Suffolk County Council & Ipswich Borough Council

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1 INTRODUCTION

1.1.1. WSP was commissioned by Suffolk County Council (SCC) on behalf of Ipswich Borough Council (IBC) to provide an assessment of the potential local air quality impacts of the proposed aligned local plans for the administrative areas of IBC, Babergh District Council (BDC), Mid Suffolk District Council (MSDC), and the former Suffolk Coastal District Council (SCDC) element of the administrative area now known as East Suffolk - which together form the Ipswich Strategic Planning Area (ISPA). The focus of the study is on the impacts of air pollutant levels due to changes in road traffic emissions within the IBC administrative area associated with the Ipswich Local Plan Review.

1.1.2. This Air Quality Assessment report follows on from the report for SCC and IBC on 'The Aligned Local Plans for Suffolk Districts Air Quality Screening Study' (WSP report ref. AQ1, January 2020)[1].

1.1.3. The Air Quality Screening Study report includes details of:

- the road networks that would be substantially affected by local plan growth in 2026 and 2036 - referred to as the 'affected road network' (ARN);
- baseline air quality conditions; and
- the study area for the air quality assessment.

1.1.4. The Air Quality Assessment report provides an overview of the relevant legislation, policy and guidance, sets out the methodology and presents the assessment findings.

1.1.5. The assessment focused on areas where the potential air quality impacts of the Ipswich Local Plan Review are likely to be most noticeable. These areas are adjacent to sections of road that are expected to experience substantial changes in traffic with the Ipswich Local Plan Review proposals, in-particular near to road junctions with frequent traffic congestion.

1.1.6. The impacts were determined at sensitive locations ('receptors') in these areas. Receptors were identified to have either relevant public exposure ('human receptors') or ecological features sensitive to changes in air pollution ('ecological receptors'). The impacts at human receptors were assessed in terms of changes in ambient concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The impacts at ecological receptors were assessed in terms of changes in oxides of nitrogen (NO_x) and nutrient nitrogen levels. The assessment considered the impacts of the Ipswich Local Plan Review without and with transport mitigation measures.

[1] WSP (2020) *The Aligned Local Plans for Suffolk Districts Air Quality Screening Study*. Available at: https://www.ipswich.gov.uk/content/new-evidence-base-documents-ipswich-local-plan-review-2036 [Accessed January 2020].

2 LEGISLATION AND POLICY

2.1.1. The relevant air quality legislation, policy and guidance is discussed below.

2.2 LEGISLATION

ENVIRONMENT ACT 1995

2.2.1. Part IV of the Environment Act[2] requires the Secretary of State for the Environment, Food and Rural Affairs to publish a national Air Quality Strategy and set up a system of Local Air Quality Management (LAQM). Local authorities are required to periodically review and document local air quality, with the aim of meeting the air quality objectives defined in the Air Quality Regulations. Where a local authority determines that one or more objective is unlikely to be achieved it is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority must produce an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

AIR QUALITY REGULATIONS

2.2.2. The Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] set the objectives for ambient pollutant concentrations. The objectives apply where there is relevant exposure: *"at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"*.

2.2.3. The Air Quality Standards Regulations 2010[5,6] transpose the European Union (EU) Ambient Air Quality Directive (2008/50/EC)[7] into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health including NO_2, PM_{10} and $PM_{2.5}$. The Regulations also include critical levels for the protection of vegetation. The limit values are numerically the same as the objectives.

[2] The National Archives (1995) *Environment Act 1995*. Available at: http://www.legislation.gov.uk/ukpga/1995/25/contents [Accessed February 2020].
[3] The National Archives (2000) *The Air Quality (England) Regulations 2000*. Available at: http://www.legislation.gov.uk/uksi/2000/928/contents/made [Accessed February 2020].
[4] The National Archives (2002) *The Air Quality (England) (Amendment) Regulations 2002*. Available at: http://www.legislation.gov.uk/uksi/2002/3043/contents/made [Accessed February 2020].
[5] The National Archives (2010) *The Air Quality Standards Regulations 2010*. Available at: http://www.legislation.gov.uk/uksi/2010/1001/contents/made [Accessed February 2020].
[6] The National Archives (2016) *The Air Quality Standards (Amendment) Regulations 2016*. Available at: https://www.legislation.gov.uk/uksi/2016/1184/contents/made [Accessed February 2020].
[7] Official Journal of the European Union (2008) *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe*. Available at: https://eur-lex.europa.eu/eli/dir/2008/50/oj [Accessed February 2020].

2.2.4. The air quality standards (AQS), in terms of objectives, limit values and critical levels that are relevant to this assessment, are given in **Table 2-1**. The abbreviation 'AQS' is used throughout this report when referring to objectives, limit values and critical levels.

Table 2-1 – Relevant Air Quality Standards (AQS)

Pollutant	Measured as	Concentration (µg/m^3)	Requirement
Nitrogen dioxide (NO_2)	Annual mean	40	Not to be exceeded, as a national objective and as an EU limit value.
	1-hour (hourly) mean	200	Not to be exceeded, more than 18 times a year as a national objective and as an EU limit value.
PM_{10} (particulate matter less than 10 micrometres in diameter)	Annual mean	40	Not to be exceeded, as a national objective and as an EU limit value.
	24-hour (daily) mean	50	Not to be exceeded, more than 35 time a year as a national objective and as an EU limit value.
$PM_{2.5}$ (particulate matter less than 2.5 micrometres in diameter)	Annual mean	25	Not to be exceeded, as a national objective and as an EU limit value.
Oxides of nitrogen (NO_x)	Annual mean	30	Critical level for the protection of vegetation.

2.3 POLICY

CLEAN AIR STRATEGY 2019

2.3.1. The Clean Air Strategy[8] sets out the comprehensive action required from all parts of government and society to help meet EU limit values for the five most damaging air pollutants: NO_x (including NO_2), $PM_{2.5}$, ammonia, sulphur dioxide and non-methane volatile organic compounds. The immediate national challenge is to reduce NO_x emissions due to non-compliance with the limit value for annual mean NO_2 (**Table 2-1**). Targets for action include road traffic to reduce ambient NO_2

[8] Defra (2019). *Clean Air Strategy*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf [Accessed February 2020].

concentrations, the reduction of particulate matter emissions by 30% by 2020, as well as the reduction in domestic coal and wood burning to improve ambient $PM_{2.5}$ concentrations.

UK AIR QUALITY STRATEGY

2.3.2. Government policy on air quality within the UK, which predates the Clean Air Strategy 2019, is set out in The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[9], 2007. This provides a framework for reducing air pollution in the UK with the aim of meeting the objectives and mandatory limit values set by the Air Quality Regulations.

UK PLAN FOR TACKLING ROADSIDE NITROGEN DIOXIDE CONCENTRATIONS

2.3.3. The UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations[10] was published in 2017. This sets out roles and responsibilities and measures for bringing NO_2 levels within the mandatory limit values in the shortest possible time. Under the UK Plan, local authorities with roadside concentrations of NO_2 forecast by the Department for Environment, Food and Rural Affairs (Defra) as exceeding legal limits are identified. Whilst the UK Plan itself does not identify Ipswich as having roadside concentrations exceeding the annual mean NO_2 standard, nonetheless IBC has developed an action plan in response to roadside exceedances recorded from its own monitoring programme[11].

NATIONAL PLANNING POLICY FRAMEWORK

2.3.4. The National Planning Policy Framework[12] encompasses the Government's overall planning policies for England and was updated in 2019. The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as:

- *"… meeting the needs of the present without compromising the ability of future generations to meet their own needs"*

2.3.5. One of the three overarching objectives is that planning should *"contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."*

2.3.6. In relation to air quality, the following paragraphs in the document are relevant:

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[9] Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1)*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf [Accessed February 2020].
[10] Defra (2017) *UK plan for tackling roadside nitrogen dioxide concentrations – Detailed plan*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf [Accessed February 2020].
[11] IBC (2019) *Ipswich Borough Council Air Quality Action Plan 2019 – 2024*. Available at: https://www.ipswich.gov.uk/sites/default/files/air_quality_action_plan_2019_-_executive_approved_pdf_version.pdf [Accessed March 2020].
[12] Ministry of Housing, Communities and Local Government (2019). *National Planning Policy Framework*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf [Accessed February 2020].

- Paragraph 170 states that "*Planning policies and decisions should contribute to and enhance the natural and local environment by:…preventing new and existing development from contributing to, or being adversely affected by unacceptable levels of soil, air, water, or noise.*"
- Also of relevance to this assessment, paragraph 181 states with regards to air quality: *"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. 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."*

ADOPTED IPSWICH LOCAL PLAN 2011 - 2031

2.3.7. The Adopted Ipswich Local Plan 2011 – 2031 sets out the *"vision, objectives and spatial planning strategy for the Borough of Ipswich up to 2031"*[13]. Objective number 11 of the Local Plan is *"To improve air quality and create a safer, greener, more cohesive town".* The Council intends to meet this objective through the implementation of policies that are expected to be beneficial to air quality. These policies include:

- Policy CS1: Sustainable Development
- Policy CS5: Improving Accessibility
- Policy CS16: Green Infrastructure, Sport and Recreation
- Policy CS20: Key Transport Proposals
- Policy DM1: Sustainable Design and Construction
- Policy DM5: Design and Character
- Policy DM10: Protection of Trees and Hedgerows
- Policy DM17: Transport and Access in New Developments
- Policy DM26: Protection of Amenity
- Policy DM28: Protection of Open Spaces and Recreation Facilities.

2.3.8. The Council aims to achieve a 75% reduction in the number of exceedances of the AQS for annual mean NO_2 (**Table 2-1**) recorded each year by 2031, from a total of 27 recorded exceedances at the beginning of the plan period (2011), as referenced in the adopted Local Plan Key Targets chapter.

IPSWICH LOCAL PLAN REVIEW 2018 - 2036

2.3.9. Within the Ipswich Local Plan Review 2018 – 2036[14] the improvement of air quality remains one of its twelve strategic objectives. Like the Adopted Ipswich Local Plan 2011 – 2031, the Ipswich Local Plan Review includes several policies identified as being beneficial to air quality. Of most relevance to this assessment however is the inclusion of the Policy DM3 'Air Quality'. The purposes of this new policy are to ensure a reduction in exposure to poor air quality and to mitigate the impact of

[13] IBC (2017) *Adopted Ipswich Local Plan 2011 – 2031*. Available at: https://www.ipswich.gov.uk/content/adopted-ipswich-local-plan-2011-2031 [Accessed February 2020].
[14] IBC (2020) *Ipswich Borough Council Local Plan Core Strategy and Policies Development Plan Document Review – Final Draft*. Available at: https://www.ipswich.gov.uk/sites/default/files/ipswich_lp_reg_19_cs_clean.pdf [Accessed February 2020].

development on air quality. It requires that the impact of a development on air quality is mitigated to prevent a negative impact on existing air quality in the Borough. According to this Policy, developments should not:

a) *"create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits;*
b) *reduce air quality benefits that result from the Borough Council's activities to improve air quality; and*
c) *create unacceptable risk of exposure to high levels of poor air quality, for example, through having a negative impact on an existing AQMA."*

2.3.10. Planning permission will not be granted to a development shown to cause harm to air quality *"unless measures are adopted to mitigate the impact".*

2.3.11. Also of relevance to this assessment is Policy CS5 'Improving Accessibility' which identifies that the preparation of the Ipswich Transport Strategy is a priority to the Council. Measures needed to mitigate traffic and air quality impacts of planned growth across the ISPA will be included in the Transport Strategy. Policy CS15 'Education Provision' also accepts that measures identified to mitigate the impact of traffic on congestion and air quality could assist in ensuring sustainable travel to educational establishments.

2.3.12. In addition, Policy CS20 'Key Transport Proposals', within the Ipswich Local Plan Review, sets out the following key proposals that would mitigate the impacts of traffic due to planned growth within the ISPA:

a. *"Measures to increase bus usage such as a quality bus partnership or demand responsive transport;*
b. *Promoting 'Smarter Choices' and requiring travel planning for larger new developments;*
c. *The use of new and emerging technologies and the delivery of more electric vehicle charging points;*
d. *Reviewing park and ride provision, with an ambition to re-establish the Bury Road Park and Ride service and site and exploring the feasibility of a new park and ride facility at Nacton Road;*
e. *Adopting an Ipswich town centre parking plan;*
f. *Enhancing cycling and walking infrastructure;*
g. *Infrastructure improvements where necessary; and*
h. *Exploring longer term legislative measures to help improve air quality."*

2.4 GUIDANCE

NATIONAL PLANNING PRACTICE GUIDANCE

2.4.1. National Planning Practice Guidance[15] provides guidance principles appropriate to this assessment on how the planning process can account for the impact of new development on air quality. The guidance explains how much detail air quality assessments need to include for a proposed development, and how impacts on air quality can be mitigated. It also provides information on how air quality is considered by Local Authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

LOCAL AIR QUALITY MANAGEMENT TECHNICAL GUIDANCE, LAQM.TG(16)

2.4.2. LAQM.TG(16)[16] was published by Defra to assist local authorities in undertaking their LAQM duties. This guidance includes relevant good practice procedures for air quality modelling.

LAND-USE PLANNING AND DEVELOPMENT CONTROL: PLANNING FOR AIR QUALITY

2.4.3. Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) Land-Use Planning and Development Control: Planning for Air Quality guidance[17] provides comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, mitigation measures that may be implemented to minimise these impacts.

THE DESIGN MANUAL FOR ROADS AND BRIDGES, LA105 AIR QUALITY

2.4.4. Updated by Highways England in November 2019, the Design Manual for Roads and Bridges (DMRB) document LA105 Air Quality[18] provides a framework for assessing, mitigating and reporting the effects of motorway and all-purpose trunk road projects on air quality. Of relevance to this assessment is the direction it provides to consider designated habitat sites that are sensitive to changes in nitrogen deposition.

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[15] Ministry of Housing, Communities & Local Government (2014) *Planning Practice Guidance: Air Quality*. Available at: https://www.gov.uk/guidance/air-quality--3 [Accessed March 2020].
[16] Defra (2018) *Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III – Local Air Quality Management Technical Guidance (TG16)*. Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf [Accessed February 2020].
[17] EPUK / IAQM (2017) *Land-Use Planning & Development Control: Planning For Air Quality*. Available at: https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf [Accessed February 2020].
[18] Highways England (2019) *Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA150 Air quality (formerly HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15) Revision 0*. Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf [Accessed February 2020].

A GUIDE TO THE ASSESSMENT OF AIR QUALITY IMPACTS ON DESIGNATED NATURE CONSERVATION SITES

2.4.5. Published in June 2019, the IAQM guidance on the assessment of air quality impacts on designated nature conservation sites[19] provides practical guidance on how to undertake assessment. It seeks to encourage greater communication and co-operation between air quality and ecology specialists. The advice provided in this document is not prescriptive and professional judgement on the part of an air quality specialist and ecology specialist is required due to *"the diverse range of projects and wide range of factors that influence the approach taken."*

[19] IAQM (2019) *A guide to the assessment of air quality impacts on designated nature conservation sites Version 1.0*. Available at: https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2019.pdf [Accessed February 2020].

3 METHODOLOGY

3.1 AIR QUALITY MODELLING

OVERVIEW

3.1.1. For the prediction of impacts on ambient air quality due to road traffic emissions, the dispersion model ADMS-Roads (version 4.1.1.0)[20] was used. This model uses detailed information regarding traffic flows on the local road network, land use characteristics and local meteorological conditions to predict pollutant concentrations at specific receptor locations, as specified by the user. Detailed information concerning model set-up and verification are given in **Appendix A** to supplement the commentary provided below. Associated limitations and assumptions are considered in **Section 4**.

3.1.2. The study area that was defined in the Air Quality Screening Study is shown in **Figure 1**.

MODELLED SCENARIOS

3.1.3. Modelled scenarios include:

- 2017 base year
- 2026 without the Ipswich Local Plan Review
- 2026 with the Ipswich Local Plan Review without transport mitigation
- 2036 without the Ipswich Local Plan Review
- 2036 with the Ipswich Local Plan Review without transport mitigation
- 2026 with the Ipswich Local Plan Review and transport mitigation[21]
- 2036 with the Ipswich Local Plan Review and transport mitigation[21].

TRAFFIC AND EMISSIONS DATA

3.1.4. Traffic data used for the assessment were provided by the WSP Transport team and were derived from the Suffolk County Transport Model, which includes all ISPA local authorities. The data used are included in **Appendix B**.

3.1.5. The traffic data, in the 'without Ipswich Local Plan Review' scenario, account for the implementation of BDC, MSDC and SCDC (now part of East Suffolk) local plans but not the implementation of the Ipswich Local Plan Review. The data in the 'with Ipswich Local Plan Review' scenario account for the implementation of the Ipswich Local Plan Review as well as the BDC, MSDC and SCDC local plans[14]. Realistically, the 'without Ipswich Local Plan Review' scenario would not come forward. It should be understood this scenario still leads to traffic growth in Ipswich due to the growth in traffic from surrounding districts. This scenario was generated to isolate the impacts related to the with

[20] Cambridge Environmental Research Consultants Ltd. Further details can be found at: https://www.cerc.co.uk/environmental-software/ADMS-Roads-model.html

[21] Suffolk County Council (2019) *Suffolk County Council Transport Mitigation Strategy for the Ipswich Strategic Planning Area*. Available at: https://www.ipswich.gov.uk/sites/default/files/2019-08.ispa_mitigation_strategy.pdf [Accessed March 2020].

Ipswich Local Plan Review. None of the scenarios modelled include assumptions relating to Sizewell C. The proposed development of Sizewell C would be subject to its own separate assessment under the national infrastructure planning process, if or when an application for development consent were submitted to the Planning Inspectorate.

3.1.6. **Figure 2** provides an overview of the roads that were included explicitly as emissions sources in ADMS-Roads. For how these roads were identified, reference should be made to the Air Quality Screening Study report[1].

3.1.7. Vehicle emissions data for all modelled scenarios were derived from Defra's Emissions Factors Toolkit (EFT, version 9.0)[22]. For the predictions of future year emissions, the toolkit accounts for anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time. As the EFT only predicts up to the year 2030, 2030 emission factors were used for the 2036 scenario. This is a conservative approach as it assumes that there is no improvement in vehicle technology and reduction in vehicle emissions beyond 2030.

STREET CANYONS

3.1.8. LAQM.TG(16) generally defines a street canyon as *"narrow streets where the height of buildings on both sides of the road is greater than the road width"*. These locations are important as under certain meteorological conditions pollutants can become trapped and concentrated within the street thereby increasing the risk of exposure to high pollutant concentrations.

3.1.9. A total of 41 road links were identified as street canyons. These were included within ADMS-Roads as 'basic canyons' whereby buildings are assumed to have equal height on either side of the road. Street canyons were identified in the following locations, shown on **Figure 3**:

- A1156 Norwich Road between the B1067 Bramford Road and Barrack Lane
- St Matthew's Street between Barrack Lane and 48 St Matthew's Street
- High Street
- Museum Street
- A1156 Crown Street between Neale Street and Fonnereau Road
- A1156 St Margaret's Street between Soane Street and Margaret's Street
- Old Foundry Road between Northgate Street and Great Colman Street
- Northgate Street between A1156 St Margaret's Street and Great Colman Street
- Great Colman Street between Northgate Street and Great Colman Street
- Upper Brook Street
- Dogs Head Street between Tacket Street and Turret Lane
- Falcon Street
- Silent Street
- St Nicholas Street between Falcon Street and the Cromwell Square car park
- St Peter's Street between A1022 Star Lane and Rose Lane

[22] Defra (2019) *Emissions Factors Toolkit*. Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html [Accessed February 2020].

- Turret Lane
- Eagle Street
- Fore Street between Lower Orwell Street and A1156 Star Lane
- St Helen's Street between Orchard Street and 45 St Helen's Street
- Key Street for the length of the Waterfront House, Wherry Quay
- Fore Street
- Foundry Lane
- College Street.

METEOROLOGICAL DATA

3.1.10. Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model were obtained from the Met Office observing station at Wattisham for 2017. This station is considered to provide representative data. Details of key parameters are included in **Appendix A**.

RECEPTORS

3.1.11. The ADMS-Roads models were set up for each scenario to predict road traffic contributions to annual mean NO_x, PM_{10} and $PM_{2.5}$ concentrations at a selection of sensitive receptors locations. Two types of receptor were included: 1) human receptors, 2) ecological receptors.

3.1.12. It is well established from monitoring that the influence of road emissions on ambient pollutant concentrations diminishes very rapidly with increasing distance away from the roadside[23]. At distances approaching 200 metres (m) the concentrations are indistinguishable from background levels and the impact of any change in traffic emissions will always be negligible/imperceptible. Receptors that are more than 200m from the ARN were therefore discounted from the assessment.

Human Receptors

3.1.13. Human receptors were chosen to represent locations with likely relevant public exposure to annual mean, 24-hour mean and/or 1-hour mean pollutant concentrations for which standards are included in the Air Quality Regulations (**Table 2-1**). **Table 3-1** includes information from *Box 1.1* of the LAQM.TG(16) guidance with examples of where the relevant national air quality objectives (i.e. AQS) should apply.

Table 3-1 - Examples of Where National Air Quality Objectives Should Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building	Building façades of offices or other places of work where members of the public do not have regular access.

[23] Air Quality Consultants Ltd. (2008) *NO_2 Concentrations and Distance from Roads*. Available at: https://www.aqconsultants.co.uk/CMSPages/GetFile.aspx?guid=d00fc017-d43d-4313-ae8f-dba0a96d0cb8 [Accessed February 2020].

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
	façades of residential properties, schools, hospitals, care homes, etc.	Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and: 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.1.14. The modelled human receptors are highlighted in **Figure 4**, with details included in **Appendix C**. These receptors are adjacent to sections of road that are expected to experience substantial changes in traffic with the Ipswich Local Plan Review proposals, in-particular near to road junctions with frequent traffic congestion.

Ecological Receptors

3.1.15. Ecological receptors were selected to determine the air quality impacts of the Ipswich Local Plan Review proposals at designated habitat sites within the IBC area. DMRB LA105 guidance requires the following designated habitat sites to be considered in an air quality assessment: Ramsar site, Special Protection Area (SPA), Special Area of Conservation (SAC), Site of Scientific Special Interest (SSSI), Local Nature Reserve (LNR), Local Wildlife Site (LWS), Nature Improvement Area (NIA), Ancient Woodland (AW) as well as veteran trees. County Wildlife Sites (CWS) have also been included within this assessment. The guidance advises that the assessment should be limited to those sites for which the designated features are sensitive to air pollution, either directly or indirectly, and which could be adversely affected by the effect of local air pollution on vegetation. DMRB LA105 specifies that designated habitat sites only need to be considered if they are within 200m of the ARN. It is inferred that air quality impacts on habitats are unlikely to be significant beyond this distance. Designated habitat sites within the IBC area that are not within 200m of the ARN were

therefore excluded from the assessment on basis that any impacts will be imperceptible and not significant.

3.1.16. There are 22 designated habitat sites within the study area with features that are potentially sensitive to air quality impacts. There is a degree of spatial overlap between some of the designation types where sites may have more than one designation (with either the same or slightly different boundaries). For example, The Dales Open Space is a designated LNR and Dales Road Woodland a CWS - although they are effectively one site hosting two designations. The designated habitat sites that were considered in the assessment are shown in **Figure 5** and include:

- Sites with statutory protection:
  - Orwell Estuary SSSI
  - Stour and Orwell Estuaries SPA and Ramsar
  - Alderman Canal East LNR
  - Alderman Canal West LNR
  - Piper's Vale LNR
  - Bridge Wood LNR
  - The Dales Open Space LNR
- Sites without statutory protection
  - Brazier's Wood AW
  - Dales Road Woodland CWS
  - Rushmere Heath CWS
  - Holywells Park and Canal CWS
  - Bridge Wood CWS
  - Brazier's Wood, Pond Alder Carr and Meadows CWS
  - Pipers Vale CWS
  - Volvo Raeburn Road site CWS
  - Landseer Park Carr CWS
  - Christchurch Park CWS
  - Alderman Canal CWS
  - Broomhill Park, south of Valley LWS
  - Stoke Hill, Ancaster Road LWS
  - St Clements Hospital Grounds, north of Felixstowe Road LWS
  - Slope above former Cliff Quay Power Station, Sandy Hill Lane LWS.

3.1.17. To determine the habitats at each designated site, the following desk-study sources were used:

- Citation information for CWS and LWS designations was obtained from IBC (under licence for use on this project from Suffolk Wildlife Trust)
- Information on habitats present in SSSIs, SPAs and Ramsar sites was obtained from publicly available citation information held by Natural England and the Joint Nature Conservation Committee
- Information on LNRs, AW sites and for all designations was obtained by viewing publicly available aerial imagery for each site.

3.1.18. In each instance, habitats in each site within 200m from the centreline of the nearest ARN road link were identified. If more than one habitat was present, the most sensitive habitat type to air pollution was selected. Habitat sensitivity was assessed using information provided by the Habitat/Species Pollutant Impact Database, which is hosted by APIS[24]. A critical load threshold was also extracted from the Habitat/Species Pollutant Impact Database. Information on designated habitat sites, confirmation of which sensitive habitats are present and critical load thresholds used in the assessment are provided in **Appendix D**.

3.1.19. Potential impacts on ambient annual mean NO_x concentrations and nutrient nitrogen deposition were determined at ground level receptor points. Receptor points are aligned in transects within each site, up to 200m from the centreline of the nearest ARN road link. These transects are shown in **Figure 5**, with details of transect receptors included in **Appendix C**.

3.1.20. There are some instances where several ARN road links surround a designated habitat site, necessitating more than one transect. Where this occurred, the transects were labelled according to the applicable side of the designated habitat site e.g. Landseer Park Carr (west), Landseer Park Carr (east). Identification of sensitive habitats took into consideration instances where there several transects across a designation.

TREATMENT OF MODEL OUTPUTS

3.1.21. To predict the total pollutant concentrations at the selected receptors it was necessary to combine the modelled road traffic contributions with the contributions from other emissions sources that were not explicitly modelled. This was done using background pollution data.

3.1.22. Background data published by Defra[25] were used. These data provide annual mean concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ for every 1 x 1-kilometre grid square across the country for each year from 2017 to 2030 inclusive. There are no data for years beyond 2030. The forecast data assume some reductions in concentrations over time, in line with forecast reductions in emissions from vehicles and other sources. For this assessment background concentrations for 2017, 2026 and 2030 (for scenarios in 2036) were used. The range of concentrations for each pollutant across the study area in each modelled year are given in **Table 3-2**.

Table 3-2 – Background Annual Mean Concentrations of Pollutants

Modelled Year	NO_x (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
2017	16.8 to 25.9	12.2 to 19.8	15.1 to 16.4	10.1 to 11.4
2026	11.8 to 18.4	8.8 to 14.6	13.8 to 15.2	8.9 to 10.2

[24] APIS (Undated). *Habitat/species pollutant impacts database*. Available at: http://www.apis.ac.uk/search-pollutant-impacts [Accessed March 2020].
[25] Defra (2017) *UK AIR Background Mapping data for local authorities*. Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017 [Accessed February 2020].

Modelled Year	NO_x (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
2030 (for 2036 scenarios)	10.9 to 17.1	8.2 to 13.5	13.8 to 15.1	9.0 to 10.2

3.1.23. Before finalising the results for each scenario, model verification was undertaken by comparing the results for the baseline year with data from IBC monitoring sites that were included in the 2017 base year model scenario. The verification was undertaken in accordance with the process set out in LAQM.TG(16). Verification of the model provides an indication of performance against data from actual 'real-world' measurements and enables model refinement and adjustment to compensate for any systematic bias, i.e. tendency to either under- or over- predict concentrations. In this assessment the model was found to underestimate road contributed annual mean concentrations and all modelled concentrations were adjusted accordingly. Details of model verification and adjustment are given in **Appendix A**.

Concentrations at Human Receptors

3.1.24. To determine the total annual mean NO_2 concentration at each receptor, it was necessary to convert the adjusted modelled road contribution of NO_x to NO_2 and add it to the 2017 background NO_2 concentration. As the relationship between NO_x and NO_2 in the atmosphere is complex, this was undertaken using Defra's NO_x to NO_2 calculator (version 6.1)[26]. The resulting total annual mean NO_2 concentration is comparable with the standard of 40µg/m^3 (**Table 2-1**).

3.1.25. To consider compliance with the 1-hour mean objective for NO_2, LAQM.TG(16) advises that non-compliance is unlikely to occur if the annual mean concentration is below 60µg/m^3. Therefore, annual mean NO_2 concentrations of 60µg/m^3 or more are indicative of non-compliance.

3.1.26. To determine the total annual mean concentrations for PM_{10} and $PM_{2.5}$ at each receptor, the adjusted modelled road contributions were simply added to the 2017 background concentrations. The resulting total annual mean PM_{10} and $PM_{2.5}$ concentrations are comparable with the standards of 40µg/m^3 and 25µg/m^3 respectively (**Table 2-1**).

3.1.27. To consider compliance with the 24-hour mean air quality objective for PM_{10}, LAQM.TG(16) gives the following equation that relates the annual mean concentration to the number of exceedances of the 50µg/m^3 threshold, where up to 35 exceedances are allowed (**Table 2-1**):

Number of 24-hour mean PM_{10} exceedances of 50µg/m^3 = -18.5 + 0.00145 x annual mean^3 + (206 ÷ annual mean)

Note: where the annual mean PM_{10} concentration is less than 16.6µg/m^3 then the number of exceedances of the 24-hour mean objective can be assumed to be zero.

[26] Defra (2019) *Background Maps: NO_x to NO_2 Calculator*. Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html [Accessed February 2020].

Concentrations and Deposition Rates at Ecological Receptors

3.1.28. The adjusted road source annual mean NO_x contributions were combined with background NO_x data to generate total concentrations at the transect receptors.

3.1.29. Nitrogen deposition rates were derived for each designated habitat site in accordance with DMRB LA105 guidance. The predicted nitrogen deposition rates were then compared to the lower critical load specified for the most sensitive feature at the site in question.

3.2 ASSESSMENT OF IMPACTS

HUMAN RECEPTORS

3.2.1. EPUK/IAQM guidance was followed to describe air quality impacts and determine the significance of effect in relation to human receptors. This guidance provides a means of describing the impact on (i.e. change in) the annual mean concentration of NO_2, PM_{10} or $PM_{2.5}$ at an individual receptor. The matrix of impact descriptors, adapted from the EPUK/IAQM guidance, that was used for annual mean concentrations is given in **Table 3-3**.

Table 3-3 – Impact Descriptors for Individual Human Receptors

Annual mean concentration at receptor	Percentage change in concentration relative to AQS			
	1	2 - 5	6 - 10	>10
75% or less of AQS	Negligible	Negligible	Slight	Moderate
76-94% of AQS	Negligible	Slight	Moderate	Moderate
95-102% of AQS	Slight	Moderate	Moderate	Substantial
103-109% of AQS	Moderate	Moderate	Substantial	Substantial
110% or more of AQS	Moderate	Substantial	Substantial	Substantial

Notes

Where the change is less than 0.5%, the change is described as 'negligible' regardless of the concentration.

When defining the concentration as a percentage of the AQS, the 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme' concentration where there is an increase.

Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

3.2.2. The EPUK/IAQM guidance notes that the criteria in **Table 3-3** should be used to describe impacts at individual human receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for.

3.2.3. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, with account of several factors, including:

- The existing and future air quality in the absence of the development
- The extent of current and future population exposure to the impacts

- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

3.2.4. The EPUK/IAQM guidance states that for most road transport related emissions, annual average concentrations are the most useful for evaluating the impacts. The guidance does not include criteria for determining the significance of the effect on 1-hour mean NO_2 concentrations or 24-hour mean PM_{10} concentrations.

ECOLOGICAL RECEPTORS

3.2.5. DMRB LA 105 guidance was used to assess the impacts on nitrogen deposition at designated habitat sites. Unlike previous DMRB guidance (HA 207/07)[27], there is no requirement to review the impacts on annual mean NO_x to determine if assessment of nitrogen deposition impacts is necessary, although these impacts have been considered in this report.

3.2.6. Following DMRB LA 105 guidance, if the 'with Ipswich Local Plan Review' scenario does not result in exceedance of the lower critical load for nitrogen deposition of the most sensitive feature, then it is considered that the impact will not give rise to a significant effect. The same is true if the change in nitrogen deposition is less than 1% of the lower critical load. If the change in nitrogen deposition is greater than 1% of the lower critical load then the impact cannot simply be discounted as not significant and must be given further consideration by an ecologist. If the change in nitrogen deposition is greater than 0.4kg N/ha/yr then the implication of the guidance is that there is some potential for species richness to be reduced[28] which should be considered by an ecologist in determining if a significant air quality effect is triggered.

[27] DMRB Volume 11, Section 3, Part 1 HA 207/07 *Air Quality* (superseded by LA 105)
[28] DMRB LA105 references Table 21 of the Natural England Commissioned Report NECR210 *Assessing the effects of small increments of atmospheric nitrogen deposition (above the critical load) on semi-natural habitats of conservation importance*. Available at: http://publications.naturalengland.org.uk/

4 ASSESSMENT ASSUMPTIONS AND LIMITATIONS

4.1.1. The ADMS-Roads dispersion model used in this assessment relies on input data (including predicted traffic flows), which have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. A process of continual model validation against measured data ensures that these algorithms remain fit for purpose in line with scientific and technical developments[29].

4.1.2. The dispersion modelling was based on traffic data derived from the Suffolk County Transport Model forecasts for 2026 and 2036 without and with the IBC contribution to the proposed ISPA aligned Local Plans. The traffic model has been validated and calibrated using observed traffic data.

4.1.3. In the baseline year, systematic uncertainties in the model inputs and process are accounted for by verifying the modelled roadside concentrations. This process produces an adjustment factor which can then be applied to all model outputs. This assumes that the underlying reasons for the over or under-prediction of concentrations in the baseline year persist into the future. Different verification factors were applied to account for local conditions. Model verification was carried out following guidance set out in Defra's Technical Guidance LAQM.TG(16). As the model was verified against local NO_2 monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations. Full details of the verification are included in **Appendix A**.

4.1.4. Projections for the UK fleet mix and vehicle emissions are not available beyond 2030. Therefore, emissions in the 2036 scenario was modelled using projections for 2030. This is a conservative assumption, since the emission rates per vehicle are anticipated to decline beyond 2030 as the number of 'zero emissions' (fully electric) vehicles increases.

4.1.5. The ADMS-Roads models assume that height differences between modelled roads and receptors are minimal. This is a model limitation. For human receptors, heights of 1.5 and 4.5 m were assumed corresponding to breathing zones at ground and first floor levels respectively. For ecological receptors, a height of 0m was assumed. This may result in concentrations being over-estimated in some locations where the real-world position of the receptor is at lower or higher level relative to road level. A notable location where concentrations may be over-estimated is where the ARN crosses over the Orwell Estuary SSSI and Stour and Orwell Estuaries Ramsar and SPA where the real-world position of the site is at a lower level relative to the A14 Orwell Bridge.

4.1.6. The street canyon algorithm used in this assessment simply assumes buildings of the same height either site of each road link, without any physical gaps created by side roads (for example). This simplistic representation tends to over-estimate concentrations at receptors located within the street canyon.

4.1.7. Habitats present in designated habitat sites were identified using desk-study sources alone and are not based on field survey. Use of field survey data would provide detailed information on the

[29] Details of model validation can be found at: https://www.cerc.co.uk/environmental-software/model-validation.html

vegetation communities present (e.g. it is not possible to determine whether acid grassland or neutral grassland is present from interpretation of aerial imagery alone). This is not considered to be a major weakness in the approach taken as critical thresholds are only available on APIS for a subset of the range of habitats present in the field – in all instances the closest matching habitat was chosen. Furthermore, where there was uncertainty over which habitat was present (e.g. type of grassland), a lower (more onerous) critical threshold was selected to ensure that a precautionary approach was adopted.

4.1.8. This study does not consider impacts on veteran trees where they occur outside of designated habitat sites. DMRB LA 105 indicates that veteran trees should be assessed for possible air quality impacts. However, there is no comprehensive source of data for this ecological feature category and publicly available data sources (e.g. the Woodland Trust's Ancient Tree Inventory database) contain both accurate and unverified data entries. Furthermore, APIS does not propose critical levels or loads for this ecological feature type. It was not considered practicable at to undertake an evidence-based assessment of veteran trees which would be sufficiently robust to inform the Ipswich Local Plan Review.

5 MODELLED BASELINE AIR QUALITY

5.1 2017 BASE YEAR

HUMAN RECEPTORS

5.1.1. All 2017 base year results for human receptors are provided in **Appendix E**.

5.1.2. As illustrated in **Figure 6**, in the 2017 base year, most modelled exceedances of the annual mean NO_2 AQS of 40µg/m^3 (**Table 2-1**) occur at human receptors within the existing AQMAs (all declared by IBC for exceedances of the annual mean NO_2 AQS at monitoring sites). The modelled exceedances that occur outside of the AQMAs are limited to:

- Within 20m of AQMA No.1 on the A1214 Valley Road and A1156 Norwich Road (south of the junction with Valley Road)
- On A1156 St Matthew's Street and Civic Drive within 40m of the roundabout junction
- On the south side of the A1156 Crown Street between Westgate Street and High Street
- On the corner of Orwell Place and Upper Orwell Street
- On Falcon Street within a street canyon
- On the south side of the A1156 Fore Street within 20m of AQMA No.3
- On the north side of the A1156 Fore Hamlet within 50m of Back Hamlet
- On the south side of the A1214 Woodbridge Road East at the junction with the A1189 Heath Road.

5.1.3. The highest concentration is 83.4µg/m^3 at receptor R414 'The Halberd Inn' on Crown Street, which is within AQMA No.2. This result is at odds with IBC diffusion tube monitoring sites 20, 21 and 22, all located within 50m of R414, where annual mean NO_2 concentrations for 2017 were reported[30] to be between 34 and 37 µg/m^3. It is likely that this discrepancy is because R414 was modelled as within a street canyon (**Appendix C**) whilst diffusion tube sites 20, 21 and 22 are not within a street canyon.

5.1.4. The 2017 base year model results for PM_{10} and $PM_{2.5}$ are well below the AQS (**Table 2-1**) at all receptors.

ECOLOGICAL RECEPTORS

5.1.5. All 2017 base year results for ecological receptors within the designated habitat sites are provided in **Appendix F**. The key details are summarised in **Table 5-1**.

5.1.6. Annual mean NO_x concentrations exceed the critical level of 30µg/m^3 (**Table 2-1**) at 17 out of 22 designated habitat sites (shown in **Figures 5-1** to **5-5**).

[30] Ipswich Borough Council. 2019 Air Quality Annual Status Report (ASR) In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management (June, 2019). Available from: https://www.ipswich.gov.uk/airqualitymanagement

5.1.7. Nitrogen deposition exceeds the lower critical load at 20 of the 22 designated habitat sites. In relation to the Orwell Estuary SSSI and Stour and Orwell Estuaries SPA and Ramsar the exceedance is limited to the transect point at the side of the rod (0m, north of the A14). The two designated habitat sites where exceedances were not registered are Landseer Park Carr LWS and the Volvo Raeburn Road LWS; this is mainly because a higher critical load threshold is applicable as these are primarily neutral grassland sites.

Table 5-1 – Baseline Annual Mean NO_x Concentrations and Nitrogen Deposition Rates in 2017 at Designated Habitat Sites

Site	Transect receptors	2017 baseline annual mean NO_x		2017 baseline nitrogen deposition rate		
		Concentration at closest point within site to road ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	Lower critical load for most sensitive feature (kg N/ha/yr)	Deposition rate at closest point within site to road (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)
Sites of Scientific Special Interest, Special Protection Areas and Ramsar Sites						
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, north of A14	E88 – E108	**178.5**	200	20	**20.5**	0
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, south of A14	E109 – E129	**134.8**	200	20	18.6	-
Ancient Woodlands						
Brazier's Wood	E130 – E137	**37.6**	195	10	**21.1**	195
County Wildlife Sites						
Dales Road Woodland, east	E147 – E160	**38.8**	139	10	**24.1**	139
Rushmere Heath	E175 – E194	**61.2**	71	10	**19.8**	200+

Site	Transect receptors	2017 baseline annual mean NO_x		2017 baseline nitrogen deposition rate		
		Concentration at closest point within site to road ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Lower critical load for most sensitive feature (kg N/ha/yr)	Deposition rate at closest point within site to road (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)
Holywells Park and Canal, north	E196 - E216	**34.0**	7	10	**20.6**	200+
Holywells Park and Canal, south	E217 – E237	**33.5**	8	10	**20.6**	200+
Bridge Wood, south of A14, west	E238 – E243	**86.0**	61	10	**26.7**	61
Bridge Wood, south of A14, east	E244 – E262	**59.3**	72	10	**23.8**	200+
Brazier's Wood, Pond Alder Carr and Meadows, north of A14	E265 - E284	**128.3**	200	10	**31.0**	200+
Brazier's Wood, Pond Alder Carr and Meadows, east of Brazier's Wood Road	E286 – E303	23.0	-	10	**17.4**	198
Piper's Vale	E307 – E325	27.7	-	10	**19.7**	200+
Volvo Raeburn Road site	E328 – E345	25.7	-	20	19.6	-

Site	Transect receptors	2017 baseline annual mean NO_x		2017 baseline nitrogen deposition rate		
		Concentration at closest point within site to road ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	Lower critical load for most sensitive feature (kg N/ha/yr)	Deposition rate at closest point within site to road (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)
Landseer Park Carr, west	E349 – E369	**47.0**	17	20	19.0	-
Landseer Park Carr, east	E370 – E387	23.4	-	20	17.5	-
Christchurch Park, west of Westerfield Road	E391 – E411	**31.1**	7	10	**20.9**	200+
Christchurch Park, east of Henley Road	E412 – E432	**57.1**	106	10	**22.5**	200+
Christchurch Park, north east of Fonnereau Road	E433 – E453	**54.2**	88	10	**23.0**	200+
Christchurch Park, north of Soane Street	E454 – E474	**57.9**	196	10	**19.5**	200+
Christchurch Park, west of Parkside Avenue	E475 – E494	**33.1**	24	10	**21.0**	200+
Alderman Canal, north of Sir Alf Ramsey Way	E66 – E80	**41.2**	144	10	**21.5**	144

Site	Transect receptors	2017 baseline annual mean NO_x		2017 baseline nitrogen deposition rate		
		Concentration at closest point within site to road ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Lower critical load for most sensitive feature (kg N/ha/yr)	Deposition rate at closest point within site to road (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)
Local Nature Reserves						
Alderman Canal East, south of the A1071	E40 – E48	**32.7**	121	10	**20.4**	121
Alderman Canal East, west of Alderman Road	E49 – E53	**35.1**	66	10	**20.7**	66
Alderman Canal West, south of Cullingham Road	E54 – E65	**33.9**	184	10	**20.6**	184
Piper's Vale	E81 – E87	27.0	-	10	**19.7**	200
Bridge Wood	E138 – E146	**73.0**	69	10	**25.4**	89
The Dales Open Space, west	E161 – E174	**32.3**	172	10	**23.3**	172
Local Wildlife Sites						
Broomhill Park, south of Valley Road	E1 – E9	**55.4**	94	10	**26.2**	94

Site	Transect receptors	2017 baseline annual mean NO_x		2017 baseline nitrogen deposition rate		
		Concentration at closest point within site to road ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Lower critical load for most sensitive feature (kg N/ha/yr)	Deposition rate at closest point within site to road (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)
Stoke Hill, Ancaster Road	E10 – E14	24.6	-	10	**19.4**	77
St Clements Hospital Grounds	E15 – E34	**72.1**	89	10	**20.4**	199
Slope above former Cliff Quay Power Station, near Sandy Hill Lane	E35 – E39	20.6	-	10	**18.8**	186

6 ASSESSMENT OF IMPACTS WITHOUT TRANSPORT MITIGATION

6.1 HUMAN RECEPTORS

Full assessment results for human receptors are provided in **Appendix E**.

IMPACTS ON ANNUAL MEAN NO_2 CONCENTRATIONS

6.1.1. Modelled NO_2 concentrations without the Ipswich Local Plan Review proposals in 2026 are predicted to be approximately 33% lower than in the 2017 base year at most human receptors. This is primarily due to government targeted measures to tackle roadside exceedances of the EU limit value for this pollutant. By 2036, most human receptors are predicted to experience concentrations that are approximately 40% lower than in 2017. With the Ipswich Local Plan Review proposals, most human receptors in 2026 would experience concentrations that are 30% lower than in 2017 without any transport mitigation. The situation in 2036 with the Ipswich Local Plan Review proposals is very similar to that without where most human receptors experience concentrations that are approximately 40% lower than in 2017.

6.1.2. Without transport mitigation, most human receptors would experience negligible impacts on annual mean NO_2 concentrations with Ipswich Local Plan Review in 2026 and 2036. **Table 6-1** and **Table 6-2** identify the notable impacts that are not negligible, most of which are within existing AQMA's. The concentrations at all modelled human receptors with Ipswich Local Plan Review without transport mitigation in 2026 and 2036 are illustrated in **Figure 7** and **Figure 8** respectively.

6.1.3. Of all the modelled human receptors, only R414 'The Halberd Inn' on the A1156 Crown Street (within AQMA No.2 and modelled street canyon) is predicted to experience exceedances of the 40µg/m^3 AQS (**Table 2-1**) in all scenarios for 2026 and 2036. Concentrations at all other human receptors are predicted to be below the AQS.

Table 6-1 – Notable Impacts on Annual Mean NO_2 Concentrations in 2026 (Without Transport Mitigation)

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review (µg/m^3)	NO_2 with Ipswich Local Plan Review (µg/m^3)	Change (µg/m^3)	Change relative to AQS of 40µg/m^3 (%)	Impact
Within AQMA No.5 (street canyon)							
R321	Barrack Lane	1.5	30.8	31.6	0.8	2	Slight Adverse
R324	St. Matthew's Street	1.5	29.9	30.7	0.8	2	Slight Adverse
Within AQMA No.2							

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review (µg/m^3)	NO_2 with Ipswich Local Plan Review (µg/m^3)	Change (µg/m^3)	Change relative to AQS of 40µg/m^3 (%)	Impact
R411	Electric House Lloyds Avenue	1.5	28.9	30.3	1.4	4	Slight Adverse
R414	The Halberd Inn, Crown Street	1.5	**45.5**	**50.4**	4.9	12	Substantial Adverse
R414	The Halberd Inn, Crown Street (1st floor)	4.5	**44.6**	**49.3**	4.7	12	Substantial Adverse
R421	St. Margaret's Plain	1.5	29.6	32.7	3.1	8	Moderate Adverse
R422	Foundry House Old Foundry Road	1.5	25.8	28.3	2.5	6	Slight Adverse
R427	St. Margaret's Street	1.5	29.2	31.9	2.7	7	Moderate Adverse
R454	Atlas Houses Woodbridge Road	1.5	30.2	32.3	2.1	5	Slight Adverse
R510	St. Helens Street	1.5	29.4	31.7	2.3	6	Moderate Adverse
R511	St. Helens Street	1.5	29.0	31.4	2.4	6	Moderate Adverse
Within AQMA No.3							
R608	The Wolsey Apartments College Street	1.5	28.8	31.7	2.9	7	Moderate Adverse
R609	Foundry Lane	1.5	27.8	30.7	2.9	7	Moderate Adverse
R610	Foundry College Street	1.5	26.8	29.3	2.5	6	Slight Adverse
Not within an AQMA							
R522	Bond Street	1.5	26.0	28.3	2.3	6	Slight Adverse

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review ($\mu g/m^3$)	NO_2 with Ipswich Local Plan Review ($\mu g/m^3$)	Change ($\mu g/m^3$)	Change relative to AQS of 40$\mu g/m^3$ (%)	Impact
R523	Bond Street	1.5	25.9	28.1	2.2	6	Slight Adverse
R528	Bond Street	1.5	25.7	27.9	2.2	6	Slight Adverse

Table 6-2 - Notable Impacts on Annual Mean NO_2 Concentrations in 2036 (Without Transport Mitigation)

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review ($\mu g/m^3$)	NO_2 with Ipswich Local Plan Review ($\mu g/m^3$)	Change ($\mu g/m^3$)	Change relative to AQS of 40$\mu g/m^3$ (%)	Impact
Within AQMA No.2							
R414	The Halberd Inn, Crown Street	1.5	**41.5**	**45.6**	4.1	10	Substantial Adverse
R414	The Halberd Inn, Crown Street (1st floor)	4.5	**40.6**	**44.7**	4.1	10	Substantial Adverse
R421	St. Margaret's Plain	1.5	27.9	30.2	2.3	6	Moderate Adverse
R427	St. Margaret's Street	1.5	27.0	29.8	2.8	7	Slight Adverse
R454	Atlas Houses Woodbridge Road	1.5	28.2	30.3	2.1	5	Slight Adverse
R479	St. Helens Street	1.5	23.0	25.4	2.4	6	Slight Adverse
R480	St. Helens Street	1.5	25.5	31.3	5.8	15	Moderate Adverse
R480	St. Helens Street (1st floor)	4.5	24.1	29.9	5.8	15	Moderate Adverse

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review (µg/m^3)	NO_2 with Ipswich Local Plan Review (µg/m^3)	Change (µg/m^3)	Change relative to AQS of 40µg/m^3 (%)	Impact
R481	St. Helens Street	1.5	25.1	30.9	5.8	15	Moderate Adverse
R481	St. Helens Street (1st floor)	4.5	24.1	30.0	5.9	15	Moderate Adverse
R482	St. Helens Street	1.5	20.6	23.2	2.6	7	Slight Adverse
R483	St. Helens Street	1.5	24.4	30.5	6.1	15	Moderate Adverse
R483	St. Helens Street (1st floor)	4.5	24.0	29.9	5.9	15	Moderate Adverse
R484	St. Helens Street	1.5	22.0	25.9	3.9	10	Slight Adverse
R485	St. Helens Street	1.5	20.0	22.3	2.3	6	Slight Adverse
Within AQMA No.3							
R608	The Wolsey Apartments College Street	1.5	25.0	27.8	2.8	7	Slight Adverse
R609	Foundry Lane	1.5	24.3	27.0	2.7	7	Slight Adverse
R618	Foundry College Street	1.5	17.7	20.0	2.3	6	Slight Adverse
R619	Foundry Lane	1.5	17.5	20.0	2.5	6	Slight Adverse
R619	Foundry Lane (1st floor)	4.5	17.1	19.3	2.5	6	Slight Adverse
Not within an AQMA							
R72	Cauldwell Hall Road	1.5	19.6	22.2	2.6	7%	Slight Adverse

IMPACTS ON 1-HOUR MEAN NO_2 CONCENTRATIONS

6.1.4. As annual mean NO_2 concentrations in all future year scenarios are predicted to be below 60µg/m^3, according to LAQM.TG(16) guidance it is unlikely that there would be any exceedances of the 1-hour mean NO_2 AQS (**Table 2-1**) as a consequence of the Ipswich Local Plan Review proposals without transport mitigation.

IMPACTS ON ANNUAL MEAN PM_{10} CONCENTRATIONS

6.1.5. Annual mean PM_{10} concentrations in all future year scenarios are predicted to be below the 40µg/m^3 AQS (**Table 2-1**). All impacts with the Ipswich Local Plan Review proposals without transport mitigation would be negligible.

IMPACTS ON 24-HOUR MEAN PM_{10} CONCENTRATIONS

6.1.6. Compliance with the AQS for 24-hour mean PM_{10} concentrations (**Table 2-1**) is predicted in all future year scenarios. All impacts with the Ipswich Local Plan Review proposals without transport mitigation would be negligible.

IMPACTS ON ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS

6.1.7. Annual mean $PM_{2.5}$ concentrations in all future year scenarios are predicted to be below the 25µg/m^3 AQS (**Table 2-1**). All impacts with the Ipswich Local Plan Review proposals without transport mitigation would be negligible.

6.2 ECOLOGICAL RECEPTORS

6.2.1. Full assessment results for ecological receptors are provided in **Appendix F** (see Table F1 - Impacts on Annual Mean NO_x without Transport Mitigation, and Table F2 - Impacts on Nitrogen Deposition without Transport Mitigation). Transect receptors are shown in **Figure 5**.

6.2.2. Notable impacts on annual mean NO_x concentrations at the designated habitat sites where the critical level for annual mean NO_x of 30µg/m^3 (**Table 2-1**) is exceeded and the change is greater than 1% of the critical level are summarised in **Table 6-3** and **Table 6-4** for 2026 and 2036 respectively.

6.2.3. The Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI transects are predicted to experience exceedances of the critical level in 2026 and 2036 with changes that cannot be considered as imperceptible.

6.2.4. Of the other designated habitat sites, seven would experience exceedances of the critical level in 2026 with changes in annual mean NO_x that cannot be considered as imperceptible. These sites are:

- Rushmere Heath CWS (E175 – E194)
- Bridge Wood CWS (E238 – E243 and E244 – E262)
- Brazier's Wood, Pond Alder Carr and Meadows CWS (E265 – E284)
- Christchurch Park CWS (E412 – E432, E433 – E453 and E454 – E474)
- Bridge Wood LNR (E138 – E146)
- Broomhill Park LWS (E1 – E9)
- St Clements Hospital Grounds LWS (E15 – E34).

6.2.5. In 2036, six of the other designated habitat sites would experience exceedances of the critical level with changes in annual mean NO_x of greater than or equal to 1% of the critical level:

- Rushmere Heath CWS (E175 – E194)
- Bridge Wood CWS (E238 – E243)
- Brazier's Wood, Pond Alder Carr and Meadows (E265 – E284)
- Christchurch Park CWS (E412 – E432, E433 – E453 and E454 – E474)
- Bridge Wood LNR (E138 – E146)
- St Clements Hospital Grounds (E15 – E34).

6.2.6. The NO_x impacts at the remaining LNR and non-statutory designated habitat sites can be discounted as unlikely to give rise to a significant effect as the critical level would not be exceeded for 2026 and 2036.

6.2.7. The transects with notable impacts on nitrogen deposition - where the lower critical load for the most sensitive feature is exceeded and the change is greater than 1% of the lower critical load - are summarised in **Table 6-5** and **Table 6-6**. Impacts on the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI for 2026 and 2036 were determined to be not significant according to DMRB LA 105 criteria - primarily as the lower critical load is not exceeded but also as the changes relative to the lower critical load are less than 1%, and in absolute terms less than 0.4kg N/ha/yr.

Table 6-3 – Notable Impacts on Annual Mean NO_x in 2026 at Designated Habitat Sites (Without Transport Mitigation)

Site	Transect receptors	Annual mean NO_x in 2026 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of 30$\mu g/m^3$ (%)
Sites of Scientific Special Interest, Special Protection Areas and Ramsar Sites							
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, north of A14	E88 – E108	91.8	70	92.9	70	1.1	4
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, south of A14	E109 – E129	70.7	40	71.7	50	1.0	3
County Wildlife Sites							
Rushmere Heath	E175 – E194	36.3	11	36.7	11	0.4	1
Bridge Wood, south of A14, west	E238 – E243	45.4	21	46.0	21	0.6	2

Site	Transect receptors	Annual mean NO_x in 2026 at closest point within site to road					
		Without Ipswich Local Plan Review (µg/m^3)	Distance from road beyond which concentration is below the critical level of 30µg/m^3 (m)	With Ipswich Local Plan Review (µg/m^3)	Distance from road beyond which concentration is below the critical level of 30µg/m^3 (m)	Difference in concentration (µg/m^3)	Change relative to critical level of 30µg/m^3 (%)
Bridge Wood, south of A14, east	E244 – E262	32.6	22	32.9	22	0.3	1
Brazier's Wood, Pond Alder Carr and Meadows, north of A14	E265 - 284	65.9	64	66.7	64	0.8	3
Christchurch Park, east of Henley Road	E412 – E432	35.7	6	37.1	6	1.4	5
Christchurch Park, north east of Fonnereau Road	E433 – E453	32.8	8	34.0	8	1.2	4
Christchurch Park, north of Soane Street	E454 – E474	34.5	16	37.3	36	2.8	9
Local Nature Reserves							
Bridge Wood	E138 – E146	38.5	9	39.0	9	0.5	2
Local Wildlife Sites							

Site	Transect receptors	Annual mean NO_x in 2026 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
Broomhill Park, south of Valley Road	E1 – E9	30.9	11	31.7	11	0.8	3
St Clements Hospital Grounds	E15 – E34	42.8	19	44.3	19	1.5	5

Table 6-4 – Notable Impacts on Annual Mean NO_x in 2036 at Designated Habitat Sites (Without Transport Mitigation)

Site	Transect receptors	Annual mean NO_x in 2036 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
Sites of Scientific Special Interest, Special Protection Areas and Ramsar Sites							
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, north of A14	E88 – E108	73.6	40	74.1	40	0.5	2%
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, south of A14	E109 – E129	57.8	20	58.3	20	0.5	2%
County Wildlife Sites							
Rushmere Heath	E175 – E194	29.9	-	30.4	11	0.5	2%
Bridge Wood, south of A14, west	E238 – E243	37.2	11	37.6	11	0.4	1%
Brazier's Wood, **Pond Alder Carr**	E265 - 284	52.9	34	53.3	44	0.4	1%

Site	Transect receptors	Annual mean NO_x in 2036 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
and Meadows, north of A14							
Christchurch Park, east of Henley Road	E412 – E432	30.3	6	31.3	6	1.0	3%
Christchurch Park, north of Soane Street	E454 – E474	32.1	6	34.5	16	2.5	8%
Local Nature Reserves							
Bridge Wood	E138 – E146	31.7	9	31.9	9	0.3	1%
Local Wildlife Sites							
St Clements Hospital Grounds	E15 – E34	36.8	9	39.7	9	2.9	10%

Table 6-5 – Notable Impacts on Nitrogen Deposition in 2026 at Designated Habitat Sites (Without Transport Mitigation)

Site	Transect receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2026 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2026 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
County Wildlife Sites									
Holywells Park and Canal, south	E217 – E237	10	18.9	200+	19.0	200+	1	17	No
Bridge Wood, south of A14, west	E238 – E243	10	22.1	61+	22.2	61+	1	11	No
Brazier's Wood, Pond Alder Carr and Meadows, north of A14	E265 - 284	10	24.6	200+	24.7	200+	1	34	No
Christchurch Park, west of Westerfield Road	E391 – E411	10	20.2	200+	20.3	200+	1	6	No
Christchurch Park, east of Henley Road	E412 – E432	10	21.2	200+	21.3	200+	1	16	No
Christchurch Park, north east of Fonnereau Road	E433 – E453	10	20.4	200+	20.6	200+	2	128	No

Site	Transect receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2026 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2026 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
Christchurch Park, north of Soane Street	E454 – E474	10	18.2	200+	18.3	200+	2	86	No
Christchurch Park, west of Parkside Avenue	E475 – E494	10	20.3	200+	20.4	200+	1	14	No
Alderman Canal West, North of Sir Alf Ramsey Way	E66 – E80	10	19.5	144	19.6	144	1	9	No
Bridge Wood	E138 – E146	10	21.3	89+	21.4	89+	1	9	No
Local Wildlife Sites									
Broomhill Park	E1 – E9	10	23.2	94	23.3	94	1	41	No
St Clements Hospital Grounds	E15 – E34	10	18.7	200+	18.8	200+	1	19	No

Table 6-6– Notable Impacts on Nitrogen Deposition Rates in 2036 at Designated Habitat Sites (Without Transport Mitigation)

Site	Transect receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2036 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2036 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
County Wildlife Sites									
Holywells Park and Canal, south	E217 – E237	10	18.6	200+	19.1	200+	5	200+	Yes
Christchurch Park, east of Henley Road	E412 – E432	10	20.8	200+	20.9	200+	1	6	No
Christchurch Park, north east of Fonnereau Road	E433 – E453	10	19.9	200+	20.1	200+	2	138	No
Christchurch Park, north of Soane Street	E454 – E474	10	18.0	200+	18.1	200+	1	86	No
Local Wildlife Sites									
Broomhill Park	E1 – E9	10	22.5	94	22.6	94	2	11	No

Site	Transect receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2036 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2036 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
St Clements Hospital Grounds	E15 – E34	10	18.3	199	18.5	199	2	9	No

ECOLOGIST OPINION

6.2.8. Considering impacts on annual mean NO_x concentrations at designated habitat sites by comparing the baseline year (2017), it is evident that the number of designated sites experiencing an exceedance above the critical level of 30µg/m^3 reduces considerably from 17 sites (2017), to nine sites by 2026 and then to eight sites by 2036. This trend is in the absence of targeted mitigation and is likely to be linked to improvements in vehicular emissions standards (for vehicles burning fossil fuels) and a predicted shift towards use of low emissions vehicles.

6.2.9. It is evident that in the baseline year, and presumably a period leading up to this, multiple designated sites may have experienced NO_x concentrations that have the potential to influence the vegetation present through eutrophication and possibly toxic effects on plant physiology. However, in the future, this trend is one of improving conditions with these air quality impacts markedly abating. By 2036, the eight sites that will continue to experience exceedances of the critical threshold for NO_x concentrations are:

- Stour and Orwell Estuaries SPA and Ramsar site
- Orwell Estuary SSSI
- Bridge Wood LNR and Bridge Wood CWS* (two sites)
- Rushmere Heath CWS
- Brazier's Wood, Pond Alder Carr and Meadows CWS*
- Christchurch Park CWS*
- St Clements Hospital Grounds LWS

6.2.10. For three of these sites with NO_x critical level exceedance in 2036, not all of the modelled transects show an exceedance – these are shown with an asterisk (*****) in the above list.

6.2.11. Following guidance in the previous version of the DMRB guidance (HA 207/07), exceedance of a critical level for NO_x by greater than 1% of that critical level is cause to consider the potential for negative impacts arising from nitrogen deposition.

6.2.12. Considering nitrogen deposition, 20 sites exceeded the lower critical load in the baseline year (2017), this decreases to 18 designated sites which register exceedances in both 2026 and 2036 in the absence of transport mitigation.

6.2.13. Importantly, among the sites that are no longer exceeding the lower critical load in 2026 or 2036 are the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI. Applying DMRB LA 105 guidance, it is inferred from this that the changes in nitrogen deposition are unlikely to lead to adverse changes in the vegetation present in the SPA/Ramsar and SSSI.

6.2.14. Exceedance of the lower critical load where there is greater than a 1% change in the 2026 scenario only occurs at eight sites. However, none of these sites register an increase in nitrogen deposition greater than 0.4kg N/ha/yr – the indicative threshold at which a change in the species-richness of the vegetation at these sites may occur:

- Alderman Canal CWS
- Brazier's Wood, Pond Alder Carr and Meadows CWS
- Bridge Wood LNR
- Bridge Wood CWS
- Broomhill Park LWS
- Christchurch Park CWS

- Holywells Park and Canal CWS
- St Clements Hospital Grounds LWS

6.2.15. In the 2036 scenario exceedance of 1% of the lower critical load also occurs at four sites (note that Bridge Wood LWS is replaced by Holywells Park and Canal LWS). However, only in a single instance, Holywells Park and Canal LWS) does a designated habitat site register an increase in nitrogen deposition greater than 0.4kg N/ha/yr which is the threshold at which a change in the species-richness of the vegetation at these sites is likely to occur:

- Holywells Park and Canal CWS
- Christchurch Park CWS
- Broomhill Park LWS
- St Clements Hospital Grounds LWS

6.2.16. It should be noted that the critical loads used by APIS are likely to relate to relatively high-quality examples of woodland and grassland, which may not match those present in the study area, which are only assumed to be high quality examples, in the absence of field data. Holywells Park and Canal CWS is the only site to experience an increase in nitrogen deposition above 0.4kg N/ha/yr but this applies to only one of the two transects modelled in this CWS and not to the second.

7 ASSESSMENT OF IMPACTS WITH TRANSPORT MITIGATION

7.1 HUMAN RECEPTORS

7.1.1. Full assessment results for human receptors are provided in **Appendix E**.

7.1.2. The impacts at human receptors on pollutant concentrations with transport mitigation tend to be more beneficial than without. This is due to the reductions in traffic at junctions which would otherwise experience substantial congestion and higher emissions.

IMPACTS ON ANNUAL MEAN NO_2 CONCENTRATIONS

7.1.3. Modelled annual mean NO_2 concentrations without the Ipswich Local Plan Review proposals in 2026 are predicted to be approximately 33% lower than in the 2017 base year at most human receptors. By 2036, most human receptors are predicted to experience concentrations that are approximately 40% lower than in 2017. The Ipswich Local Plan Review proposals with transport mitigation would bring about the same percentage reductions at most human receptors in 2026 and 2036 as the scenarios without the proposals.

7.1.4. With transport mitigation, most human receptors would experience negligible impacts on annual mean NO_2 concentrations with the Ipswich Local Plan Review proposals in 2026 and 2036. **Table 7-1** and **Table 7-2** identify notable impacts that would not be negligible. In 2026 these notable impacts are expected to be beneficial due to reductions in concentrations. By 2036, despite transport mitigation, there would be some notable adverse impacts which are limited to AQMA No.2 only. The concentrations at all modelled human receptors with transport mitigation in 2026 and 2036 are illustrated in **Figure 9** and **Figure 10** respectively.

7.1.1. Of all the modelled human receptors, only R414 'The Halberd Inn' on Crown Street is predicted to experience exceedances of the 40µg/m^3 AQS (**Table 2-1**) in all scenarios. Concentrations at all other human receptors are predicted to be below the AQS.

Table 7-1 – Notable Impacts on Annual Mean NO_2 Concentrations in 2026 (With Transport Mitigation)

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review (µg/m^3)	NO_2 with Ipswich Local Plan Review (µg/m^3)	Change (µg/m^3)	Change relative to AQS of 40µg/m^3 (%)	Impact
Within AQMA No.2							
R414	The Halberd Inn, Crown Street	1.5	**45.5**	**44.9**	-0.6	-2	Substantial Beneficial
R414	The Halberd Inn, Crown Street (1st floor)	4.5	**44.6**	**44.0**	-0.6	-2	Substantial Beneficial

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review ($\mu g/m^3$)	NO_2 with Ipswich Local Plan Review ($\mu g/m^3$)	Change ($\mu g/m^3$)	Change relative to AQS of 40$\mu g/m^3$ (%)	Impact
Not within an AQMA							
R11	Woodbridge Road East	1.5	27.2	24.8	-2.4	-6	Slight Beneficial
R90	Tuddenham Road	1.5	23.6	20.8	-2.8	-7	Slight Beneficial
R321	Barrack Lane	1.5	30.8	30.2	-0.6	-2	Slight Beneficial

Table 7-2 – Notable Impacts on Annual Mean NO_2 Concentrations in 2036 (With Transport Mitigation)

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review ($\mu g/m^3$)	NO_2 with Ipswich Local Plan Review ($\mu g/m^3$)	Change ($\mu g/m^3$)	Change relative to AQS of 40$\mu g/m^3$ (%)	Impact
Within AQMA No.2							
R414	The Halberd Inn, Crown Street	1.5	**41.5**	**44.5**	3.0	8	Substantial Adverse
R414	The Halberd Inn, Crown Street (1st floor)	4.5	**40.6**	**43.5**	2.9	7	Substantial Adverse
R421	St. Margaret's Plain	1.5	27.9	30.1	2.2	6	Slight Adverse
R427	St. Margaret's Street	1.5	27.0	29.4	2.4	6	Slight Adverse
R479	St. Helen's Street	1.5	23.0	25.6	2.6	7	Slight Adverse
R480	St. Helen's Street	1.5	25.5	31.9	6.4	16	Moderate Adverse

Receptor	Location	Height above ground level (m)	NO_2 without Ipswich Local Plan Review (µg/m^3)	NO_2 with Ipswich Local Plan Review (µg/m^3)	Change (µg/m^3)	Change relative to AQS of 40µg/m^3 (%)	Impact
R480	St. Helen's Street (1st floor)	4.5	24.1	30.5	6.4	16	Moderate Adverse
R481	St. Helen's Street	1.5	25.1	31.5	6.4	16	Moderate Adverse
R481	St. Helen's Street (1st floor)	4.5	24.1	30.6	6.5	16	Moderate Adverse
R482	St. Helen's Street	1.5	20.6	23.3	2.7	7	Slight Adverse
R483	St. Helen's Street	1.5	24.4	31.0	6.6	17	Moderate Adverse
R483	St. Helen's Street (1st floor)	4.5	24.0	30.6	6.6	17	Moderate Adverse
R484	St. Helen's Street	1.5	22.0	26.0	4.0	10	Slight Adverse

IMPACTS ON 1-HOUR MEAN NO_2 CONCENTRATIONS

7.1.2. As annual mean NO_2 concentrations in all future year scenarios are predicted to be below 60µg/m^3, according to LAQM.TG(16) it is unlikely that there would be any exceedances of the 1-hour mean NO_2 AQS (**Table 2-1**) as a consequence of the Ipswich Local Plan Review proposals with transport mitigation.

IMPACTS ON ANNUAL MEAN PM_{10} CONCENTRATIONS

7.1.3. Annual mean PM_{10} concentrations in all future year mitigation scenarios are predicted to be below the 40µg/m^3 AQS (**Table 2-1**). All impacts with the Ipswich Local Plan Review proposals with transport mitigation would be negligible.

IMPACTS ON 24-HOUR MEAN PM_{10} CONCENTRATIONS

7.1.4. Compliance with the AQS for 24-hour mean PM_{10} concentrations (**Table 2-1**) is predicted in all future year mitigation scenarios. All impacts with the Ipswich Local Plan Review proposals with transport mitigation would be negligible.

IMPACTS ON ANNUAL MEAN $PM_{2.5}$ CONCENTRATIONS

7.1.5. Annual mean $PM_{2.5}$ concentrations in all future year mitigation scenarios are predicted to be below the 25µg/m^3 AQS (**Table 2-1**). All impacts with the Ipswich Local Plan Review proposals with transport would be negligible.

7.2 ECOLOGICAL RECEPTORS

7.2.1. Full assessment results for ecological receptors are provided in **Appendix F** (see Table F3 - Impacts on Annual Mean NO_x with Transport Mitigation, and Table F4 - Impacts on Nitrogen Deposition with Transport Mitigation). Transect receptors are shown in **Figure 5**.

7.2.2. Notable impacts on annual mean NO_x concentrations at the designated habitat sites where the critical level of 30µg/m^3 (**Table 2-1**) is exceeded and the change is greater than 1% of the critical level are summarised in are summarised in **Table 7-3** and **Table 7-4** for 2026 and 2036 respectively.

7.2.3. Exceedances of the critical level are predicted at all transect receptors within the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI in 2026 and 2036 with changes that cannot be considered as imperceptible.

7.2.4. Of the other designated habitat sites, seven would experience exceedances of the critical level in 2026 with changes in annual mean NO_x that cannot be considered as imperceptible. These sites are:

- Rushmere Heath CWS (E175 – E194)
- Bridge Wood CWS (E238 – E243 and E244 – E262)
- Brazier's Wood, Pond Alder Carr and Meadows CWS (E265 – E284)
- Christchurch Park CWS (E412 – E432, E433 – E453 and E454 – E474)
- Bridge Wood LNR (E138 – E146)
- Broomhill Park LWS (E1 – E9)
- St Clements Hospital Grounds LWS (E15 – E34).

7.2.5. In the 2036, six of the other designated habitat sites would experience exceedances of the critical level with changes in annual mean NO_x that cannot be considered as imperceptible. These sites are:

- Bridge Wood CWS (E238 – E243)
- Rushmere Heath CWS (E175 – E194)
- Brazier's Wood CWS (E265 – E284)
- Christchurch Park CWS (E412 – E432, E433 – E453 and E454 – E474)
- Bridge Wood LNR (E138 – E146)
- St Clements Hospital Grounds LWS (E15 – E34).

7.2.6. The NO_x impacts at other LNR and non-statutory designated habitat sites can be discounted as unlikely to give rise to a significant effect as the critical level would not be exceeded for 2026 and 2036.

7.2.7. The transects with notable impacts on nitrogen deposition - where the lower critical load for the most sensitive feature is exceeded and the change is greater than 1% of the lower critical load - are summarised in **Table 7-5** and **Table 7-6**. Impacts on the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI for 2026 and 2036 were determined to be not significant according to DMRB LA 105 criteria - primarily as the lower critical load is not exceeded but also as the

changes relative to the lower critical load are less than 1%, and in absolute terms less than 0.4kg N/ha/yr.

Table 7-3 – Notable Impacts on Annual Mean NO_x Concentrations in 2026 at Designated Habitat Sites (With Transport Mitigation)

Site	Transect receptors	Annual mean NO_x in 2026 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
Sites of Scientific Special Interest, Special Protection Areas and Ramsar Sites							
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, north of A14	E88 – E108	91.8	70	91.2	70	-0.6	-2
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, south of A14	E109 – E129	70.7	40	70.3	40	-0.5	-2
County Wildlife Sites							
Rushmere Heath	E175 – E194	36.3	10.6	35.7	10.6	-0.6	-2
Bridge Wood, south of A14, west	E238 – E243	45.4	21.0	45.1	21.0	-0.3	-1
Bridge Wood, south of A14, east	E244 – E262	32.6	21.7	32.4	21.7	-0.2	-1

Site	Transect receptors	Annual mean NO_x in 2026 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
Brazier's Wood, Pond Alder Carr and Meadows, north of A14	E265 – 284	65.9	64.2	65.5	54.2	-0.4	-1
Christchurch Park, east of Henley Road	E412 – E432	35.7	5.8	35.1	5.8	-0.5	-2
Christchurch Park, north east of Fonnereau Road	E433 – E453	32.8	7.8	32.5	7.8	-0.3	-1
Christchurch Park, north of Soane Street	E454 – E474	34.5	15.6	34.0	15.6	-0.5	-2
Local Nature Reserves							
Bridge Wood	E138 – E146	38.5	8.5	38.3	8.5	-0.2	-1
Local Wildlife Sites							
Broomhill Park	E1 – E9	30.9	11.3	30.2	11.3	-0.7	-2
St Clements Hospital Grounds	E15 – E34	42.8	18.5	41.2	8.5	-1.6	-5

Table 7-4 – Notable Impacts on Annual Mean NO_x Concentrations in 2036 at Designated Habitat Sites (With Transport Mitigation)

Site	Transect receptors	Annual mean NO_x in 2036 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of 30$\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of 30$\mu g/m^3$ (%)
Sites of Scientific Special Interest, Special Protection Areas and Ramsar Sites							
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, north of A14	E88 – E108	73.6	40	73.9	40	0.2	1
Orwell Estuary SSSI and **Stour and Orwell Estuaries SPA and Ramsar**, south of A14	E109 – E129	57.8	20	58.1	20	0.3	1
County Wildlife Sites							
Bridge Wood, south of A14, west	E238 – E243	37.2	11.0	37.4	11.0	0.2	1
Brazier's Wood, Pond Alder Carr and Meadows, north of A14	E265 - 284	52.9	34.2	53.1	34.2	0.2	1

Site	Transect receptors	Annual mean NO_x in 2036 at closest point within site to road					
		Without Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	With Ipswich Local Plan Review ($\mu g/m^3$)	Distance from road beyond which concentration is below the critical level of $30\mu g/m^3$ (m)	Difference in concentration ($\mu g/m^3$)	Change relative to critical level of $30\mu g/m^3$ (%)
Christchurch Park, east of Henley Road	E412 – E432	30.3	5.8	31.1	5.8	0.9	3
Christchurch Park, north east of Fonnereau Road	E433 – E453	29.2	-	30.5	7.8	1.3	4
Christchurch Park, north of Soane Street	E454 – E474	32.1	5.6	31.7	5.6	-0.4	-1
Local Nature Reserve							
Bridge Wood	E138 – E146	31.7	8.5	31.8	8.5	0.2	1

Table 7-5 – Notable Impacts on Nitrogen Deposition Rates in 2026 at Designated Habitat Sites (With Transport Mitigation)

Site	Transect receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2026 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2026 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
Local Wildlife Sites									
Broomhill Park	E1 – E9	10	23.2	94	23.1	94	-1	11	No
St Clements Hospital Grounds	E15 – E34	10	18.7	199	18.6	199	-1	19	No

Table 7-6 – Notable Impacts on Nitrogen Deposition Rates in 2036 at Designated Habitat Sites (With Transport Mitigation)

Site	Transect Receptors	Lower critical load for most sensitive feature (kg N/ha/yr)	2036 without Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	2036 with Ipswich Local Plan Review (kg N/ha/yr)	Distance from road beyond which deposition is below the lower critical load (m)	Change relative to lower critical load (%)	Distance from road beyond which the change is <1% (m)	Change in deposition >0.4 kg N/ha/yr?
County Wildlife Sites									
Holywells Park and Canal, south	E217 – E237	10	18.6	200+	18.7	200+	1	7	No
Christchurch Park, east of Henley Road	E412 – E432	10	20.8	200+	20.9	200+	1	6	No
Christchurch Park, north east of Fonnereau Road	E433 – E453	10	19.9	200+	20.1	200+	2	38	No

ECOLOGIST OPINION

7.2.8. Considering impacts on annual mean NO_x concentrations, once transport mitigation is applied, it is apparent that there is a continued downward trend in NO_x concentrations. However, by 2036, the eight sites with exceedances in the unmitigated scenario, continue to experience exceedances even when mitigation is applied:

- Stour and Orwell Estuaries SPA and Ramsar site
- Orwell Estuary SSSI
- Bridge Wood CWS* and LNR (two sites)
- Brazier's Wood, Pond Alder Carr and Meadows CWS*
- Christchurch Park CWS*
- St Clements Hospital Grounds LWS
- Rushmere Heath CWS

7.2.9. For three of these sites with NO_x critical level exceedance in 2036, not all of the modelled transects show an exceedance – these are shown with an asterisk (*****) in the above list. For two of these sites (St Clements Hospital Grounds LWS and Rushmere Heath CWS) the exceedance of NO_x is less than 1% of the critical level.

7.2.10. Following guidance in the previous edition of the DMRB (prior to the LA 105), exceedance of the critical level for NO_x by greater than 1% of that critical level is cause to consider the potential for negative impacts arising from nitrogen deposition.

7.2.11. Considering nitrogen deposition, 20 sites exceed the critical load in the baseline year (2017), this decreases to 18 designated sites in both 2026 and 2036 in the absence of transport mitigation. 18 sites still exceed the critical load for nitrogen deposition when transport mitigation is applied in both 2026 and 2036. However, in only four cases do these exceedances represent greater than a 1% change of the critical load but in no case does the change represent greater than 0.4kg N/ha/yr which is the indicative threshold at which a change in the species-richness of the vegetation at these sites is likely to occur:

- Broomhill Park (2026 only)
- St Clements Hospital Grounds LWS (2026 only)
- Holywells Park and Canal CWS (2036 only)
- Christchurch Park CWS (2036 only)

7.2.12. The lower critical load for nitrogen deposition is not exceeded for the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI.

8 SUMMARY OF KEY FINDINGS AND CONCLUSIONS

8.1 2017 BASE YEAR

HUMAN RECEPTORS

8.1.1. In the 2017 base year, most modelled exceedances of the annual mean NO_2 AQS of 40µg/m^3 occur at human receptors within the existing AQMAs (all declared by IBC for exceedances of the annual mean NO_2 AQS at monitoring sites). The modelled exceedances that occur outside of the AQMAs are limited to:

- Within 20m of AQMA No.1 on the A1214 Valley Road and A1156 Norwich Road (south of the junction with Valley Road)
- On A1156 St Matthew's Street and Civic Drive within 40m of the roundabout junction
- On the south side of the A1156 Crown Street between Westgate Street and High Street
- On the corner of Orwell Place and Upper Orwell Street
- On Falcon Street within a street canyon
- On the south side of the A1156 Fore Street within 20m of AQMA No.3
- On the north side of the A1156 Fore Hamlet within 50m of Back Hamlet
- On the south side of the A1214 Woodbridge Road East at the junction with the A1189 Heath Road.

8.1.2. The highest modelled annual mean NO_2 concentration occurs on the south side of Crown Street at 'The Halberd Inn'. Elsewhere within the study area, annual mean NO_2 concentrations were determined to be well below the AQS.

8.1.3. There are no exceedances of the AQS for 1-hour mean NO_2, annual mean and 24-hour mean PM_{10} and annual mean $PM_{2.5}$ within the study area.

ECOLOGICAL RECEPTORS

8.1.4. Modelled concentrations of annual mean NO_x exceed the critical level for the protection of vegetation at most designated habitat sites including the Orwell Estuary SSSI and Stour and Orwell Estuaries SPA and Ramsar.

8.1.5. Nitrogen deposition rates exceed the lower critical load for the most sensitive feature at 20 out of 22 designated habitat sites (two statutory and 20 non-statutory) within the study area, including the Orwell Estuary SSSI and Stour and Orwell Estuaries SPA and Ramsar site.

8.1.6. There is potential therefore that in 2017 designated habitat sites may have been subject to existing ambient pollutant concentrations beyond the levels/loads which could result in changes to the ecological communities present.

8.2 2026 AND 2036 IPSWICH LOCAL PLAN REVIEW PROPOSALS WITHOUT TRANSPORT MITIGATION

HUMAN RECEPTORS

8.2.1. Modelled NO_2 concentrations without the Ipswich Local Plan Review proposals in 2026 are predicted to be approximately 33% lower than in the 2017 base year at most human receptors. By 2036, most human receptors are predicted to experience concentrations that are approximately 40%

lower than in 2017. With the Ipswich Local Plan Review proposals, most human receptors in 2026 would experience concentrations that are 30% lower than in 2017 without any transport mitigation. The situation in 2036 with the Ipswich Local Plan Review proposals is very similar to that without where most human receptors experience concentrations that are approximately 40% lower than in 2017.

8.2.2. Most human receptors would experience negligible impacts on annual mean NO_2 concentrations with Ipswich Local Plan Review proposals without transport mitigation, despite associated increases in traffic. There are some notable exceptions, generally within central Ipswich and existing AQMA's, that would experience adverse impacts on annual mean NO_2.

8.2.3. Modelled annual mean NO_2 concentrations that exceed the AQS are limited to the south side of Crown Street at 'The Halberd Inn'. This location was modelled as a street canyon environment and the predictions are likely to be conservative. Elsewhere, concentrations are predicted to be below the AQS.

8.2.4. There are no exceedances of the AQS for 1-hour mean NO_2 concentrations and all impacts on PM_{10} and $PM_{2.5}$ are negligible.

ECOLOGICAL RECEPTORS

8.2.5. The Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI transects are predicted to experience exceedances of the critical level in 2026 and 2036, although concentrations are predicted to be lower than in 2017, with changes in annual mean NO_x that cannot be considered as imperceptible.

8.2.6. There are seven other designated habitat sites in 2026 that would experience exceedances of the critical level with changes in annual mean NO_x that cannot be considered as imperceptible. By 2036 this number reduces to six.

8.2.7. Nitrogen deposition impacts on the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI for 2026 and 2036 were determined to be not significant according to DMRB LA 105 criteria - primarily as the lower critical load is not exceeded but also as the changes relative to the lower critical load are imperceptible, and in absolute terms less than 0.4kg N/ha/yr (the threshold at which a change in the species-richness of the vegetation may occur).

8.2.8. At non-statutory sites in 2026, the number with exceedances of the lower critical load is 18 with imperceptible impacts at 10 of these. Of the eight sites experiencing perceptible impacts, none of the increases in nitrogen deposition exceed 0.4kg N/ha/yr. By 2036, the changes in nitrogen deposition levels are perceptible at only four sites. However, only in a single instance (Holywells Park and Canal LWS), is there an increase greater than 0.4kg N/ha/yr which only occurs only to a limited extent within the site.

8.3 2026 AND 2036 IPSWICH LOCAL PLAN REVIEW PROPOSALS WITH TRANSPORT MITIGATION

HUMAN RECEPTORS

8.3.1. Modelled annual mean NO_2 concentrations without the Ipswich Local Plan Review proposals in 2026 are predicted to be approximately 33% lower than in the 2017 base year at most human receptors. By 2036, most human receptors are predicted to experience concentrations that are approximately

40% lower than in 2017. The Ipswich Local Plan Review proposals with transport mitigation would bring about the same percentage reductions at most human receptors in 2026 and 2036 as the scenarios without the proposals.

8.3.2. Most human receptors would experience negligible impacts on annual mean NO_2 concentrations with Ipswich Local Plan Review proposal with transport mitigation, which would generally reduce the amount of traffic with Ipswich compared to the situation without transport mitigation. There are some notable exceptions within central Ipswich that would experience beneficial impacts on annual mean NO_2 in 2026 including at 'The Halberd Inn' on Crown Street. However, by 2036, despite transport mitigation, there would be some adverse impacts which are confined to AQMA No.2.

8.3.3. Modelled annual mean NO_2 concentrations that exceed the AQS are limited to the south side of Crown Street at 'The Halberd Inn'. This location was modelled as a street canyon environment and the predictions are likely to be conservative. Elsewhere, concentrations are predicted to be below the AQS.

8.3.4. There are no exceedances of the AQS for 1-hour mean NO_2 concentrations and all impacts on PM_{10} and $PM_{2.5}$ are negligible.

ECOLOGICAL RECEPTORS

8.3.5. The Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI transects are predicted to experience exceedances of the critical level in 2026 and 2036, although concentrations are predicted to be lower than in 2017, with changes in annual mean NO_x that cannot be considered as imperceptible.

8.3.6. There are seven other designated habitat sites in 2026 that would experience exceedances of the critical level with changes in annual mean NO_x that cannot be considered as imperceptible. By 2036 this number reduces to six.

8.3.7. Nitrogen deposition impacts on the Stour and Orwell Estuaries SPA and Ramsar and Orwell Estuary SSSI for 2026 and 2036 were determined to be not significant according to DMRB LA 105 criteria - primarily as the lower critical load is not exceeded but also as the changes relative to the lower critical load are imperceptible, and in absolute terms less than 0.4kg N/ha/yr (the threshold at which a change in the species-richness of the vegetation may occur).

8.3.8. At non-statutory sites in 2026, the number with exceedances of the lower critical load is 18 with imperceptible impacts at 16 of these. Of the four sites experiencing perceptible impacts in 2026, none of the increases in nitrogen deposition exceed 0.4kg N/ha/yr. By 2036, the changes in nitrogen deposition levels are also perceptible at two different sites but none of the increases in nitrogen deposition exceed 0.4kg N/ha/yr and are therefore not significant according to DMRB LA 105 criteria.

8.4 CONCLUSIONS

8.4.1. The assessment considered the potential air quality impacts of the Ipswich Local Plan Review proposals within the IBC district at: a) human receptors expected to experience the most substantial changes in traffic, and b) ecological receptors within designated habitat sites that are sensitive to changes in nitrogen deposition.

8.4.2. The assessment accounted for road traffic forecasts without the Ipswich Local Plan Review proposals but with local plans implemented by other ISPA boroughs, and in-combination with the

Ipswich Local Plan Review proposals. Using well established methodology and datasets for vehicle emissions and background pollutant levels, the air quality assessment established that the impacts at human and ecological receptors would - in nearly all locations - be negligible and imperceptible.

8.4.3. Future levels of air pollutants would generally be lower than at present, in-particular concentrations of NO_2, which are predicted to be substantially lower - primarily due to government targeted measures to tackle roadside exceedances of the EU limit value for this pollutant.

8.4.4. The only adverse impacts at human receptors with the Local Plan Review proposals, where there is also an exceedance of an AQS (for annual mean NO_2), are predicted at one location ('The Halberd Inn') within IBC AQMA No.2 on Crown Street, Ipswich. With SCC transport mitigation strategy measures applied across all ISPA boroughs, the magnitude of these adverse impacts would be reduced and in 2026 it is predicted that there would be beneficial impacts at this location, although the modelling did not predict the removal of exceedance (potentially due to the simplistic street canyon model representation applied at this location).

8.4.5. For ecological receptors, with the proposed transport mitigation, the assessment demonstrates that there would be no significant effects on designated habitat sites.

8.4.6. Overall, it can be concluded that the Ipswich Local Plan Review proposals with SCC transport mitigation strategy measures applied across all ISPA boroughs would not give rise to a significant air quality effect within the IBC district.

8.4.7. It is recommended that IBC undertake long-term monitoring of NO_2 at 'The Halberd Inn' on Crown Street within AQMA No.2, as part of its routine LAQM duties, to determine if the modelled predictions for this location are likely and to enable any localised mitigation to be developed.

GLOSSARY

Term	Definition
Annual Average Daily Traffic (AADT)	Daily (24 hours) total traffic flow, expressed as a mean daily flow across all 365 days of the year.
Affected road network (ARN)	All roads that trigger the traffic screening criteria and adjoining roads within 200 metres.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard (AQS)	Air quality standards are concentrations recorded over a given period considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment. They can also be used as a benchmark to indicate whether air pollution is getting better or worse (see air quality objective and EU limit value).
Ambient air	Outdoor air.
Ancient Woodland (AW)	This is typically a woodland that has existed since 1600 or earlier. Ancient woodland does not have statutory protection.
Annual mean	The average (mean) of the concentrations measured for each pollutant over one calendar year.
Air Pollution Information System (APIS)	An online searchable database that provides information on air pollutants and their impacts on habitats and species.
AQMA	Air Quality Management Area.
AQAP	Air Quality Action Plan
ARN	Affected road network (roads that are screened into the assessment as having changes that cannot simply be discounted as negligible)
BDC	Babergh District Council
Baseline	The conditions that exist in the absence of the scheme either at the time when an assessment is undertaken or in the future when the scheme is constructed, operational or decommissioned.
Conservative	Cautious - tending to over-predict the impact rather than under-predict.
Critical level	The concentration of an air pollutant above which adverse effects on ecosystems may occur according to present knowledge.

Term	Definition
Critical load	Deposition flux of an air pollutant below which significant harmful effects on sensitive ecosystems do not occur according to present knowledge. Usually measured in units of kilograms per hectare per year (kg/ha/yr).
County Wildlife Site (CWS)	County Wildlife Site designation is non-statutory, but it recognises the high value of a site for wildlife.
Defra	Department for Environment, Food and Rural Affairs.
Deposition	The main pathway for the removal of pollutants from the atmosphere through settling.
DMRB	Design Manual for Roads and Bridges.
EFT	Emissions Factors Toolkit, a spreadsheet application periodically updated and published by Defra enabling the calculation of road vehicle emission rates of oxides of nitrogen
Emission rate	The quantity of a pollutant released from a source over a given period of time.
EU	European Union.
EU limit value	EU Limit values are legally binding EU parameters that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV	Heavy-duty vehicle, includes all vehicles over 3.5 tonnes gross weight including lorries (heavy goods vehicles), buses and coaches.
IBC	Ipswich Borough Council
ISPA	Ipswich Strategic Planning Area formed of the administrative areas of Ipswich Borough Council, Babergh District Council, Mid Suffolk District Council and Suffolk Coastal District Council element of the administrative area now known as East Suffolk.
kg N/ha/yr	Kilograms of nitrogen per hectare per year (nitrogen deposition rate)
LAQM	Local Air Quality Management
LAQM.TG(16)	Local Air Quality Management Technical Guidance.

Term	Definition
LDV	Light duty vehicle, includes all vehicles less than 3.5 tonnes gross weight including motorcycles, cars, taxis, minibuses and vans.
Local Nature Reserve (LNR)	The statutory designation given to places with wildlife or geological features that are of local special interest.
Local Wildlife Site (LWS)	The non-statutory designation given to sites that have locally been identified as having conservation value.
Mitigation	The measures taken to avoid, reduce or otherwise address the potential negative effects due to air quality impacts.
$\mu g/m^3$	Micrograms per cubic metre. A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
MSDC	Mid Suffolk District Council
NO_2	Nitrogen dioxide.
NO_x	Oxides of nitrogen, including nitrogen dioxide and nitric oxide (NO).
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Ramsar site	A wetland site designated with international importance and statutory protection under the International Convention on Wetlands (Ramsar Convention).
Receptor	An identified location where an effect may occur.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
SCC	Suffolk County Council
SCDC	Suffolk Coastal District Council
Special Protection Area (SPA)	A designated site for birds with statutory protection.
Street canyon	Generally defined as narrow streets where the height of buildings on both sides of the road is greater than the road width, leading to the formation of vortices and recirculation of air flow that can trap pollutants and restrict dispersion.

Term	Definition
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it in European legislation.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

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