Impact Assessment, when a proposed development is likely to have significant environmental effects. However, the local authority could explore including these for all new developments above a specified size and this represents a key area where further air quality improvements, particularly relating to particulate matter can be actualised.
- 9.15 Mansfield is already prioritising green infrastructure through two key objectives within their Local Plan Review, as set out in paragraph 3.43. This could be further enhanced by requiring green infrastructure to be considered through an air quality lens. For example, hedges placed between an emissions source (road) and receptor (building) are expected to reduce exposure by increasing source-receptor distance and forming a barrier to pollutants, as well as all the co-benefits that green infrastructure brings. Furthermore, Objective 7 in the Local Plan Review could include a reference to the air quality conditions at the green spaces discussed in order to ensure that residents and visitors are able to access the maximum health benefits from such spaces.

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Appendix A Model Verification

A.1 The local authority monitoring sites used in model verification are shown in Table 10.

A.2 No applicable sites were excluded from model verification.

Table 10. Local Authority Monitoring Sites used in model verification

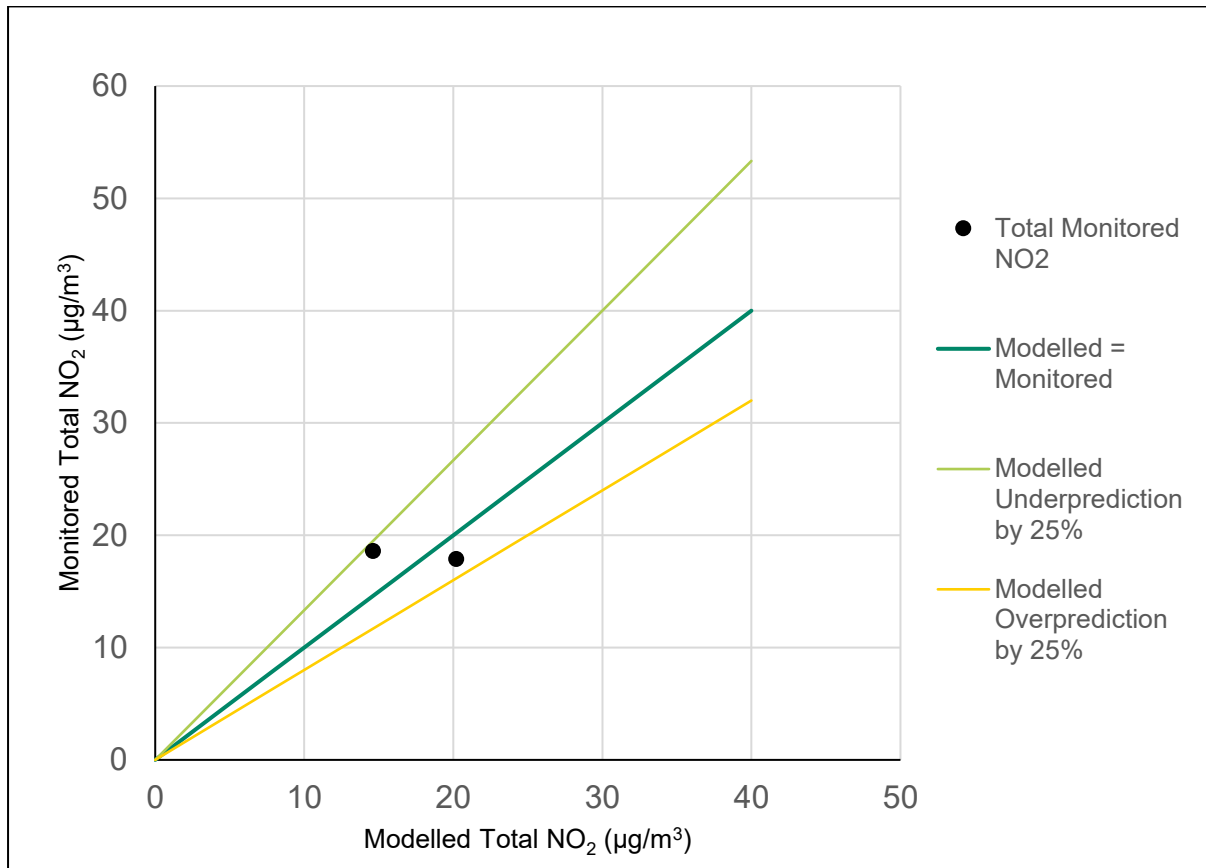
Site ID	Site Type	Grid reference (X, Y)	Height (m)
WT	Roadside	456663, 368018	2
CRN1	Roadside	450980, 363716	2

A.3 Following Defra's Technical Guidance LAQM.TG(22), model performance was analysed at these monitoring sites. An adjustment factor of 3.83 was applied as shown in Table 11. With adjustment, the root mean square error (RMSE) was 3.3 $\mu\text{g}/\text{m}^3$. LAQM.TG(22) indicates that an RMSE within 10% of the AQO (4 $\mu\text{g}/\text{m}^3$) is ideal.

A.4 The application of adjustment factors to model outputs minimises the inherent uncertainties associated with dispersion modelling.

Table 11. Verification details

Number of Sites	Number of Monitoring Sites within $\pm 25\%$ of the Monitored Concentration Pre-Adjustment	RMSE pre-adjustment ($\mu\text{g}/\text{m}^3$)	Model Adjustment Factor Applied	Number of Sites within $\pm 25\%$ of the Monitored Concentration Post Adjustment	RMSE post adjustment ($\mu\text{g}/\text{m}^3$)	Fractional Bias post adjustment
2	0	8.4	3.83	2	3.3	0.0

Figure A-1 Modelled vs Monitored Total NO₂ (after adjustment)

Appendix B Results

Table 12. Predicted Annual Mean Concentrations at Selected Receptors for 2023

Receptor ID	X co-ordinate (m)	Y co-ordinate (m)	Height (m)	Annual Mean (µg/m³)		
				NO ₂	PM ₁₀	PM _{2.5}
South of Market Warsop						
R1	456475.04	367655.21	1.5	29.1	18.1	10.8
R2	456684.29	368028.67	1.5	22.4	16.8	9.3
R3	456113.28	367206.86	1.5	12.8	14.4	8.2
R4	456313.60	367548.29	1.5	17.5	15.4	8.9
R5	456755.55	367973.77	1.5	13.2	14.2	8.1
R6	456258.09	367379.16	1.5	14.9	14.9	8.6
R7	455975.60	366841.68	1.5	12.7	15.7	7.6
R8	456573.67	367836.82	1.5	16.5	15.1	8.7
R9	456784.28	367955.44	1.5	10.3	13.6	7.7
P1	456038.87	367055.58	1.5	N/A	N/A	N/A
P2	456029.42	366977.33	1.5	N/A	N/A	N/A
P3	456037.92	367301.01	1.5	N/A	N/A	N/A
The A617 and Pleasley						
R10	450279.45	363252.76	1.5	7.8	13.6	6.7
R11	450967.00	363731.47	1.5	19.0	16.2	8.5
R12	450591.75	364247.99	1.5	10.6	13.5	7.1
R13	451470.65	363389.70	1.5	17.9	15.9	8.4
R14	451421.46	362379.95	1.5	15.1	14.7	7.8
R15	450634.50	363718.65	1.5	8.1	13.7	6.8
R16	450193.20	364060.10	1.5	8.6	13.1	6.8
R17	451322.25	363470.15	1.5	20.8	16.1	8.5
R18	449814.67	363442.56	1.5	8.8	13.4	6.8
R19	451729.93	362238.84	1.5	11.8	14.3	7.5
R20	451695.17	362042.42	1.5	11.9	14.3	7.5

Receptor ID	X co-ordinate (m)	Y co-ordinate (m)	Height (m)	Annual Mean ($\mu\text{g}/\text{m}^3$)		
				NO ₂	PM ₁₀	PM _{2.5}
R21	450814.99	364041.41	1.5	20.7	16.0	8.7
R22	451243.41	363463.03	1.5	17.7	15.5	8.1
P4	451155.55	362581.65	1.5	N/A	N/A	N/A
P5	451334.97	362423.53	1.5	N/A	N/A	N/A
P6	451183.77	363330.38	1.5	N/A	N/A	N/A
P7	451258.93	361859.59	1.5	N/A	N/A	N/A
P8	451709.98	361961.52	1.5	N/A	N/A	N/A
P9	451320.80	361386.64	1.5	N/A	N/A	N/A
P10	451310.50	361375.21	1.5	N/A	N/A	N/A
The A6117 southeast of Mansfield						
R23	457075.08	360244.64	1.5	9.6	12.6	6.9
R24	456989.25	360857.45	1.5	14.3	13.1	7.8
R25	456596.55	360087.88	1.5	13.3	13.0	7.7
R26	456432.58	360350.35	1.5	14.2	13.1	7.8
R27	456350.70	361216.60	1.5	18.0	14.0	8.3
R28	456319.25	359730.00	1.5	16.0	13.6	7.8
R29	456160.05	359107.25	1.5	15.5	13.3	7.7
R30	455903.55	359002.80	1.5	10.7	12.1	7.0
R31	455484.45	358744.55	1.5	9.7	14.3	7.1
R32	455980.40	359138.13	1.5	10.9	12.1	7.1
R33	454891.75	358907.80	1.5	12.6	14.8	7.5
R34	454370.75	358510.54	1.5	15.6	15.4	8.0
R35	454653.84	358752.69	1.5	15.1	15.4	7.9
R36	454101.27	358581.74	1.5	12.3	14.7	7.5
R37	456005.70	358953.95	1.5	11.6	15.8	7.5
R38	456892.24	360688.17	1.5	9.9	12.1	7.1
R39	456456.25	361222.95	1.5	13.8	12.9	7.6

Receptor ID	X co-ordinate (m)	Y co-ordinate (m)	Height (m)	Annual Mean ($\mu\text{g}/\text{m}^3$)		
				NO ₂	PM ₁₀	PM _{2.5}
R40	456847.62	361230.33	1.5	11.5	12.4	7.3
R41	456504.75	360081.00	1.5	18.1	14.2	8.5
R42	456388.60	360513.30	1.5	10.5	12.3	7.2
P11	457108.19	358733.34	1.5	N/A	N/A	N/A
P12	456667.88	358587.75	1.5	N/A	N/A	N/A
P13	456184.65	358458.86	1.5	N/A	N/A	N/A
P14	455810.29	358302.75	1.5	N/A	N/A	N/A
P15	455168.68	358258.33	1.5	N/A	N/A	N/A
P16	454599.35	358245.40	1.5	N/A	N/A	N/A
P17	457045.82	360668.69	1.5	N/A	N/A	N/A
P18	456135.26	359147.63	1.5	N/A	N/A	N/A
P19	456426.74	360900.90	1.5	N/A	N/A	N/A

Table 13. Annual Mean Air Quality Results for 2043 traffic flows

Receptor ID	Without Local Plan ($\mu\text{g}/\text{m}^3$)			With Local Plan ($\mu\text{g}/\text{m}^3$)			Change ($\mu\text{g}/\text{m}^3$)		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
South of Market Warsop									
R1	6.7	15.6	8.6	6.9	16.1	8.9	0.2	0.5	0.3
R2	5.8	14.9	7.6	5.8	15.1	7.7	0.0	0.2	0.1
R3	5.1	12.8	6.8	5.3	13.1	7.0	0.2	0.2	0.2
R4	5.6	13.5	7.3	5.6	13.7	7.4	0.1	0.2	0.1
R5	5.3	12.7	6.7	5.4	13.0	6.9	0.1	0.3	0.2
R6	5.3	13.3	7.1	5.6	13.6	7.3	0.3	0.4	0.2
R7	5.0	14.4	6.4	5.0	14.5	6.5	0.0	0.1	0.1
R8	5.5	13.3	7.1	5.5	13.5	7.2	0.0	0.1	0.1
R9	5.0	12.2	6.4	5.1	12.4	6.5	0.1	0.1	0.1
R10	5.1	12.6	5.8	5.1	12.6	5.8	0.0	0.0	0.0
P1	N/A	N/A	N/A	5.5	14.0	7.5	N/A	N/A	N/A

Receptor ID	Without Local Plan (µg/m³)			With Local Plan (µg/m³)			Change (µg/m³)		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
P2	N/A	N/A	N/A	5.3	15.4	7.2	N/A	N/A	N/A
P3	N/A	N/A	N/A	4.8	11.9	6.2	N/A	N/A	N/A
The A617 and Pleasley									
R11	6.5	15.1	7.4	6.5	15.3	7.5	0.0	0.2	0.1
R12	5.4	12.5	6.1	5.4	12.7	6.2	0.0	0.2	0.1
R13	6.2	14.4	7.0	6.2	14.4	7.0	0.0	0.0	0.0
R14	6.5	13.7	6.8	6.3	13.7	6.8	-0.1	0.0	0.0
R15	5.1	12.7	5.8	5.2	12.8	5.9	0.0	0.1	0.1
R16	5.2	12.1	5.9	5.2	12.2	5.9	0.0	0.0	0.0
R17	6.9	14.8	7.3	7.0	14.8	7.3	0.1	0.1	0.0
R18	5.2	12.4	5.9	5.2	12.5	5.9	0.0	0.1	0.1
R19	5.8	13.0	6.4	5.8	13.1	6.4	0.0	0.1	0.0
R20	5.8	13.0	6.4	5.8	13.1	6.4	0.0	0.1	0.1
R21	6.7	14.8	7.6	6.7	15.1	7.7	0.0	0.3	0.2
R22	6.5	14.3	7.0	6.5	14.3	7.1	0.0	0.0	0.1
P4	N/A	N/A	N/A	5.7	12.8	6.3	N/A	N/A	N/A
P5	N/A	N/A	N/A	6.3	14.2	7.1	N/A	N/A	N/A
P6	N/A	N/A	N/A	5.8	13.7	6.6	N/A	N/A	N/A
P7	N/A	N/A	N/A	6.4	12.4	6.7	N/A	N/A	N/A
P8	N/A	N/A	N/A	7.2	14.8	8.2	N/A	N/A	N/A
P9	N/A	N/A	N/A	7.2	14.7	8.2	N/A	N/A	N/A
P10	N/A	N/A	N/A	7.0	14.2	7.9	N/A	N/A	N/A
The A6117 southeast of Mansfield									
R23	5.3	11.5	5.9	5.4	11.7	6.0	0.0	0.1	0.1
R24	6.3	11.8	6.6	6.3	11.9	6.6	0.0	0.1	0.0
R25	6.2	11.7	6.5	6.2	11.9	6.6	0.1	0.1	0.1
R26	6.3	11.8	6.6	6.3	11.8	6.6	0.0	0.0	0.0

Receptor ID	Without Local Plan (µg/m³)			With Local Plan (µg/m³)			Change (µg/m³)		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
R27	7.2	12.6	7.0	7.3	12.7	7.1	0.0	0.2	0.1
R28	7.1	12.2	6.6	7.2	12.3	6.7	0.1	0.1	0.1
R29	7.3	12.2	6.6	7.4	12.4	6.7	0.1	0.2	0.1
R30	5.9	11.0	6.0	5.9	11.0	6.0	0.0	0.0	0.0
R31	5.5	13.3	6.1	5.5	13.3	6.1	0.0	0.0	0.0
R32	5.9	11.0	6.0	5.9	11.0	6.0	0.0	0.0	0.0
R33	6.0	13.6	6.4	6.0	13.6	6.4	0.0	0.0	0.0
R34	6.4	14.2	6.8	6.4	14.2	6.8	0.0	0.0	0.0
R35	6.2	14.0	6.7	6.2	14.1	6.7	0.0	0.0	0.0
R36	6.0	13.4	6.3	6.0	13.4	6.3	0.0	0.0	0.0
R37	5.5	14.7	6.4	5.5	14.8	6.5	0.0	0.1	0.1
R38	5.9	11.0	6.1	5.9	11.1	6.1	0.0	0.0	0.0
R39	6.8	11.7	6.5	6.9	11.9	6.6	0.1	0.3	0.2
R40	6.6	11.3	6.2	6.7	11.6	6.4	0.1	0.3	0.2
R41	6.7	12.8	7.2	6.8	13.0	7.3	0.1	0.2	0.1
R42	5.9	11.2	6.2	5.9	11.2	6.2	0.0	0.0	0.0
P11	N/A	N/A	N/A	6.2	16.0	7.3	N/A	N/A	N/A
P12	N/A	N/A	N/A	6.2	15.5	6.9	N/A	N/A	N/A
P13	N/A	N/A	N/A	6.8	16.5	7.6	N/A	N/A	N/A
P14	N/A	N/A	N/A	7.1	15.5	7.5	N/A	N/A	N/A
P15	N/A	N/A	N/A	7.8	17.6	8.8	N/A	N/A	N/A
P16	N/A	N/A	N/A	7.8	16.0	8.0	N/A	N/A	N/A
P17	N/A	N/A	N/A	5.6	12.0	6.2	N/A	N/A	N/A
P18	N/A	N/A	N/A	8.1	13.9	7.7	N/A	N/A	N/A
P19	N/A	N/A	N/A	7.6	15.0	8.6	N/A	N/A	N/A

Table 14. Air Quality Significance

Receptor ID	IAQM Significance		
	NO ₂	PM ₁₀	PM _{2.5}
South of Market Warsop			
R1	Negligible	Negligible	Slight Adverse
R2	Negligible	Negligible	Negligible
R3	Negligible	Negligible	Negligible
R4	Negligible	Negligible	Negligible
R5	Negligible	Negligible	Negligible
R6	Negligible	Negligible	Negligible
R7	Negligible	Negligible	Negligible
R8	Negligible	Negligible	Negligible
R9	Negligible	Negligible	Negligible
R10	Negligible	Negligible	Negligible
The A617 and Pleasley			
R11	Negligible	Negligible	Negligible
R12	Negligible	Negligible	Negligible
R13	Negligible	Negligible	Negligible
R14	Negligible	Negligible	Negligible
R15	Negligible	Negligible	Negligible
R16	Negligible	Negligible	Negligible
R17	Negligible	Negligible	Negligible
R18	Negligible	Negligible	Negligible
R19	Negligible	Negligible	Negligible
R20	Negligible	Negligible	Negligible
R21	Negligible	Negligible	Negligible
R22	Negligible	Negligible	Negligible
The A6117 southeast of Mansfield			
R23	Negligible	Negligible	Negligible

Receptor ID	IAQM Significance		
	NO ₂	PM ₁₀	PM _{2.5}
R24	Negligible	Negligible	Negligible
R25	Negligible	Negligible	Negligible
R26	Negligible	Negligible	Negligible
R27	Negligible	Negligible	Negligible
R28	Negligible	Negligible	Negligible
R29	Negligible	Negligible	Negligible
R30	Negligible	Negligible	Negligible
R31	Negligible	Negligible	Negligible
R32	Negligible	Negligible	Negligible
R33	Negligible	Negligible	Negligible
R34	Negligible	Negligible	Negligible
R35	Negligible	Negligible	Negligible
R36	Negligible	Negligible	Negligible
R37	Negligible	Negligible	Negligible
R38	Negligible	Negligible	Negligible
R39	Negligible	Negligible	Negligible
R40	Negligible	Negligible	Negligible
R41	Negligible	Negligible	Negligible
R42	Negligible	Negligible	Negligible

Appendix C Figures

Figure 2. Traffic Screening- Exceeding DMRB Criteria

Figure 3. Traffic Screening- Change in NO_x emissions (g/km/s)

Figure 4. Traffic Screening- Change in Change in PM₁₀ Emissions (g/km/s)

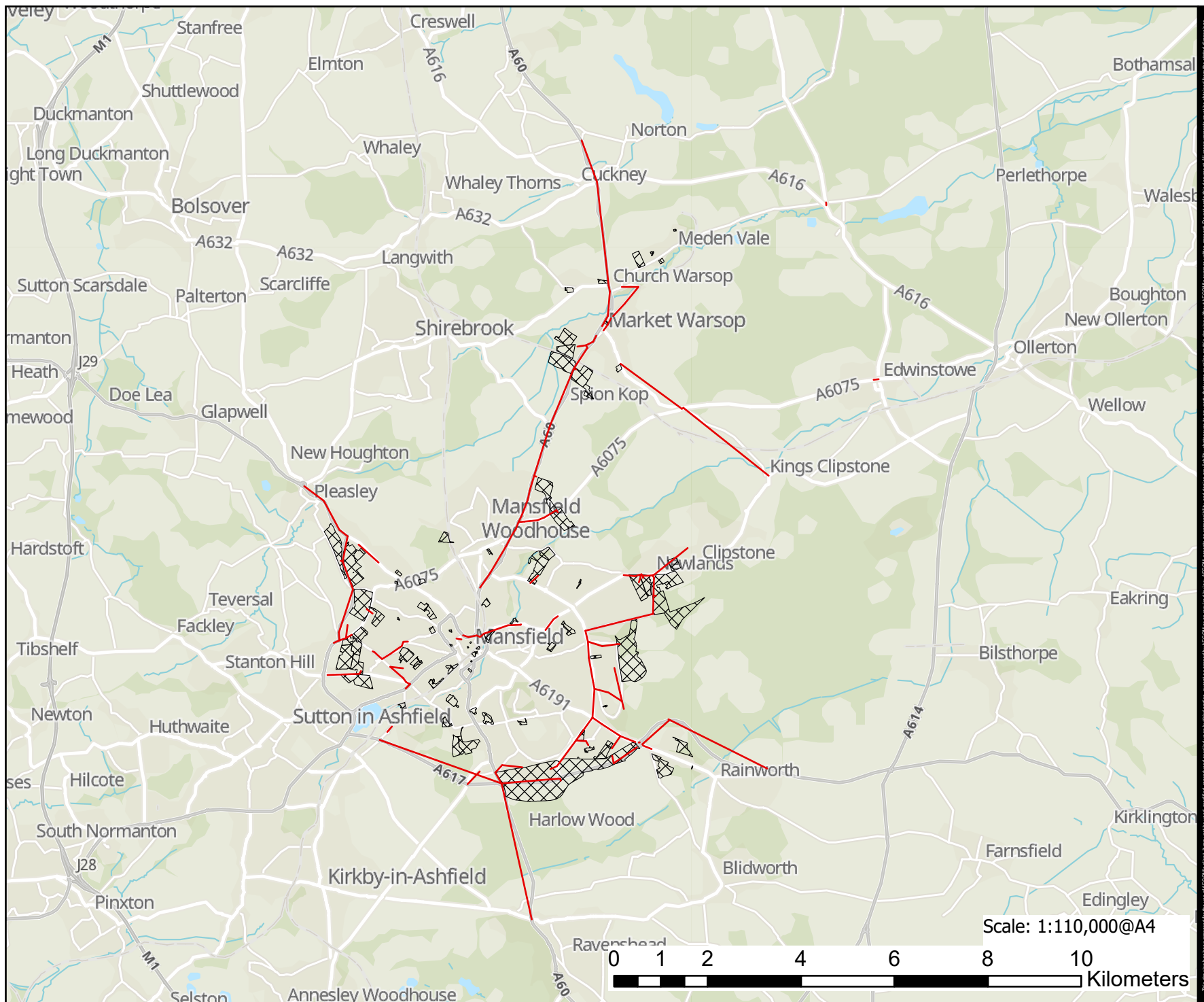
Figure 5. Traffic Screening- Change in PM_{2.5} Emissions (g/km/s)

Figure 6. Baseline Study Area

Figure 7. South of Markey Warsop DS Study Area

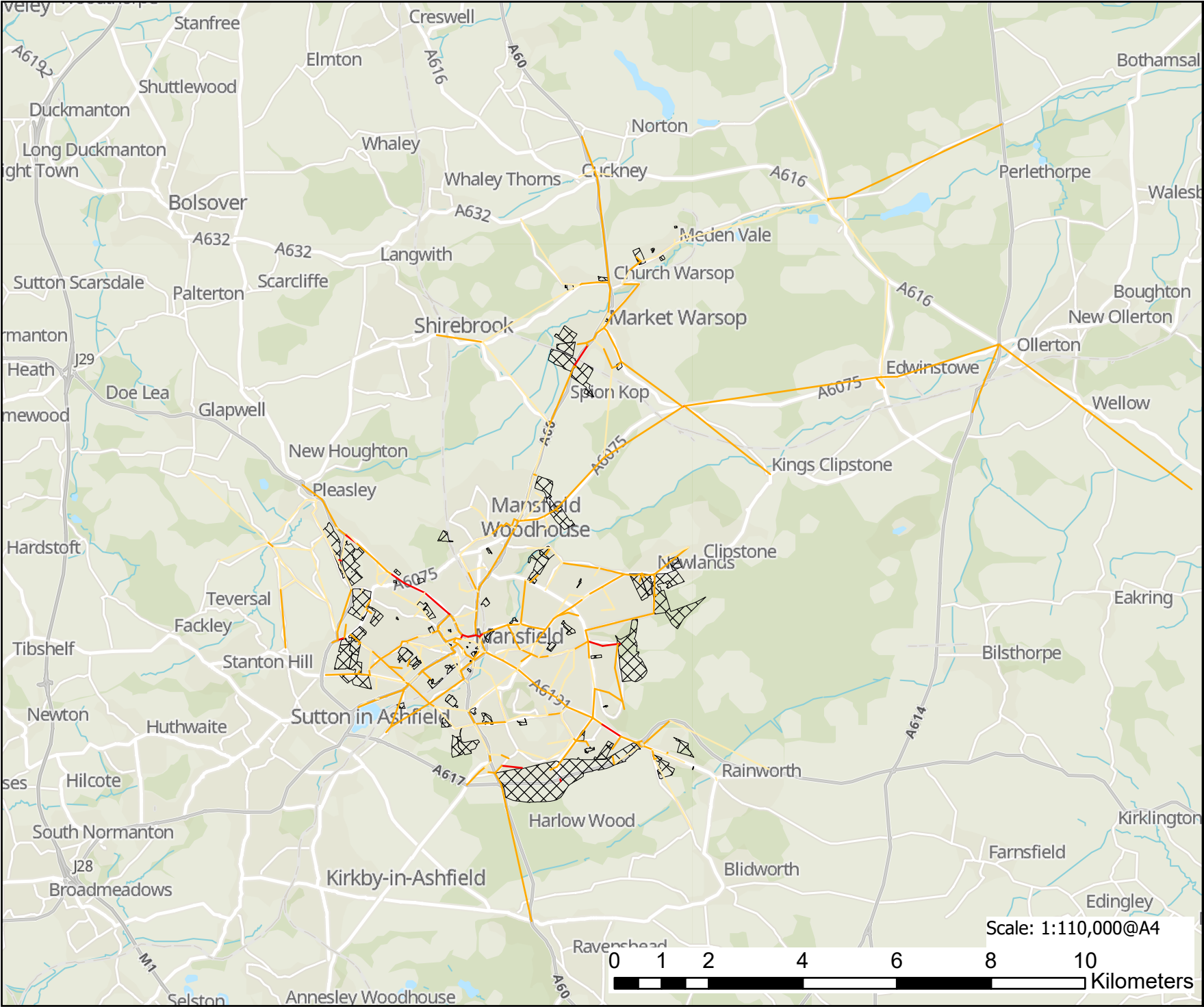
Figure 8. The A617 and Pleasley DS Study Area

Figure 9. The A6117 southeast of Mansfield DS Study Area



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Figure 2



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- Preferred Sites,
Allocations and Sites
with Planning Permission
- Change in NO_x Emissions (g/
km/s)
- <0
 - 0.0001
 - 0.0002 - 0.0006
 - 0.0007 - 0.0018

NOTES

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PROJECT NUMBER

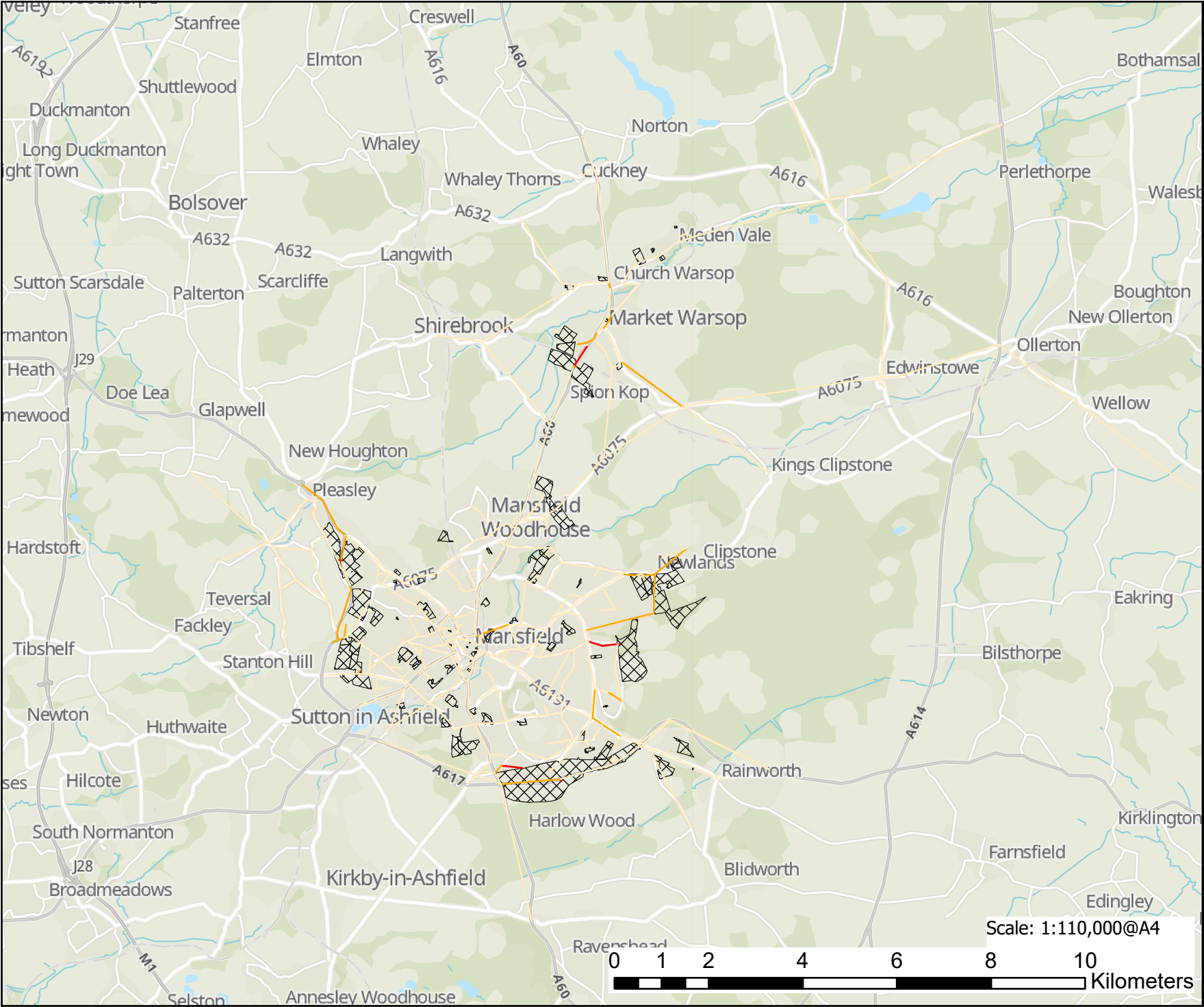
60772520

FIGURE TITLE

Traffic Screening- Change in NO_x
emissions (g/km/s)

FIGURE NUMBER

Figure 3



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- Change in PM₁₀ Emissions (g/
km/s)
- <0
 - 0.0001 - 0.0005
 - 0.0006 - 0.0010
 - 0.0011 - 0.0015

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FIGURE TITLE

Traffic Screening- Change in Change
in PM₁₀ Emissions (g/km/s)

FIGURE NUMBER

Figure 4



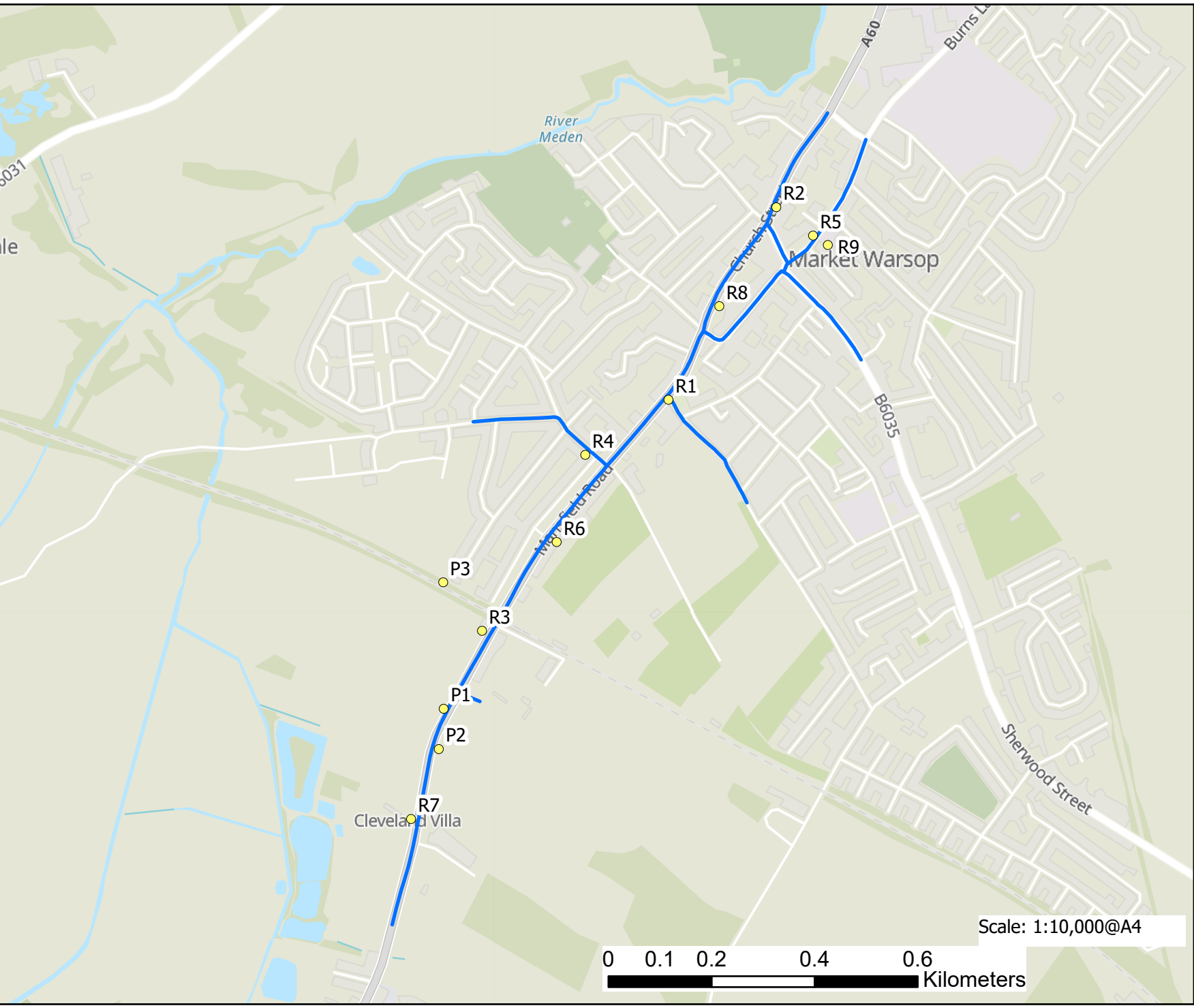
Figure 5

Scale: 1:110,000@A4

A horizontal scale bar with a black background and white markings. The bar is divided into segments by white vertical lines. Above the bar, the numbers 0, 1, 2, 4, 6, 8, and 10 are printed in black. Below the bar, the word "Kilometers" is printed in black. The bar represents a distance of 10 kilometers.



Figure 6



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- Final Receptors
- Area 1 DS Modelled Road Links

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ISSUE PURPOSE

DRAFT

PROJECT NUMBER

60772520

FIGURE TITLE

South of Market Warsop DS
Study Area

FIGURE NUMBER

Figure 7



PROJECT

Mansfield Local Plan
Review

CLIENT

Mansfield District Council

CONSULTANT

AECOM Limited
69 Park Lane
Croydon
CRO 1JD
www.aecom.com

LEGEND

- Final Receptors
- Area 2 DS Modelled Road Links

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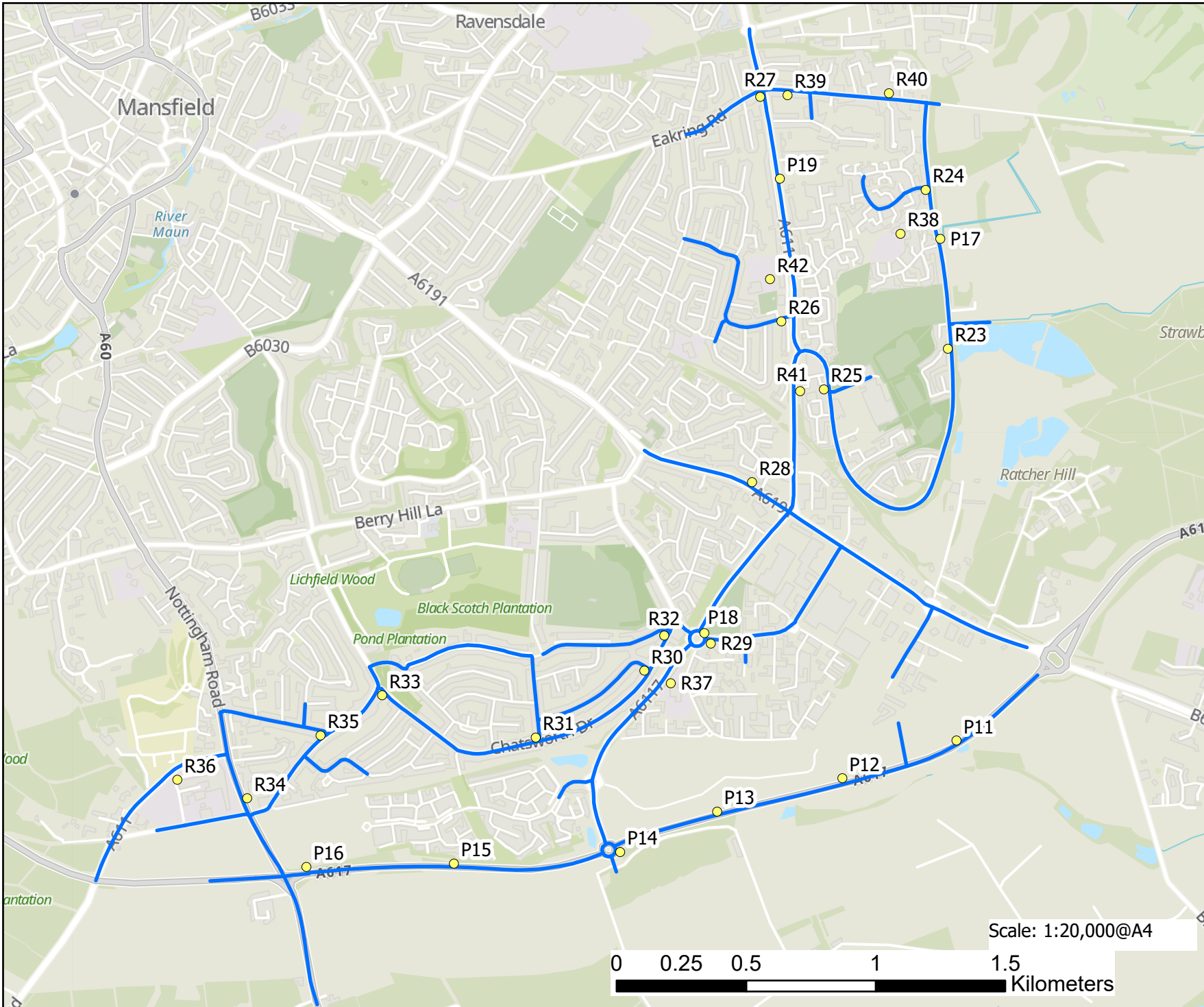
60772520

FIGURE TITLE

The A617 and Pleasley DS Study
Area

FIGURE NUMBER

Figure 8



AECOM

PROJECT

Mansfield Local Plan
Review

CLIENT

Mansfield District Council

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AECOM Limited
69 Park Lane
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FIGURE TITLE

The A6117 southeast of Mansfield
DS Study Area

FIGURE NUMBER

Figure 9

