M5 Junction 10 Improvements Scheme

Environmental Statement

Chapter 5: Air Quality

TR010063 – APP 6.3

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

6.3 Environmental Statement: Chapter 5: Air Quality

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5 Air Quality

5.1 Introduction

5.1.1 This chapter presents the environmental assessment of the M5 Junction 10 Improvements Scheme (the Scheme) for Air Quality based on the Scheme as it is described in Chapter 2 – The Scheme (application document TR010063 – APP 6.2) and detailed in the General Arrangement Plans (application document TR010063 – APP 2.9)). This chapter sets out the standards and methodologies that have been used to carry out the assessment of Air Quality for the Environmental Statement (ES).

5.1.2 The Scheme, which comprises improvements to Junction 10 on the M5; a new road linking Junction 10 to west Cheltenham; and widening of the A4019 east of Junction 10, has the potential to alter vehicle flows on the road network which may change air quality at sensitive receptors. As demonstrated in the Environmental Scoping Report, changes to vehicle flows exceeded the traffic scoping criteria. Consideration of air quality impacts was therefore included as part of the Preliminary Environmental Information Report, (PEIR) and the potential air quality impact has been assessed in this ES chapter. In addition, allocated land at West and North-west Cheltenham and the safeguarded land to the west and north-west of Cheltenham, where development is enabled in the future as a result of the Scheme (referred to as strategic development sites) would result in additional traffic on the road network and new receptors in the vicinity of the road network.

5.2 Competent expert evidence

5.2.1 The Air Quality chapter has been produced by competent experts who are full members of the Chartered Institute of Environmental Sciences (IES) and the Institute of Air Quality Management (IAQM), each with over fifteen years of professional consultancy experience. They have used their knowledge and professional judgement to undertake the assessment reported here.

5.3 Planning policy and legislative context

5.3.1 Section provides details of the planning policy and legislation relevant to this topic. It should be noted that the details presented in this section are not intended to provide a full consideration of the relevant documents and their application to the Scheme. This information is provided within the Planning Statement and Schedule of Accordance with National Policy Statement (application document TR010063 – APP 7.1) that accompanies the application for a DCO.

UK air quality legislation

5.3.2 The air quality legislation that applies in England includes:

- Regulations implementing air quality limit values
- Regulations implementing national air quality objectives: Air Quality (England) Regulations 2000 (SI 2000/928) and Air Quality (England) (Amendment) Regulations 2002 (SI 2002/3043)
- Regulations implementing targets for fine particulate ($PM_{2.5}$): The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 (SI 2023/96)

Air quality limit values

5.3.3 Regulations implementing air quality limit values in the EU Directive on ambient air quality and cleaner air for Europe (2008/50/EC) are included in the Air Quality Standards Regulations 2010 (SI 2010/1001) as amended by The Air Quality Standards (Amendment) Regulations 2016 (SI 2016/1184). The Air Quality Standards Regulations are retained under the European Union (Withdrawal) Act 2018, (2018 c.16), but have been amended by the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (SI

2019/74) and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (SI 2020/1313). The relevant limit values in the context of this assessment for the protection of human health for NO_2 and fine particulate matter are presented in Table 5-1.

5.3.4 Local authorities have no responsibility for achieving the national air quality criteria, although they should contribute to this through local action plans designed to reduce pollution levels in Air Quality Management Areas (AQMAs), and through the targeted feasibility studies[1], including clean air zones where appropriate, to supplement the government's air quality plan for nitrogen dioxide in the UK[2].

National Air Quality Strategy

5.3.5 The 2007 Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland[3] set out the national air quality standards and objectives for a number of local air pollutants. The standards are set by expert organisations with regard to scientific and medical evidence on the effects of the particular pollutant on health and define the level of pollution below which health effects are expected to be minimum or low risk even for the most sensitive members of the population. The objectives are targets for air pollution levels to be achieved by a specified timescale, which take account of the costs and benefits of achieving the standard, either without exception or, for certain short-term averaging period standards, with a permitted number of exceedances. Local authorities have a responsibility (under Part IV of the Environment Act 1995, and as amended by the Environment Act 2021, see below) to review and assess local pollution levels against these objectives. These criteria are defined in Regulations SI 2000 No. 928 and SI 2002 No. 3043.

5.3.6 It should be noted that the AQS objectives only apply in locations likely to have 'relevant exposure' i.e., where members of the public are exposed for periods equal to or exceeding the averaging periods set for the standards. For this assessment, locations of relevant exposure include building façades of residential premises, schools, public buildings and medical facilities; places of work (other than certain community facilities) are excluded.

5.3.7 In 2019, the UK Government published its Clean Air Strategy[4], which set out actions to improve air quality by reducing pollution from a wide range of sources, including a commitment to set a legally binding target for $PM_{2.5}$. Targets for $PM_{2.5}$ are defined in Regulations SI 2023 No.96 as an annual mean concentration of 10 µg/m^3 to be met by 2040, and a 35% reduction in population exposure by 2040, (as compared to a 3-year baseline period 2016-2018). Interim targets have also been introduced in the latest Defra's Environmental Improvement Plan[5] to be achieved by the end of January 2028. The limit values, objectives and targets are all referenced in the Government's Air Quality Strategy for England[6], published in April 2023, which sets out a framework to enable local authorities to continue to improve air quality.

5.3.8 Further details of the limit values and AQS objectives for relevant pollutants are provided below in Table 5-1.

[1] Uk-air.defra.gov.uk. Supplement to the UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations: Local Authorities Feasibility Studies - Defra, UK. [online] Available at: https://uk-air.defra.gov.uk/library/no2ten/2018-la-tfs-documents [Accessed September 2022].
[2] DEFRA, UK plan for tackling roadside nitrogen dioxide concentrations, July 2017, Available at: https://uk-air.defra.gov.uk/library/no2ten/index [Accessed September 2022]
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf
[4] DEFRA, 2019. Clean Air Strategy 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf.
[5] Defra, 2023, Environmental Improvement Plan 2023. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1133967/environmental-improvement-plan-2023.pdf
[6] Defra, 2023, Air quality strategy: framework for local authority delivery, 2023. Available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery#framework-for-action

Table 5-1 - Relevant air quality criteria

Pollutant	Criteria
NO_2	Hourly mean concentration should not exceed 200 µg/m^3 more than 18 times a year Annual mean concentration should not exceed 40 µg/m^3
PM_{10}	24-hour mean concentration should not exceed 50 µg/m^3 more than 35 times a year Annual mean concentration should not exceed 40 µg/m^3
$PM_{2.5}$	†UK (Except Scotland) annual mean concentration should not exceed 20 µg/m^3 ^Exposure reduction (UK urban areas): target of 15% reduction in concentrations at urban background between 2010 and 2020
	*Annual mean concentration target – must be equal to or less than 10 µg/m^3 to be met across England by 2040, with an interim target of 12 µg/m^3 by the end of January 2028 *Population exposure reduction target – a 35% reduction in population exposure by 2040 (compared to a baseline period (2016-2018), with an interim target to reduce by 22% by the end of January 2028
† AQS objective is 20 µg/m^3 to be met by 2020. Limit value is 25 µg/m^3 to be met by 2015, with a requirement in urban areas to bring exposure down to below 20 µg/m^3 by 2020. ^ Limit value exposure reduction target of 20% reduction between 2010 and 2020.	

Local Air Quality Management

5.3.9 Under Part IV of the Environment Act 1995, and as amended by the Environment Act 2021, all local authorities are responsible for Local Air Quality Management, (LAQM), the mechanism by which the Government's AQS objectives are to be achieved. As part of this LAQM role, local authorities are required to periodically review air quality in their area and to assess present and likely future air quality against the objectives defined in Regulations. Where a local authority anticipates an objective is expected to be breached within their area, they must designate an AQMA and develop an action plan to improve pollution levels and work towards achieving the AQS objectives. Under the current LAQM regime, a local authority is responsible for regular review and assessment of local air quality, reports on which are published following public consultation and review by the Department for Environment, Food and Rural Affairs (DEFRA).

Dust deposition

5.3.10 There are no national standards or guidelines for dust deposition currently set for the UK, nor by the EU or any international organisation. This is mainly due to the difficulty in setting a standard that needs to relate to dust being a perceptual problem rather than being specifically related to health effects. Typically, assessments use an indicative threshold for the 'likelihood of complaint' for instance, in residential areas a dust deposition flux (as an average measured over a 4 week period using a passive deposition gauge) of 200 mg/m^2/day or greater[7].

Designated habitat criteria

5.3.11 Critical levels for the protection of vegetation are set for oxides of nitrogen (NO_x) and sulphur dioxide under the Air Quality Standards Regulations 2010. For NO_x the annual mean critical level is 30 µg/m^3, which is commonly used within assessments for all ecological habitats. Critical loads for nitrogen deposition have been set by the United Nations Economic Commission for Europe. A critical load is a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified

[7] Institute of Air Quality Management, Guidance on Monitoring in the Vicinity of Demolition and Construction Sites. October 2018. Available at: https://iaqm.co.uk/text/guidance/guidance_monitoring_dust_2018.pdf [Accessed October 2022]

sensitive elements of the environment do not occur, according to present knowledge. Critical loads vary by type of habitat and species. The critical load for deposition (eutrophication) is given as a range and is quoted in units of kg/ha/year, with the lower value of the critical load range typically used in assessments.

National policy

National Policy Statement for National Networks

5.3.12 The National Policy Statement for National Networks[8] (NPS NN, 2014) contains advice in Paragraphs 5.3 – 5.15 relating to air quality assessment of transport schemes. Paragraphs 5.7 – 5.9 detail what should be presented in the air quality chapter of the environmental statement, this has been considered in the preparation of this document. Paragraph 5.11 states "Air quality considerations are likely to be particularly relevant where schemes are proposed: within or adjacent to AQMAs; roads identified as being above Limit Values or nature conservation sites; and where changes are sufficient to bring about the need for a new AQMA or change the size of an existing AQMA; or bring about changes to exceedances of the Limit Values, or where they may have the potential to impact on nature conservation sites."

5.3.13 Paragraph 5.12 states that air quality considerations must be given substantial weight where a project would lead to a significant air quality impact and/or lead to a deterioration in air quality in a zone/agglomeration.

5.3.14 Paragraph 5.13 of the NPS NN is particularly relevant and sets out that the Secretary of State should refuse consent, if including mitigation measures, the Scheme will 'result in a zone/agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant.' Furthermore, consent should be refused where air quality impacts will 'affect the ability of a non-compliant area to achieve compliance within the most recent timescale reported to the European Commission at the time of the decision'.

National Planning Policy Framework

5.3.15 The National Planning Policy Framework (NPPF, 2021)[9] does not contain specific policies for nationally significant infrastructure projects. However, it is considered to be material to the Secretary of State's consideration of the application for development consent for the Scheme. It provides guidance for local authorities on incorporating air quality considerations into planning decisions and aims to protect the environment and to promote sustainable growth.

5.3.16 Paragraph 105 refers to sustainable transport:

"*The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.*"

5.3.17 Paragraph 186 considers impacts on local 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. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these

[8] DfT (2014) National Policy Statement for National Networks. [Online] Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf [Accessed September 2022]
[9] Ministry of Housing, Communities & Local Government, National Planning Policy Framework (NPPF), July 2021, from: National Planning Policy Framework - GOV.UK (www.gov.uk)

opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

Local and regional policy

Gloucestershire Local Transport Plan 2020–2041

5.3.18 LTP PD PD0.2 – Environment states that the County Council will work with District Councils to improve air quality on the highway network. This will be achieved through developing, adopting and delivering 'Air Quality Action Plans required where Air Quality Management Areas have been declared, in relation to transport emissions.

Gloucester, Cheltenham and Tewkesbury Joint Core Strategy 2011-2031

5.3.19 Policy SD3 Sustainable Design and Construction states that proposals should demonstrate how they contribute to the aims of sustainability by a number of factors, including the unnecessary pollution of air.

5.3.20 Policy SD14 Health and Environmental Quality states that development should protect and seek to improve environmental quality through development resulting in no unacceptable levels of air pollution.

5.3.21 Strategic Objective 9 – Promoting healthy communities outlines the stance that a healthy population will be maintained through 'ensuring that environmental quality and air quality is protected.'

Gloucestershire Air Quality and Health Strategy

5.3.22 A strategy developed by the Gloucestershire Air Quality and Health Partnership and published in 2020. The vision is for organisations, professionals and the public across Gloucestershire to work together to improve air quality in the county and reduce the impact of air pollution on human health and the environment. To contribute to the vision of Gloucestershire as a prosperous, happy, healthy, and sustainable county. This is to be achieved through co-ordinating efforts across the county in planning and policy, public engagement, air quality monitoring, active travel, and cleaner fleets and public transport.

Cheltenham Borough Council Local Plan 2011-2031 – Adopted July 2020

5.3.23 No borough wide air quality specific policies are included. Location specific guidance is provided for the protection of the Beechwoods Special Area of Conservation (SAC) as below:

5.3.24 Policy BG2: Cotswold Beechwoods SAC air quality development - Development which is likely to generate additional road traffic emissions to air which are capable of affecting the Cotswold Beechwoods SAC will be screened against the HRA Framework in line with Natural England's guidance 'Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (NEA001)'.

Tewkesbury Borough Local Plan – Saved Policies (2011)

5.3.25 Policy EVT4: Air Quality states that 'appropriate measures should be taken to ensure there is no risk to public health from the release of airborne pollutants.'

Gloucester City Council Local Plan – Saved Policies (2002)

5.3.26 Policy FRP.11 Pollution states that 'Development that may be liable to cause pollution of water, air or soil, or pollution through noise, dust, vibration, light, heat or radiation will only be permitted if the quality and enjoyment of the environment would not be unduly damaged or put at risk.'

Cheltenham Borough - Air Quality Action Plan 2014

5.3.27 The air quality action plan identifies road transport as the principal source of air pollution and encourages sustainable travel following a series of transport measures within the Local Sustainable Transport Plan (LSTP). Measures identified in the Air Quality Action Plan (AQAP) include highway improvements, air quality awareness by publishing air quality data and encouraging sustainable transport choices, promoting the use of park-ride schemes, personalised travel plans, promoting bike use to commute to school for parents and kids, car sharing, greener vehicles, HGV and LGV restrictions, school and business travel grants, wayfinding initiatives, adopting an air quality policy to ensure impact of significant developments are assessed and mitigation measures in places where necessary, traffic light appraisal, bus and taxi quality partnership, reducing speed limit to 20mph in busier roads, low emission bus fleets and improvement of road layouts and greener areas. The Council is currently revising their AQAP, which is now in the process of being finalised and is expected to be released for consultation during 2022.

5.4 Methodology

5.4.1 The air quality assessment for both the construction and the operational phase of the Scheme has been undertaken in line with the methodology detailed in National Highways' Design Manual for Roads and Bridges (DMRB) LA 105, which is considered to be the most appropriate approach for assessing the effects of road schemes on air quality.

5.4.2 To determine the potential air quality impacts, this assessment includes:

- Identification of baseline air quality conditions referencing Department for Environment, Food and Rural Affairs (DEFRA) background[10] and Pollution Climate Mapping (PCM)[11], and LAQM reports, and a Scheme-specific air quality monitoring survey.
- Identification of air quality constraints and sensitive receptors, including both human health receptors and designated habitats.
- Qualitative consideration of construction phase effects.
- Assessment of the likely changes in air pollutant concentrations during operation of the Scheme at selected human health receptors. The assessment follows the 'detailed' assessment framework outlined in DMRB LA 105.
- Assessment of the likely changes in nitrogen deposition rates during operation of the Scheme at selected ecological receptors.
- Assessment of significance of the air quality effects in the Scheme opening year (2027), including an assessment of compliance with air quality limit values set within the EU Air Quality Directive, and now implemented through the EU (Withdrawal Agreement) Act 2020. The Air Quality Standards Regulations are retained under the European Union (Withdrawal) Act 2018, (2018 c.16), but have been amended by the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (SI 2019/74) and the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (SI 2020/1313).
- Recommendations for mitigation to prevent or reasonably minimise any potentially significant effects identified.

5.4.3 Since the PEIR was completed, which supported the statutory consultation on the Scheme (December 2021 – February 2022), the following key changes have occurred which has resulted in the air quality assessment being updated:

- The design of the Scheme has been revised as described in Chapter 2 – The Scheme (application document TR010063 – APP 6.2).
- The Scheme specific traffic model has been revised and updated traffic data has been made available for the air quality assessment.

[10] uk-air.defra.gov.uk. Background Mapping Data For Local Authorities - DEFRA, UK. [online] Available at: https://uk-air.defra.gov.uk/data/laqm-background-home [Accessed September 2022].
[11] uk-air.defra.gov.uk. 2020. 2020 NO_2 and PM Projections Data (2018 Reference Year) - DEFRA, UK. [online] Available at: https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data [Accessed September 2022].

- Updated Defra air quality assessment tools and datasets, and updated National Highways speed band emission rates which account for the 2021 Defra tools update, have become available.

Construction phase

5.4.4 A qualitative assessment of the likely effects on air quality from construction has been undertaken in line with DMRB LA 105. The construction dust risk potential of the Scheme to the receiving environment has been determined using Table 2.58a in DMRB LA 105.

5.4.5 For construction dust the number of sensitive receptors and their distance from the footprint of the construction works have been considered to determine the construction dust risk potential and the appropriate level of mitigation using Table 2.58b in DMRB LA 105.

5.4.6 Receptors within 200 m of the boundary of the Order limits were identified using Ordnance Survey (OS) MasterMap and Addressbaseplus data representing all current properties and addresses sourced from local authorities and objects without postal addresses. Address data was filtered for classifications sensitive to construction dust including residential properties, hospitals, GP surgery's, care homes, education establishments, libraries, sensitive commercial properties. The remaining sensitive receptors have been counted using GIS.

5.4.7 As construction works were expected to last more than 2 years (30 months) further examination of the potential impact of construction traffic was undertaken, in accordance with DMRB LA 105.

Operational phase

5.4.8 The air quality assessment has been undertaken following the DMRB LA 105, as well as Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management Technical Guidance (LAQM.TG22)[12].

5.4.9 The assessment has used the latest Defra air quality assessment tools and datasets (released November 2021) and latest National Highways speed band emission rates released 2022.

5.4.10 The assessment has been undertaken for NO_x, NO_2, PM_{10} and $PM_{2.5}$.

5.4.11 The assessment of operational effects was undertaken using Cambridge Environmental Research Consultants' ADMS Roads v5.0.0.1 (latest version at the time of assessment) dispersion modelling software to estimate the impact of the Scheme at selected representative sensitive receptor locations. The key scenarios included in the assessment were:

- the base year (2019) for model verification (NO_x, NO_2, PM_{10} and $PM_{2.5}$).
- Projected Base Year (2027) for long term trends assessment (NO_x and NO_2).
- First full opening year (2027) for both without the Scheme (Do Minimum) and with the Scheme (Do Something) (NO_x and NO_2).
- Future year (2042) both without and with the Scheme and the traffic associated with the strategic development sites (NO_2).

5.4.12 The DMRB LA 105 requires the local air quality assessment to be undertaken for the opening year, as this is likely to represent the worst case, given the expected improvements in emissions in future years, with a less polluting fleet.

5.4.13 For this Scheme, given that there is expected to be traffic growth associated with additional development as a result of the Junction 10 improvement, the 2042 scenario with development was also included in the assessment, to determine whether any increases in traffic after the opening year would outweigh the expected decreases in emission factors in the future. Additional receptors were also included in this scenario to represent the proposed new housing areas.

[12] DEFRA, 2022, Local Air Quality Management Technical Guidance 2022, August 2022. Available at: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

5.4.14 The hourly emissions data input to the dispersion model have been estimated using:

- National Highways speed band emission factors (based on EFT v11).
- Hourly flows of Light Duty Vehicles (LDV) and Heavy Duty Vehicles (HDV) during am, inter-peak, pm and off-peak periods.
- Traffic speeds input as a speed band category, determined in accordance with DMRB LA 105 (paragraph 2.29 – 2.38 and Appendix A) on speed banding.

5.4.15 In addition, information on road alignment, road width and local meteorological data (taken from Gloucestershire Airport for the base year 2019) have been input into the dispersion model. Further details on modelling setup are in Appendix 5.1 (application document TR010063 – APP 6.15).

Receptors

5.4.16 Representative receptors have been selected for the air quality assessment in accordance with DMRB LA 105 para 2.20 “Representative sensitive receptors shall be chosen to ensure that those receptors with the highest pollutant concentrations (closest to the road, junctions etc.) or anticipated to experience highest level of change (next to roads within the ARN with the largest change in the traffic screening criteria) are included in the air quality assessment".

5.4.17 Sensitive human health and designated habitat receptors for the purposes of air quality assessment are defined in DMRB LA 105 (paragraph 2.18 and 2.25) as:

- Residential properties, locations of susceptible populations e.g. schools, hospitals and care homes for the elderly, or any other location where a member of the public may be exposed to an air pollutant for the relevant regulated time period.
- Designated habitats with statutory designations (special protection areas (SPA), special areas of conservation (SAC), Ramsar sites, sites of special scientific interest (SSSI), and local nature reserves (LNR)), and habitats with non-statutory designations (local wildlife sites (LWS), nature improvement areas (NIA), ancient woodland (AW) and veteran trees containing habitats sensitive to nitrogen deposition.

5.4.18 To examine air quality conditions within the allocated housing areas associated with the strategic development sites, five transects from the boundary up to 200 m from the road were examined near to the M5, A4019 and B4634 to allow concentrations to be estimated at receptor points located at regular intervals across the sites. The transects were located between the closest boundary to the affected road up to 200 m from the road centreline.

Assessment scenarios

5.4.19 Traffic data were provided for the following scenarios:

- Base year (2019).
- Opening year (2027) with and without Scheme.
- Future year (2042) with Scheme and strategic development sites.

5.4.20 Pollutant concentrations have been modelled at selected sensitive receptors for the base year, opening year, and future year to determine the impact of the Scheme on local air quality.

5.4.21 Traffic data were provided to allow the without Scheme (do-minimum (DM)) and with Scheme (do-something (DS)) scenarios to reflect the changes after implementation of the M5 Junction 10 Scheme. The DM and DS scenarios for the opening and future years include committed developments and highway improvements which are expected to be completed within the relevant timescales as detailed in section 5.10 Cumulative Effects.

Traffic conditions

5.4.22 Traffic conditions vary throughout the course of a day and a 24-hour profile has been applied in the model to improve the estimation of vehicle emissions in each hour of the year, based on am, inter-peak, pm and off-peak period traffic flows. The ADMS-Roads

model has been set up with a unit emission rate entered into the model for each road link and a time varying factor file created containing the estimated emissions for each hour.

Background concentrations

5.4.23 The output from the ADMS dispersion model provides the contribution from road traffic emissions to annual mean concentrations at discrete receptor points. These incremental concentrations are combined with estimates of background concentrations, to account for other sources of air pollution, and derive total annual mean concentrations.

5.4.24 Background concentrations were derived from DEFRA's background maps with a 2018 reference year. To avoid double counting, the contribution from modelled emission sources (i.e. the in-square contributions from Motorways, Trunk A roads and Primary A-roads) within DEFRA's background maps were removed from the total background concentrations, using the NO_2 Adjustment for NO_x sector removal tool v8.0, August 2020 for the NO_2 concentrations.

NOx to NO_2 conversion

5.4.25 To derive total NO_2 concentrations from modelled road NO_x concentrations, and allow comparison with the air quality criteria, the method described in LAQM.TG22 has been used. Total annual mean NO_2 concentrations have been calculated from modelled road NO_x and background NO_2 concentrations, using the latest version of the 'NO_x to NO_2 calculator v8.1[13] (August 2020).

5.4.26 In addition to the modelled road NO_x and background NO_2 data, DEFRA's NO_x to NO_2 calculator requires a local authority area to be specified to determine regional oxidant concentrations, and a traffic mix to determine the proportion of primary NO_2. The local authority areas selected in the conversion tool were "Cheltenham" and "Tewkesbury" based on the location of the relevant receptors; the traffic mix selected was "All other urban UK traffic" for the modelled roads".

Verification

5.4.27 Model verification is the process of determining the local area performance of the base year model in comparison with measured data. The verification step involves comparison of modelled pollutant concentrations at suitable monitoring sites with monitored values that are representative of the base model period (in this case 2019).

5.4.28 Where there is a disparity between modelled and measured concentrations, and where further improvements to input data are not possible, an appropriate adjustment factor is determined to correct for systematic bias. This adjustment is applied to the base year and future year model outputs.

5.4.29 Verification has been undertaken in accordance with LAQM.TG22. Details of the adjustment factors and the model adjustment zones are presented in Appendix 5.1 - Air Quality Emission Modelling (application document TR010063 – APP 6.15).

5.4.30 In the absence of PM_{10} monitoring data for the study area against which modelled concentrations can be verified, the model adjustment factor derived for NO_x was also applied to modelled PM_{10} concentrations. This approach is suggested within LAQM.TG22, which states that "In the absence of any PM_{10} data for verification, it may be appropriate to apply the road-NO_x adjustment to the modelled road-PM_{10}". This approach is considered likely to provide a conservative estimate of the contribution of modelled roads to ambient PM_{10} concentrations and the estimated $PM_{2.5}$ concentrations in the base year.

Long Term Trends

5.4.31 An assessment has been undertaken in accordance with DMRB LA 105 (paragraph 2.47 – 2.55) on the assessment of future NO_x and NO_2 projections on Long Term Trends (LTT), to account for future year uncertainties in emissions. Air quality assessments following the latest Defra emission factors have been considered to be overly optimistic in some cases. An additional scenario (projected base year) is required to enable the gap analysis to be

[13] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator

completed. The projected base year scenario is modelled using the base year traffic data with the opening year vehicle emission factors and background concentrations. The results for the opening year are then adjusted to represent the observed long-term trend profile.

5.4.32 The National Highways Long Term Trend Euro 6 (LTTE6) projection factors have been applied to modelling results for annual mean total NO_2 at human health receptors and annual mean total NO_x and road NO_2 at ecological receptors in the opening year. Gap analysis has not been applied to the future year scenario in 2042, as this year is beyond the scope of the Long Term Trend analysis which covers the period up to 2030. Beyond this year, the assessment can be considered conservative in any case, as the emissions factors and background data do not include future fleet projections with higher proportions of electric vehicles.

Particulate matter

5.4.33 In accordance with the DMRB LA 105 (paragraphs 2.21.2 and 2.21.3), an assessment of PM_{10} in the opening year should only be included where PM_{10} concentrations exceed air quality objectives in the base year (2019).

5.4.34 The DMRB LA 105 (paragraph 2.21.4) notes that there is no requirement to include $PM_{2.5}$ in the air quality assessment as the UK currently meets its legal requirements for the achievement of the $PM_{2.5}$ air quality limit value. PM_{10} concentrations can further be used to demonstrate that the Scheme does not have an impact on the $PM_{2.5}$ air quality objective. $PM_{2.5}$ concentrations in 2019 have been estimated by applying the guidance detailed in LAQM.TG(22) and multiplying the PM_{10} concentration by the ratio of 0.7.

Comparison with short-term objectives

Nitrogen dioxide

5.4.35 Since only annual mean concentrations have been calculated using the air dispersion model, commentary on potential exceedances of the hourly mean NO_2 standard, (Hourly mean concentration should not exceed 200 µg/m^3 more than 18 times a year), has been made with reference to LAQM.TG22. The guidance suggests that if annual mean concentrations of NO_2 do not exceed 60 µg/m^3 then it is unlikely that hourly mean concentrations would exceed the relevant objective, which allows for 18 exceedances of the hourly standard in a calendar year.

Particulate matter

5.4.36 Annual mean PM_{10} concentrations are used to derive the number of exceedances of the 24-hour mean PM_{10} criterion, of which 35 are allowed in a calendar year. The method described in LAQM.TG22 was applied. This method is based on the relationship between the number of 24-hour exceedances of 50 µg/m^3 and the annual mean concentration derived from UK Automatic Network Sites. This is described in Equation 1.

Equation 1 – Calculation of PM_{10} 24-Hour Mean Exceedances

Number of exceedances of 24-hour mean of 50 µg/m^3 = $-18.5 + 0.00145 * a^3 + (206/a)$

Where ‘a’ = total annual mean PM_{10} concentration

Compliance risk assessment

5.4.37 Evaluation of compliance with limit values was undertaken in accordance with DMRB LA 105 (paragraphs 2.64 – 2.87, using the latest baseline scenario from Defra’s PCM model (2018 reference year).

5.4.38 Where roads within the extent of the ARN are identified, Defra PCM model receptors were included at the following locations to inform the compliance risk assessment:

- The nearest qualifying feature along each PCM link where concentrations are highest.

- A point 4 m from the running lane in the same general location as the qualifying feature for comparison against the national PCM modelled point.

5.4.39 Qualifying features represent locations which meet Defra's interpretation of the Air Quality Directive and include all areas of public access (footpaths, parks, pavements) and sensitive receptors (residential properties, schools, hospitals and elderly care homes), within 15m of the kerbside, but not within 25m of a junction.

5.4.40 Where there are qualifying features along the PCM link the air quality model will be used to model NO_2 concentrations at

- The nearest qualifying feature along each PCM link where concentrations are highest.
- A 4m point from the running lane in the same location as the qualifying feature for comparison against the national PCM modelled point as a local model 4m validation point.

5.4.41 Where modelling is completed, the project modelling at 4m shall be tabulated with the PCM road census id, the modelled NO_2 concentration from either the PCM model or local authority local air quality plan for the base year comparison against the PCM model. Where the difference between the PCM model or local air quality plan result and the project model result is greater than 10%, where there are modelled exceedances in either data set, the inputs into the project model should be reviewed to ensure the traffic inputs and modelling outputs are robust.

Designated habitats assessment

5.4.42 Assessment of the impact of the Scheme on sensitive designated habitats has been undertaken in accordance with DMRB LA 105 (paragraph 2.43 - 2.46 and para 2.97 to 2.102).

5.4.43 The assessment has been undertaken based on the following key inputs and assumptions:

- Designated habitats with statutory and non-statutory designations within the air quality study area for the Scheme have been identified in accordance with DMRB LA 105 (paragraph 2.18 and 2.25).
- Relevant habitat types have been obtained from APIS. Critical loads have been obtained from APIS. Where sites did not contain habitats sensitive to nitrogen deposition, then the site was excluded from further assessment.
- Receptor locations representative of those designated habitats sensitive to nitrogen deposition have been included in the air quality dispersion model.
- LTTE6 projection factors have been applied in accordance with DMRB LA 105 (paragraph 2.47 – 2.55) to annual mean road NO_2 at ecological receptors.
- The road NO_2 was converted to dry nutrient nitrogen deposition rates in kg N/ha/year using the conversion rates for "woodland" and "grassland" habitats given in DMRB LA 105 (para 2.44.1). Where habitat information was not available at screening (for the non-statutory designated ecological sites) nitrogen deposition rates were calculated for both "woodland" and "grassland" habitat types and assigned according to the habitat type identified from satellite photography, accessed using google earth, for each receptor location.
- The background nitrogen deposition rate at each designated site has been obtained from the APIS website for the mid year of 2019 - 2021. For the Scheme opening year of 2027 no reduction in background nitrogen deposition was calculated on a precautionary basis.
- The contribution to the road nitrogen deposition rates from ammonia emissions has been determined with the use of the National Highways Ammonia N Deposition Tool_v2. The contribution to modelled road NO_x concentrations was determined for light and heavy vehicles. The road NO_x contributions and habitat type (woodland or grassland) were used to calculate the equivalent ammonia concentrations. The tool was used to calculate the contribution to total nitrogen deposition rates from ammonia emissions attributed to vehicle emissions.

- Background nitrogen deposition rates, modelled road NO_x and derived road ammonia contributions were combined to give a total nitrogen deposition for each ecological receptor location, and the change in nitrogen deposition rate with the Scheme was calculated at each receptor point.
- Each ecological receptor location was screened against the DMRB LA 105 designated habitat screening criteria. The screening criteria were considered to be exceeded where total nitrogen deposition was greater than the relevant lower critical load, and the increase in nitrogen deposition was greater than 1% of the relevant lower critical load.

Significance criteria

Magnitude of impacts

5.4.44 Descriptors for magnitude of change in ambient concentrations of NO_2 and PM_{10} are provided in DMRB LA 105 (Table 2.91). Only those receptors predicted to exceed relevant air quality thresholds have been considered when determining significance for human health.

5.4.45 The changes in magnitude descriptors depend on the change in concentration relative to the air quality thresholds shown in Table 5-2. Where the change in concentrations is 1% or less of the objective (≤0.4 µg/m^3) this is considered an imperceptible change.

Table 5-2 - Magnitude of change criteria for local air quality human health receptors

Magnitude of change in concentration	**Value of change in annual mean NO_2 and PM_{10}**
Large (>4 µg/m^3)	Greater than 10% of the air quality objective (4 µg/m^3)
Medium (>2 µg/m^3)	Greater than 5% of the air quality objective (2 µg/m^3)
Small (>0.4 µg/m^3)	Greater than 1% of the objective (0.4 µg/m^3)
Imperceptible (≤0.4 µg/m^3)	Less than or equal to 1% of objective (0.4 µg/m^3)

Table source: DMRB LA 105 (Table 2.91)

Significance of effect

Local air quality

5.4.46 Evaluation of the significance of the effect of the Scheme on human health has been undertaken in accordance with DMRB LA 105 (paragraph 2.89 to 2.96). The number of receptors that exceed relevant air quality thresholds and fall within the 'small', 'medium' and 'large' magnitude of change categories has been calculated and compared to the guidelines presented in Table 5-3.

5.4.47 Significant air quality effects are only identified for receptors where AQS objectives are exceeded with or without the Scheme. Where the changes in concentrations are less than 1% of the AQS objective (i.e. less than 0.4 µg/m^3) then the change at these receptors is considered to be 'imperceptible' and can be scoped out of the judgement on significance.

Table 5-3 - Number of receptors constituting a significant effect for air quality

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4 µg/m^3)	1 to 10	1 to 10
Medium (>2 to 4 µg/m^3)	10 to 30	10 to 30
Small (>0.4 to 2 µg/m^3)	30 to 60	30 to 60

Table Source: DMRB LA 105 (Table 2.92)

Compliance risk assessment

5.4.48 The air quality modelling is used to inform the compliance risk assessment to determine whether the Scheme leads to a risk to the UK's reported ability to comply with the Air Quality Directive in the shortest timescale possible. No compliance risk is concluded where:

- there are no modelled exceedances of the air quality thresholds for any PCM link, or
- there are modelled exceedances of the air quality thresholds for any PCM link, but the change in annual mean NO_2 concentrations between the do minimum and do something is less than or equal to +/-0.4 µg/m^3, or
- the Scheme does not materially impact on measures within local air quality or national plans for the achievement of compliance.

5.4.49 The compliance risk assessment is used to establish whether a project triggers a significant air quality effect based on the following factors:

- the qualifying feature being affected e.g. little used/small section of footpath, heavily used footpaths (such as high streets with cafes etc), residential properties, school etc.
- the level of change in concentration as a result of the Scheme and whether it's an overall worsening or improvement.
- the number of features being affected e.g. number of PCM links resulting in a deterioration in air quality as a result of the Scheme.

5.4.50 Where a significant effect is identified this must be supported by evidence regarding whether the Scheme has:

- affected the reported ability of the zone to comply with the latest reported timescales,
- caused a zone to be non-compliant, and or
- materially affected the national / local air quality plan in relation to achievement of compliance in the quickest time possible.

Designated habitats

5.4.51 Evaluation of the significance of the effect of the Scheme on designated habitats has been undertaken in accordance with DMRB LA 105 (paragraph 2.97 to 2.102, and Figure 2.98). Where the nitrogen deposition lower critical load for the relevant habitat is both exceeded and the increase in nitrogen deposition is expected to be greater than 1% of the lower critical load, then the magnitude of change of the nitrogen deposition was considered further. Where the increase in nitrogen deposition was greater than 0.4 N/ha/yr then the significance of air quality impacts on designated habitats has been assessed by a competent expert for biodiversity.

Evaluating significance

5.4.52 The overall evaluation of the significance of the effects has been undertaken in accordance with DMRB LA 105 (paragraph 2.103 to 2.106) based on a combination of the likely effects of the Scheme on human health, designated habitats and the outcome of the compliance risk assessment.

Limits of deviation

5.4.53 The assessment has been conducted within the Limits of Deviation (LoD) outlined within Chapter 2 - The Scheme (application document TR010063 – APP 6.2). The vertical and lateral LoD for the Scheme have been reviewed with respect to sensitive receptors identified within this ES chapter, and would not affect the conclusions of the assessment reported in this chapter.

5.5 Consultation

5.5.1 Full details of consultation undertaken is provided in Consultation report (TR010063 – APP 5.1 and TR010063 – APP 5.2), a summary is set out below.

5.5.2 A Non-Statutory Consultation took place in the Autumn of 2020 to help identify a preferred option for the new Junction 10. Based on that consultation, the preferred route announcement took place on the 16 June 2021.

5.5.3 A scoping request to PINS included an Environmental Scoping Report (published on the PINS website in July 2021) and a Scoping Opinion was received from PINS in August 2021. A response to the comments received in the Scoping Opinion is provided as Appendix 1.2 (application document TR010063 – APP 6.15).

5.5.4 Consultation on the methodology adopted for the PEIR Air Quality chapter was undertaken with CBC and TBC Environmental Health teams. Responses were provided by CBC and TBC which included provision of baseline air quality monitoring data and local knowledge to ensure that the assessment included specific receptors of concern.

5.5.5 Consultation with National Highways was also undertaken, which required the assessment methodology to follow the DMRB LA 105, as the Scheme falls within the Strategic Road Network (SRN). This has been complied with. The method has not changed from that detailed in the PEIR with the exception that the traffic data used in the assessment for this ES has been derived from period flows including the am, inter-peak, pm and off-peak periods in accordance with the requirements in DMRB LA 105 for a detailed assessment. The air quality study area presented in this ES has thus been revised slightly from that included in the PIER, as a result of small changes to the affected road network.

5.6 Baseline conditions

5.6.1 The Scheme extent is located within the administrative areas of CBC and TBC, with a small section of the air quality study area being located within Gloucester City Council. As such, this baseline conditions section focusses on information within the CBC and TBC administrative areas.

Establishing study area

5.6.2 The air quality study areas were defined in accordance with DMRB LA 105 Air Quality[14].

5.6.3 For the likely effects of construction dust, the study area was defined as the area within 200 m of all construction activity, taken to be the boundary of the Order limits, and considers sensitive receptors within the relevant distance bands (0-50 m, 50-100 m and 100-200 m) from construction activities (DMRB LA 105 paragraph 2.57). The study area

[14] Highways England (2019). Design Manual for Roads and Bridges (DMRB) 'LA 105 Air Quality', November 2019. Available at https://www.standardsforhighways.co.uk/prod/attachments/10191621-07df-44a3-892e-c1d5c7a28d90 [Accessed September 2022]

for construction dust for the Scheme is provided in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.2 – Construction dust assessment.

5.6.4 There are approximately 32 potentially sensitive receptors that will be demolished as part of the Scheme, to make space for the new M5 Junction 10 and A4019 layout. These buildings have not been included in the assessment of the Scheme.

5.6.5 The air quality study area, for assessment of the operational phase, is determined in accordance with traffic scoping criteria set out in the National Highways DMRB LA 105 (paragraph 2.1) The following scoping criteria have been applied based on the comparison between the 'with Scheme' (Do Something) and 'without Scheme' (Do Minimum) traffic data:

- Road alignment will change by 5 m or more. or
- Daily traffic flows (two way) will change by 1,000 annual average daily traffic (AADT) or more. or
- Heavy Duty Vehicle (HDV) flows (two way) will change by 200 AADT or more. or
- A change in speed band.

5.6.6 The changes are applied to roads, rather than modelled links, and so where relevant are determined under two-way traffic conditions. The AADT and HDV criteria have been applied to two-way traffic data (for motorways and ordinary roads). The speed band criteria have been applied to both one way and two-way traffic data and have considered speeds for all modelled time periods (AADT, AM (0700-1000), inter-peak (1000-1600), PM (1600-1900) and off-peak (1900-0700).

5.6.7 The Affected Road Network (ARN) is based on all roads meeting the traffic scoping criteria and adjoining roads within 200 m. An assessment is required for air quality where there are receptors identified within 200 m of roads that trigger the traffic scoping criteria. All road links within 200 m of these relevant receptors have been included (where traffic data were available) in the air quality assessment and form part of the overall study area. This distance of 200 m from roads is industry best practice specified in DMRB LA 105. The air quality study area is situated within the administrative boundaries of Cheltenham Borough Council (CBC), Gloucester City Council and Tewkesbury Borough Council (TBC).

5.6.8 There are no designated habitats with a national and/or international statutory designation within the air quality study area. There are, however, ecological receptors representing local sites and one veteran tree, which may contain habitats sensitive to nitrogen deposition, and so have been included in the air quality assessment. A receptor point at the site boundary closest to the road edge has been included to represent the following designated habitats:

- Norton (A38) (Local Wildlife Site).
- Pegmore Farm, The Leigh 'Meadow 2' LWS (Local Wildlife Site).
- Cotswold Farm, The Leigh (Local Wildlife Site).
- Tewkesbury Nature Reserve (Local Wildlife Site).
- Tewkesbury Railway Line (Disused) (Local Wildlife Site).
- Walton Cardiff Ponds (Local Wildlife Site).
- Veteran Tree, located near Mill House east of Withybridge Lane.
- Hayden Sewage Treatment Works (Proposed Local Wildlife Site).

5.6.9 The air quality study area is shown in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.1 – Air quality constraints.

Air Quality Management Areas

5.6.10 The CBC AQMA 2020 declared in September 2020 due to exceedances of the NO_2 annual mean AQS objective, is located 1.5 km from the Scheme and within 200 m of the ARN. This designation replaces the previous CBC borough-wide AQMA which was declared in 2011.

5.6.11 TBC had declared one AQMA in 2008 encompassing individual roads within Tewkesbury town centre. This AQMA was revoked in August 2020 following several years where monitoring had demonstrated that concentrations were below the national air quality objectives.

5.6.12 A summary of the AQMA is presented in Table 5-4.

Table 5-4 - AQMA declared by CBC within the air quality study area

Name	AQ criteria exceeded	Description
Cheltenham Borough Council AQMA 2020	Annual mean nitrogen dioxide NO_2	High Street from the junction of Gloucester Road and Tewkesbury Road to the junction of Burton Street; Poole Way; and Swindon Road from the junction of Poole Way to St Georges Street.

SOURCE: https://uk-air.defra.gov.uk/aqma/

Continuous monitoring

5.6.13 Air quality monitoring is undertaken at a national and local authority level and is a key component of LAQM. Measurements of pollutant concentrations are made by analytical instruments that measure continuously, and simpler sampling devices such as diffusion tubes which give longer period results (typically monthly, to calculate an annual mean concentration).

5.6.14 There are no monitoring sites within TBC that monitor PM_{10} or $PM_{2.5}$. CBC deployed a number of AQ mesh monitoring units to record NO_2, PM_{10} and $PM_{2.5}$ results near sources of key concern. The 2021 Annual Status Report did not report results from the AQ mesh units and the 2022 ASR has not yet been made publicly available. The nearest PM_{10} and $PM_{2.5}$ monitoring sites reported through the national Automatic Urban and Rural Network is 50 km south-west of the Scheme in Chepstow.

5.6.15 The nearest Continuous Monitoring Station (CMS) to the Scheme is located at St Georges Street, in Cheltenham town centre approximately 5 km south-east of the location of the current M5 Junction 10 and 300 m south-east from the nearest affected link of the ARN. The CMS monitors concentrations of NO_2, as shown in Table 5-5.

Table 5-5 - Annual mean NO_2 concentrations - CMS monitoring results (µg/m^3)

Site ID	Site name	Site type	X	Y	2017	2018	2019	2020	2021
CM1	St Georges Street	Kerbside	394760	222878	36.0	32.7	36.0	24.7	25.3

5.6.16 The monitored values show that NO_2 concentrations as an annual mean approached but did not exceed the AQS objective of 40 µg/m^3. There were no reported exceedances of the short-term hourly objective of 200 µg/m^3 between 2017 and 2021.

Passive monitoring

5.6.17 Annual mean NO_2 concentrations are also measured by both CBC and TBC using passive diffusion tubes. There are several diffusion tubes located close to the Scheme. Concentrations of NO_2 measured at the diffusion tube locations within the air quality study area are presented below in Table 5-6.

5.6.18 The diffusion tube results show that NO_2 concentrations at roadside locations approach and in some cases exceed the annual mean AQS objective of 40 µg/m^3. The data show a general improvement in conditions between 2017 and 2021. Given that monitoring since 2020 has been affected by national lockdowns through the Covid 19 pandemic, trend analysis was not completed on recent monitoring data.

5.6.19 It is notable that the locations with NO_2 concentrations exceeding the 40 µg/m^3 annual mean NO_2 objective in 2017 - 2019 (Site ID 4 and 5) were along the A4019 High Street within the AQMA. Monitoring sites 4 and 5, which are located within the air quality study area, have relevant areas of public exposure at roadside locations and are likely to be the most sensitive to air quality impacts of the Scheme. No exceedances were recorded in 2020 and 2021, however traffic was affected by national lockdowns during the Covid 19 pandemic.

Table 5-6 - NO_2 diffusion tube monitoring results (µg/m^3)

Site	Site name	Type	X	Y	2017	2018	2019	2020	2021
Cheltenham Borough Council									
4	2 Gloucester Road	Road side	394237	223006	**45.4**	**41.2**	**43.1**	32.3	31.5
5	422 High St	Road side	394350	222923	**49.9**	**45.2**	**46.5**	32.9	34.5
13	54 Albion Street	Kerb side	395207	222465	34.8	31.3	30.4	22.3	22.0
22	Hatherley Lane	Road side	391178	221641	-	34.9	33.4	25.2	25.0
28	Princess Elizabeth Way North	Road side	393081	223643	-	38.4	38.2	31.2	31.3
29	Princess Elizabeth Way South	Road side	392066	222540	-	31.2	33.7	24.7	25.3
32	Gloucester Rd / Stoneville St	Road side	394180	222982	-	-	-	25.3	26.8
35	Berkeley Place	Road side	395340	222071	-	-	-	19.1	20.2
37	A40 PE Way Roundabout	Road side	391869	222084	-	-	-	23.9	22.2
Tewkesbury Borough Council									
14N	69 Sussex Gardens	Road side	387915	217389	24.9	26.1	23.6	17.7	18.1
15N	Comus Bamfurlong	Road side	389714	221845	26.4	27.1	25.7	14.8	14.7
16N	15 Withybridge Gardens	Road side	390461	225544	26.0	24.3	22.0	16.7	19.4
55N	Stoke Road, Bishops	Road side	395123	227638	30.9	19.0	18.8	14.3	14.8

Bold values exceed Annual NO_2 mean concentration of 40 µg/m^3

Scheme specific air quality monitoring

5.6.20 A site-specific six-month monitoring survey, conducted between July and December 2019, was conducted to provide information on baseline conditions and for model verification purposes. The survey comprised ten locations, sampled using passive NO_2 diffusion tubes in triplicate. The locations were selected to provide positions to allow model verification on road links outside the Cheltenham town central urban area and near to the Scheme. With

permission of CBC, one of the locations was co-located with the St Georges Street CMS (CMS1), to allow bias adjustment to be conducted using local data.

5.6.21 Annualised and bias-adjusted concentrations are provided in Table 5-7. Roadside locations on principal roads within the AQMA show concentrations approaching 40 µg/m^3 (D1 and D2), however these locations are not positions of relevant public exposure. All other locations recorded concentrations below 35 µg/m^3.

Table 5-7 - Scheme specific NO_2 diffusion tube monitoring survey – 2019 (µg/m^3)

Location	Description	Grid reference (m)	Annualisation factor	Adjusted annual mean concentration
D1	St George's Street - CMS Co-location	394766, 222871	1.03	35.3
D2	A40 - GCHQ	391718, 222000	0.95	34.7
D3	A4019 - West of M5 J10	389856, 226028	1.03	19.7
D4	Withybridge Gardens	390688, 225434	1.03	22.6
D5	A4019 - Near Homecroft Drive	392184, 224667	1.03	29.9
D6	B4634 - Near to Hayden Lane	390136, 223670	1.03	32.8
D7	B4634 - Near to Pilgrove Way	391789, 224221	1.03	21.3
D8	Withybridge Lane - Withybridge Farm	390460, 224669	1.03	22.5
D9	Lowdilow Lane	391521, 226422	1.03	17.0
D10	Princess Elizabeth Way	392365, 223221	1.03	27.4

Local bias adjustment factor 1.009, based on comparison between CBC CMS1 and site D1

Background mapping

5.6.22 Estimates of background pollutant concentrations in the UK are available on the DEFRA UK-Air website[10]. The background estimates, which are a combination of measured and modelled data, are available for each 1 km grid square throughout the UK for the years 2019 to 2030. The estimated annual average background concentrations in the study area for the baseline year (2019) and the Scheme opening year (2027) and future year (2042) have been reviewed with the maximum and minimum values presented in Table 5-8 for the pollutants NO_2, PM_{10} and $PM_{2.5}$. Mapped background annual mean concentrations are only available up to 2030, therefore 2042 background data has been represented by data available in 2030. All concentrations were below the relevant AQS objectives.

5.6.23 The estimated background mapping results for PM_{10} and $PM_{2.5}$ are less than half of the annual mean objectives.

Table 5-8 - DEFRA mapped background concentrations, 2019 and 2027 and 2030 (µg/m^3)

Grid square (x,y)	2019 background concentration (µg/m^3)			2027 background concentration (µg/m^3)			2030 background concentration (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
Minimum	7.2	12.4	8	5.6	11.5	7.3	5.3	11.5	7.3
Maximum	19.6	17	10.6	14.3	16.1	9.8	13.4	16	9.7

Human Health Receptors

5.6.24 It is best practice, in accordance with DMRB to select human health receptors which are expected to have the largest changes in pollutant concentrations, as well as those likely to have the highest concentrations. These include those receptors closest to the roads affected by the Scheme, those that are representative of large numbers of properties, those that house the young, the elderly and other susceptible populations, as well as those near junctions, or locations with queuing traffic within 200 m of the ARN.

5.6.25 The receptors selected for assessment are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 1.1, and include sensitive receptors within the study area, including those near M5 junction 10 and in the Cheltenham AQMA.

PCM model links within the ARN

5.6.26 DEFRA's PCM model provides estimates of roadside concentrations of annual mean NO_2 and PM_{10}, which have historically been used in reporting to the EU regarding compliance with the limit values.

5.6.27 There are 15 links in the PCM model which intersect with the ARN. The census ID and estimates of roadside NO_2 concentrations in 2018 (earliest available year), 2019 (base year) and 2027 (opening year) are presented in Table 5-9.

Table 5-9 - Road links in PCM model which intersect with the ARN model

CENSUS_ID	Road Number	Roadside NO2 concentration 2018	Roadside NO2 concentration 2019	Roadside NO2 concentration 2027
802017100	A438	32.2	30.6	19.9
802089216	A438	18.6	17.8	11.4
802027679	A4019	26.8	25.7	17.4
802018552	A4019	25.6	24.4	16.2
802028699	A4013	31.6	30.2	19.9
802018275	A4019	24.1	23.1	15.7
802038656	A46	22.7	21.7	14.5
802048638	A46	18.5	17.7	12.1
802058259	A46	24.7	23.5	15.5
802099605	A46	22.8	21.9	14.6
802048637	A46	23.8	22.8	15.2
802077985	A40	40.6	38.7	24.4
802058258	A40	25.9	24.7	15.8
802078014	A38	21.1	20.2	13.1
802089265	A38	26.2	25.1	16.7

5.6.28 There is one PCM link within the ARN which exceeded the Limit Value in 2018 with a concentration of 40.6 µg/m^3, this is part of the A40 (PCM census ID 802077985) running from Arle Court Roundabout to the A4013 at Princess Elizabeth Way Roundabout on the western side of Cheltenham. However, the PCM model estimates that compliance should have been achieved by 2019 (38.7 µg/m^3). Emissions of NO_2 on this link are forecast to reduce with the Scheme when compared to the DM scenario so further investigation of the Scheme's impact on compliance at this link is not required.

5.6.29 Estimates at all other PCM links which intersect with the ARN were less than 36 µg/m^3 in 2018, and concentrations continue to fall in future years. There are no PCM links with exceedance of the Limit Value in 2019 (base year) and 2027 (opening year).

5.6.30 Traffic changes at the ARN links which intersect with the PCM links are all forecast to have a reduction in flow with the Scheme in place. Therefore no further assessment of compliance risk is required.

Designated habitats within the study area

5.6.31 Assessment of likely effects of changes in nitrogen deposition rates has been undertaken at identified sensitive designated habitats, in accordance with DMRB LA 105 (paragraph 2.43 – 2.46). The designation, relevant habitat types and critical loads were obtained in consultation with a competent expert for biodiversity and background nitrogen deposition rates at each designated site were obtained from APIS using the GIS app (www.apis.ac.uk/app, last updated on 10/07/2023). The values used in the assessment are shown in Table 5-10.

5.6.32 Background nitrogen deposition rates can be assigned on the basis of habitat type attributed as either "woodland" or "grassland" (for which there are different NO_2 to nitrogen deposition conversion factors). As woodland habitats have a higher nitrogen deposition rate, however, all sites were treated as woodland on a conservative basis.

Table 5-10 - Background Nitrogen Deposition Rates, Habitat Type and Critical Loads for Nitrogen Sensitive Designated Sites

Site Name	Designation	Habitat Type	Lower Limit of Critical Load (Kg N/ha/yr)	APIS 2019-21 background N-dep rate (max) (kg N/ha/yr)
Norton (A38) LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	30.1
Pegmore Farm, The Leigh 'Meadow 2' LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	30.1
Cotswold Farm, The Leigh LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	29.7
Tewkesbury Nature Reserve LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	28.9
Tewkesbury Railway Line (Disused) LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	28.8
Walton Cardiff Ponds LWS	Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	28.8
Veteran Tree	Veteran Tree	Broadleaved Mixed and Yew Woodland	10	29.5
Hayden Sewage Treatment Works	Proposed Local Wildlife Site	Broadleaved Mixed and Yew Woodland	10	29.9

5.7 Potential impacts

5.7.1 The Scheme has the potential to affect local air quality, both during construction and once operational. Any effect during construction would be temporary. Construction dust, construction traffic and local traffic management is assessed in accordance with DMRB LA 105.

Construction phase

Dust emissions

5.7.2 There is the potential for elevated dust deposition and soiling at properties within 200 m of the construction site boundary as a consequence of the works, if dust raising activities are not effectively controlled and mitigated. The level and distribution of dust emissions would vary according to the duration and location of activity, weather conditions, and the effectiveness of suppression measures. The Scheme has the potential for construction dust to affect approximately 646 human health receptors. There is one veteran tree identified within 50 m of the construction site boundary.

5.7.3 Receptors within 200 m of the boundary of the Order limits for the Scheme within the respective distance bands are shown in Table 5-11. This summarises the number of properties likely to be affected by construction dust. Sensitive receptor locations are shown in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.2 – Construction dust assessment.

Table 5-11 - Approximate number of sensitive receptors likely to be affected by construction

Total number of receptors	Receptor counts in distance bands		
0-200 m	0-50 m	50-100 m	100-200 m
646	219	153	274

5.7.4 The prevailing winds recorded at Gloucestershire Airport meteorological station are from the south west as shown in the wind rose in Appendix 5.1 (application document TR010063 – APP 6.15) Figure 1.1, suggesting the wind is more likely to transport dust raised on site to the north east of the construction works.

5.7.5 The Scheme comprises major motorway junction improvements and is therefore considered to have a “large” dust risk potential. Given that there are sensitive receptors within 50 m of construction activities, the construction dust risk potential for the Scheme is therefore classed as “high” (DMRB LA 105 Table 2.58a and Table 2.58b).

5.7.6 A summary of construction dust related mitigation measures is provided in the mitigation section below. Details of mitigation measures are included in an Environmental Management Plan (1st iteration) (application document TR010063 – APP 7.3).

Construction traffic

5.7.7 The construction period is forecast to last 30 months. As this extends beyond the 2 year qualifying period recommended in DMRB LA 105, further investigation of construction traffic flows was required.

5.7.8 Chapter 12: Materials and Waste (application document TR010063 – APP 6.10) identifies the likely impacts of material use and waste generation associated with the Scheme during construction. This assessment is based on a comparison between baseline data and quantities and types of materials to be used and waste generated during construction, in accordance with the Bill of Quantities (BoQ).

5.7.9 Chapter 12 reports the potential primary materials required for the Scheme and the potential waste quantities generated by the Scheme. The assessment considers mitigation measures to reduce the use of primary material and recycling of suitable waste quantities. Table 5-12 below represents the primary material quantities required after mitigation and acknowledges that 22% of primary materials detailed in Table 12.7 might

need to be recycled from outside the Scheme and be transported via the local road network. Chapter 12 sets out that all asphalt waste, all concrete waste and at least 70% of soil waste will be recycled within the Order limits for the Scheme and will not require transport on local roads. The waste quantities remaining after recycling and re-use are detailed in Table 5-12.

Table 5-12 – Data reported in Chapter 12: Materials and Waste (application document TR010063 – APP 6.10) Material quantities.

Material assets	Primary material quantity (tonnes)#	Additional 22% recycled from original primary material quantity (tonnes)*	Waste quantity (tonnes)^	Total quantities
Aggregate	707,840	235,156		
Asphalt	69,528	23,338	waste recycled within Order limits	
Concrete	43,470	10,401	waste recycled within Order limits	
Metal (Primary Material = Steel)	2,518	554	349	
Mixed	-	-	419	
Waste Soil (30% to waste, 70% recycled within RLB)	-	-	69,173	
Timber	-	-	72	
Total	823,356	269,449	70,013	1,162,818

#Primary material quantities required after mitigation reported in Chapter 12, Table 12.9 - Material quantities required after mitigation

*22% of Primary material quantity reported in Chapter 12, Table 12.7 Potential material quantities

^Waste quantities taking account of agreed recycling rates reported in Chapter 12, Table 12.8 Potential waste quantities, assuming empty trucks arrive to take waste out

5.7.10 Based on the worst case assumption that a total of 1,162,818 tonnes of material and waste will be transported into or out of the construction area using only 20 tonne capacity road transport wagons (in reality up to 20% of aggregate movements are expected to be transported by 30 tonne capacity wagons), over the 30 month construction period, this would result in an average of approximately 180 HDV movements per day (90 movements in and 90 movements out). This assumes deliveries are spread over a minimum of 5 working days per week, with an average of 4.3 weeks per month, over the 30 month construction period[15]. The resulting traffic represents the average increase in HDVs as a result of construction activities outside the Order limits for the Scheme. The proposed road transport wagons are classed as HDV and each delivery of material to site and the return journey from site is defined as two HDV movements.

5.7.11 Construction vehicle movements will be restricted where possible to specified preferred construction traffic routes. It will be for the appointed Principal Contractor to confirm the preferred construction traffic route to each construction area within the Traffic Management Plan.

5.7.12 In accordance with DMRB LA 105 assessment methodology, the appropriate traffic scoping criteria is a change of more than 200 HDV movements over 24 hours, over a two year period. As the estimated change in the number of HDV is less than 200 vehicle

[15] A total of 645 working days

movements per day, further consideration of construction vehicle movements is not necessary.

Local traffic management

5.7.13 Local traffic management during construction is detailed in section 2.8 of Chapter 2 – The Scheme (application document TR010063 – APP 6.2). The construction sequence is based on the following principles:

- The southbound off slip and northbound on slip roads to the M5 will be permanently closed to traffic when required by the phasing of the interchange construction.
- The contraflow on the M5 is to be kept to the minimum duration consistent with safely and efficiently constructing the Scheme.
- On the A4019, a minimum of one eastbound and one westbound traffic lane will be maintained throughout the construction period except for essential overnight works lane closures where single lane working under traffic control is deployed.
- Access is to be maintained throughout construction to Cooks Lane, Moat Lane, Withybridge Lane and The Green. While access from the A4019 will generally be maintained, local diversions may be required temporarily while the new junctions are constructed.
- Withybridge Lane to have access at all times from either the A4019 or the B4634.
- M5 and A4019 closures will be minimised as far as is practicable.
- Demolition of the existing A4019 overbridge is delayed until the full opening of the new junction layout. This will permit traffic to bypass the junction by using the new slip roads to exit and re-enter the M5. This will remove the need for motorway traffic to use local roads during the closure.
- Traffic contraflow on the M5 is minimised, consistent with safe, efficient construction of the new junction.

5.7.14 Construction related traffic management measures diverting roads will be in place between Month 11 and Month 30. A summary of the key road closures and road diversions reported in the construction sequence, presented in Table 2.1 of Chapter 2 – The Scheme (application document TR010063 – APP 6.2), are detailed below:

- Point 1 – Month 11 - M5 J10 SB off slip closed – The diversion route for traffic southbound on the M5, and seeking to leave at Junction 10, will be to Junction 11, and then use the A40 and A4013.
- Point 2 – Month 15 - M5 J10 NB on slip closed (all slips closed at J10) – The diversion route will continue to Junction 11, and then use the A40 and A4013. The diversion route for traffic seeking to join the M5 at Junction 10 and travel northbound, will be via the A38 and A46 to join M5 at Junction 9.
- Point 3 – Month 20 - new SB off slip open (J10 NB on slip still closed) - The diversion route will be via the A38 and A46 to join M5 at Junction 9.
- Point 4 – Month 27 - new SB on slip open (J10 NB on slip still closed) – The diversion route will be via the A38 and A46 to join M5 at Junction 9.
- Point 5 – Month 29 - new NB off slip open (J10 NB on slip still closed) – The diversion route will be via the A38 and A46 to join M5 at Junction 9.
- Point 6 – Month 30 - new NB on slip open, all slips now open and no diversions in place.

5.7.15 Construction traffic management measures diverting roads will be in place between Month 11 and Month 30 and are not expected to be in place for longer than 19 months. As the duration of local traffic management at all locations will be less than two years, following DMRB LA 105, further consideration of the construction traffic management is not necessary.

5.7.16 The effects of construction traffic and local traffic management measures will be temporary, and considered unlikely to significantly affect air quality.

Operational phase

Human health impacts – NO_2

5.7.17 Human health receptor details are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 1.1 and receptor locations are shown in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.3 – Air quality modelling results for human health receptors and designated habitats.

5.7.18 Estimated NO_2 concentrations at 90 selected human health receptors for the opening year are presented in Appendix 5.1 (application document TR010063 – APP 6.15) Table 2.1. The results at receptors are presented graphically in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.3. Receptor locations where the annual mean NO_2 air quality objectives are exceeded, either in the DM or DS scenario are clearly labelled with the magnitude of the change (DS NO_2 concentration minus DM NO_2 concentration) is described.

5.7.19 NO_2 concentrations for the future year with the Scheme and strategic development sites were also estimated at the 90 selected human health receptors as well as at 44 locations representing five transects across the strategic development sites within 200 m of the ARN. The receptor locations are detailed in Appendix 5.1 (application document TR010063 – APP 6.15) Table 1.2. The results are presented in Appendix 5.1 (application document TR010063 – APP 6.15) Table 2.2. The results at all receptors are presented graphically in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.4 – Human health and potential future receptors (2042).

5.7.20 The NO_2 concentrations in the future year confirm that the opening year is the worst case scenario for air quality at human health receptors, as results are higher in the opening year DS scenario than with the future year DS scenario with the strategic development sites. At the receptors within the transect locations in the future year, estimates are all less than 75% of the annual mean NO_2 objective, with no exceedances expected. The discussion below on results and significance of effects focusses on the opening year (2027).

5.7.21 There are three receptors: R_59 along High Street west of Cheltenham, (within the Cheltenham Borough Council Air Quality Management Area 2020); R_66 on High Street east of Cheltenham; and R_67 on Albion Street, Cheltenham, which are estimated to exceed the annual mean NO_2 AQS objective of 40 µg/m^3 in the opening year of 2027, without the Scheme in place. All of these receptors are near to roads with an expected reduction in AADT with the Scheme. The outcomes are identified for each receptor below.

5.7.22 The modelled annual mean NO_2 concentration at R_59 in 2027 is 53.8 µg/m^3 without the Scheme, and the modelled change is -1.6 µg/m^3, a 'small' decrease to 52.2 µg/m^3.

5.7.23 The modelled annual mean NO_2 concentration at R_66 in 2027 is 44.0 µg/m^3 without the Scheme, and the modelled change is -0.6 µg/m^3, a 'small' decrease to 43.4 µg/m^3.

5.7.24 The modelled annual mean NO_2 concentration at R_67 in 2027 is 44.4 µg/m^3 without the Scheme, and the modelled change is -0.9 µg/m^3, a 'small' decrease to 43.5 µg/m^3.

5.7.25 Although there are forecast exceedances of the annual mean NO_2 AQS objective at these three receptors, concentrations at these three receptors are all estimated to decrease with the Scheme in place. Receptor R_59 is within the Cheltenham AQMA, while receptors R_66 and R_67 are outside the AQMA boundary but within Cheltenham town centre.

5.7.26 There are three receptors, R_22, R_34, and R_44 which are expected to experience an increase in annual mean NO_2 concentrations, ranging between 2.2 and 3.6 µg/m^3, with the Scheme in place, as a result of increases in traffic along Stoke Road between the A4019 and Stoke Orchard, however, none of these receptors exceed the AQS objective in any scenario.

5.7.27 There are 25 receptors where, as a result of forecast increases in traffic flows, increases in annual mean NO_2 concentrations were forecast between 0.4 and 1.9 µg/m^3 between DS and DM scenarios in 2027, none of these receptors exceed the AQS objective in any scenario.

- Three receptors, R_72, R_73 and R_74 are located on Tewkesbury Road west of M5 Junction 10.
- eight receptors, R_29, R_32, R_39, R_47, R_51, R_53, R_62 and R_64 are located on Stoke Road between A4019 and Bishops Cleeve and A435 north of Stoke Road and Voxwell Lane.
- three receptors, R_14, R_15 and R_16 are located on the A38 between B4213 and Gupshill Roundabout south of Tewkesbury.
- one receptor, R_9 is located on A40 between M5 J11 and the A417 junction.
- three receptors, R_19, R_20 and R_21 are located on the M5 between J11 and J10.
- two receptors, R_68 and R_69 (Sheldon Cottages) are located on the A4019 between J10 and Stoke Road to the west.
- one receptor, R_31 is located south of Arle Court roundabout south of the A40 south west of Cheltenham.
- two receptors, R_49 and R_79 are located on Grevil Road and Brooklyn Road south of Princess Elizabeth Way in Cheltenham.
- two receptors, R_82 and R_83 are located on Gloucester Road and Brookbank Close south of the A4019 near the River Chelt.

5.7.28 In addition to the three receptors exceeding the annual mean NO_2 concentrations discussed in para 5.7.15 which are expected to have a decrease in concentrations, a further 46 receptors included in the assessment are forecast to have a decrease in annual mean NO_2 concentrations with the Scheme, as described below,

- six receptors, two of which are located along the B4634 near the junction with Withybridge Road, (R_23 and R_24), three located on Princess Elizabeth Way (R_45, R_48 and R_50), and one on the A4019 through Uckington, (R_90 now further from the road with the new alignment), are expected to experience a decrease in annual mean NO_2 concentrations of between 2 and 4 µg/m^3.
- 40 receptors across the study area are expected to experience a decrease of between 0.4 and 2 µg/m^3 with the Scheme as a result of a decrease in traffic flows on roads near to these receptors.

No exceedance of the air quality objective is expected to occur at these receptors in any scenario.

5.7.29 The remaining 13 receptors are estimated to experience an imperceptible change of less than +/- 0.4 µg/m^3 in annual mean NO_2 concentrations with the Scheme, with modelled annual mean NO_2 concentrations being well below, (less than 75%) the AQS objective at most of these receptors. The exception is at R_58 and R_61, located within the Cheltenham Air Quality Management Area, where annual mean NO_2 concentrations are close to the air quality objective but change with the scheme is imperceptible,

5.7.30 In line with LAQM.TG22 there are not expected to be any exceedances of the NO_2 1-hour mean AQS objective as there are no receptors with an annual mean concentration above 60 µg/m^3.

Significance of air quality effects

5.7.31 In order to evaluate the number of residential locations represented by each modelled receptor with an exceedance, to inform the significance of effects, further modelling was carried out to establish the number of receptors with an exceedance in the opening year, as shown in Table 5-12.

Table 5-13 - Identification of represented receptors in the Air Quality Dispersion Model

Receptor	Number of human health receptors represented	Magnitude of decrease
R_59	2 receptors on the northern side of the High Street	Small

R_66	13 receptors north and south on High Street	Small
R_67	3 receptors north and south on Albion Street	Small

5.7.32 The number of human health receptors informing the significance of effect on air quality are presented in Table 5-14, and are based on the numbers of receptors as identified in Table 5-12 above.

5.7.33 There were no receptors with an exceedance of the NO_2 annual mean AQS objective with an increase with the Scheme. Table 5-12 shows that 18 residential properties are expected to have a small decrease in concentrations.

5.7.34 There is not expected to be an overall significant adverse effect on air quality with the Scheme as all human health receptors identified with an exceedance are expected to have an improvement in annual mean NO_2 concentrations.

Table 5-14 - Information for judgement of significance for human health

Magnitude of change in annual average NO_2 (µg/m³)	**Total receptors with:**	
	Worsening of air quality objective already above objective or creation of new exceedance	Improvement of air quality objective already above objective or the removal of an existing exceedance
Large (>4)	0 (0 in total)	0 (0 in total)
Medium (>2)	0 (0 in total)	0 (0 in total)
Small (>0.4)	0 (0 in total)	18 (18 in total)

Human health impacts – Particulate matter

5.7.35 Modelled annual mean PM_{10} and daily exceedances for all receptors are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 2.3. There are no exceedances of the PM_{10} AQS objectives in the base year (2019), therefore, assessment of PM_{10} concentrations in the Scheme opening year (2027) has not been undertaken (as per the DMRB LA 105 (para 2.21.2)).

5.7.36 Estimated annual mean $PM_{2.5}$ for all receptors are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 2.3. There are no exceedances of the $PM_{2.5}$ AQS objectives in the base year.

Designated habitats

5.7.37 Receptors details are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 1.3. Receptor locations are shown in Appendix 5.2 (application document TR010063 – APP 6.15) Figure 5.3 - Air quality modelling results for human health receptors and designated habitats.

5.7.38 Total nitrogen deposition rates have been estimated for ecological receptors within relevant designated habitats. The total nitrogen deposition rate includes modelled road NO_2 contributions including National Highways LTTE6 projection factors and estimated ammonia contribution using National Highways ammonia deposition tool. The changes in nitrogen deposition rates for these habitats are provided in Appendix 5.1 (application document TR010063 – APP 6.15) Table 2.4.

Significance of designated habitat air quality effects

5.7.39 The total nitrogen deposition rates with the Scheme were estimated to be above the lower critical load at all receptors, however, the changes in nitrogen deposition rates showed a decrease or no change at all receptor points included in the assessment with the Scheme

in place. There is no deterioration as a result of the Scheme for ecological receptors so there is no significant effect on designated habitats.

5.8 Mitigation measures

Construction

Dust emissions

5.8.1 Construction activities for the Scheme represent a 'high' construction dust risk potential. Mitigation measures to control dust during construction will be specified within contract documentation and have been incorporated into the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4).

5.8.2 Appropriate mitigation measures are detailed below:

- Regular water-spraying and sweeping of unpaved and paved roads to minimise dust and remove mud and debris.
- Using wheel washes, shaker bars or rotating bristles for vehicles leaving the site where appropriate to minimise the amount of mud and debris deposited on the roads.
- Sheeting vehicles carrying dusty materials to prevent materials being blown from the vehicles whilst travelling.
- Enforcing speed limits for vehicles on unmade surfaces to minimise dust entrainment and dispersion.
- Ensuring any temporary site roads are no wider than necessary to minimise their surface area.
- Damping down of surfaces prior to their being worked. and
- Storing dusty materials away from site boundaries and in appropriate containment (e.g. sheeting, sacks, barrels etc.).
- Ensuring plant and equipment is maintained in good working order.
- Ensuring construction plant is not left running when not in use.
- Locating plant away from sensitive receptors (including residential and ecological).
- Securing an adequate water supply on site for the effective suppression of dust.

5.8.3 The precise measures, suitable for a 'high' construction dust risk will depend on the intended construction methods and the degree of dust generation for construction activities. The proposed mitigation measures will be reviewed by the appointed Principal Contractor and detailed in the Environmental Management Plan (2nd iteration) (when produced by the Principal Contractor in advance of construction), where the main roles and responsibilities of site personnel to ensure the proposed control measures will be implemented are detailed. If necessary, a programme and parameters for monitoring will be established, and the effectiveness of mitigation will be evaluated in line with DMRB LA 105 Table 2.108.1. It is expected that the use of standard industry best practice would mitigate the risk of construction dust impacts in the majority of cases.

Construction traffic

5.8.4 No specific mitigation is currently proposed for air quality given that there is unlikely to be a significant adverse effect. The appointed Principal Contractor will provide a plan that sets out the management of construction traffic (as part of the Traffic Management Plan). The Traffic Management Plan will detail the preferred construction traffic route to access each area of the site and each source of materials and the preferred routes during road diversions, in line with best practice guidance.

Operation

5.8.5 No specific air quality mitigation is required during the operational phase in relation to air quality given that there is not expected to be an overall significant adverse effect. No monitoring is planned.

Designated Habitats Assessment

5.8.6 No specific mitigation is currently proposed for air quality given that there is not expected to be a significant adverse effect on designated habitats within the air quality study area.

5.9 Residual effects

Construction

5.9.1 With the adoption of mitigation measures detailed in paragraph 5.8.2 and discussed in the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4), and additional detailed construction dust mitigation measures and construction traffic management measures agreed with the appointed Principal Contractor in the Environmental Management Plan (2nd iteration), no significant effects are likely during construction works.

Operation

5.9.2 The assessment of potential impacts on air quality presented in this report identified that there was not considered to be an overall significant adverse effect, and that no mitigation measures would be required. As no mitigation measures are proposed, the residual effects will be the same as those without mitigation.

5.9.3 As discussed in paragraphs 5.7.21 - 5.7.258, there are three receptors expected to exceed the annual mean NO_2 AQS objective in 2027 without the Scheme. Receptor R_59 are within the Cheltenham AQMA, while receptors R_66 and R_67 are outside the AQMA. However, as all three receptors are expected to have a decrease in annual mean NO_2 concentrations with the Scheme in place, there would not be an overall significant adverse effect.

5.9.4 The results at the remaining 87 receptors included in the assessment are expected to be below the annual mean NO_2 AQS objective both with and without the Scheme.

5.9.5 As discussed in paragraph 5.7.26 onward, there are three receptors close to Stoke Road between B4019 and Bishops Cleeve where, as a result of forecast increases in traffic flows, increases in annual mean NO_2 concentrations were forecast with changes of 2.2 to 3.6 µg/m^3 between DS and DM scenarios in 2027.

5.9.6 There are 25 receptors where, as a result of forecast increases in traffic flows, increases in annual mean NO_2 concentrations were forecast between 0.4 and 1.9 µg/m^3 between DS and DM scenarios in 2027.

- three receptors are located on Tewkesbury Road west of M5 Junction 10.
- eight receptors are located on Stoke Road between A4019 and Bishops Cleeve.
- three receptors are located on the A38 between B4213 and Gupshill Roundabout south of Tewkesbury.
- one receptor is located on A40 between M5 J11 and the A417 junction.
- three receptors are located on the M5 between J11 and J10.
- two receptors are located on the A4019 between J10 and Stoke Road to the west.
- one receptor located south of the Arle Court roundabout south of A40 south west of Cheltenham.
- two receptors located on Grevil Road and Brooklyn Road, south of Princess Elizabeth Way in Cheltenham.
- two receptors located on Gloucester Road and Brookbank Close south of the

A4019 near the River Chelt.

5.9.7 There are a further 46 receptors across the air quality study area where decreases in pollution concentrations are forecast as a result of the Scheme, and a further 13 receptors where the changes are imperceptible in line with DMRB LA 105 on significance assessment.

5.10 Cumulative effects

5.10.1 This section considers the cumulative effects of the Scheme and the Scheme interacting with other Reasonably Foreseeable Future Projects (RFFPs) within the air quality topic.

Cumulative effects assessment

5.10.2 The further consideration of cross-topic intra-Scheme and inter-project cumulative effects is reported in Chapter 15 - Cumulative Effects Assessment (application document TR010063 – APP 6.13).

Intra-Scheme in-combination cumulative effects assessment (single project impacts) within topic

5.10.3 The focus of the intra-Scheme CEA is understanding how receptors may experience a number of different types of impacts from the Scheme at the same time. Within the topic assessments, the Air Quality assessment methodology focuses on single impact types within the main assessment – there are no single receptors identified as experiencing two or more different types of air quality impacts. On this basis, this intra-Scheme in-combination aspect of the CEA is scoped out of the air quality assessment.

Inter-project cumulative effects assessment (different project impacts) within topic

5.10.4 To complete the cumulative effects assessment inter-project 'within topic' element, the Air Quality assessment has been completed with reference to the list of Reasonably Foreseeable Future Projects (RFFPs) that has been developed for the Scheme. The list is based on a review of all developments known to the planning system (which extends beyond the scope of the DMRB LA 112 methodology, which focuses on residential and business development), using the methodology described in Chapter 4 – Environmental Assessment Methodology (application document TR010063 – APP 6.2).

5.10.5 The RFFP long-list was screened, identifying which RFFPs may result in inter-project cumulative effects in relation to the scope of the Air Quality assessment. The criteria used were the traffic scoping criteria set out in the National Highways DMRB LA 105 (paragraph 2.1) applied based on the comparison between the 'with RFFP' and 'without RFFP' traffic data, whereby RFFPs were screened in if they met at least one of the following criteria:

- Road alignment will change by 5 m or more.
- Daily traffic flows (two way) will change by 1,000 annual average daily traffic (AADT) or more.
- Heavy Duty Vehicle (HDV) flows (two way) will change by 200 AADT or more.
- A change in speed band.

5.10.6 Where traffic data was not provided for RFFPs, qualitative criteria were applied;

- Does the RFFP introduce a new sensitive receptor within 200 m of the ARN?
- Is the RFFP within an AQMA?
- Is the RFFP likely to generate more than 500 AADT or more than 100 HDV per day?

5.10.7 Operational traffic for four RFFPs (listed below) are embedded within the traffic modelling scenarios, as described in the Transport Assessment report (application document TR010063 - APP 7.5). The air quality assessment of cumulative effects is conducted within the limitations of the traffic data available and forecasting of traffic growth rates. Therefore this inter-project aspect of the CEA is already considered intrinsically within the air quality

impact assessment and no further assessment is required – this relates to the conclusions drawn in respect of the following RFFPs:

- 16/02000/OUT (Elms Park) – relating to land allocated under Policy A4 – North West Cheltenham Development Area.
- 20/00759/FUL (Swindon Farm) – relating to part of the land allocated under Policy A4 – North West Cheltenham Development Area.
- Safeguarded land to the north-west of Cheltenham (Policy SD5).
- 22/01817/OUT and 22/01107/OUT – relating to land allocated under Policy A7 – West Cheltenham Development Area.

5.10.8 For those RFFPs that do not fall within the traffic modelling, the traffic scoping criteria described in para 5.10.5 were applied. This allowed determination of whether they are likely to be impacted by the M5 J10 Scheme as a result of introducing new sensitive receptors within the ARN described within this air quality assessment, and also to identify if the RFFP is going to exert an impact on M5 J10 Scheme by introducing additional traffic during construction or operational phases.

5.10.9 For the CEA, the potential impact of the RFFP on the M5 J10 Scheme traffic was either included in the traffic model (projects listed in para 5.10.7 are already reflected in the main assessment) or judged qualitatively regarding the likelihood of exceeding the traffic scoping criteria. The outcomes of this exercise are provided in Table 5-15, which summarises those RFFPs for which there is potential for cumulative inter-project effects on air quality.

Table 5-15 - Assessment of impact interactions between RFFPs and air quality

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
Denhill Colmans Farm, Elmstone Hardwicke, Tewkesbury, Gloucestershire, GL51 9TG (21/00396/CLE)	The air quality assessment of the Scheme has predicted a decrease in pollutant concentrations along the M5 between J10 and J9.	Development is too small to impact on the Scheme.
Land At Manor Farm, Stoke Road, Stoke Orchard, Cheltenham, Gloucestershire, GL52 7RY (22/01377/FUL)	The air quality assessment of the Scheme has predicted an increase in pollutant concentrations along Stoke Road, however there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Manor Farm Yard, Stoke Road, Stoke Orchard, Cheltenham, Gloucestershire, GL52 7RY (20/00213/FUL)	The air quality assessment of the Scheme has predicted an increase in pollutant concentrations along Stoke Road, however there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Knightsbridge Nurseries, Tewkesbury Road, Elmstone Hardwicke, GL51 9SY (23/00328/OUT)	The air quality assessment of the Scheme has predicted an increase in pollutant concentrations along this section of Tewkesbury Road, however, there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Barns At Hayden Barn, Hayden Farm, Hayden Lane, Boddington, Cheltenham,	The air quality assessment of the Scheme identified a reduction in traffic on Hayden Lane with the	Development is too small to impact on the Scheme.

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
Gloucestershire, GL51 0SR (19/00937/PDAD)	Scheme in place, there is no likely risk of significant effects at this site.	
A & B Buildings At Pilgrove Farm, Pilgrove Farm, Old Gloucester Road Boddington, Cheltenham, Gloucestershire, GL51 0SW (19/00907/PDAD)	The air quality assessment of the Scheme has predicted a decrease in pollutant concentrations along B4634, there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Pilgrove Cottage, Old Gloucester Road, Cheltenham, Gloucestershire, GL51 0SW (22/02172/FUL)	The air quality assessment of the Scheme has predicted a decrease in pollutant concentrations along B4634, there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Warners Of Cheltenham, Blaisdon Way, Cheltenham, Gloucestershire, GL51 0WH (20/02132/FUL)	Proposed 12 business units would not be sensitive to changes in air quality as a result of the M5 J10 Scheme.	Potential additional traffic attributed to 12 business units are incorporated in general growth within traffic model.
Lansdown Industrial Estate, Gloucester Road, Cheltenham (21/02832/OUT)	Proposed 215 dwellings would not be sensitive to changes in air quality as a result of the M5 J10 Scheme.	Potential additional traffic attributed to 215 dwellings is incorporated in general growth within the traffic model, as well as reduction in HGV flows due to the demolition of industrial premises at the RFFP.
Pigeon House Farm, The Green, Uckington, Cheltenham, Gloucestershire, GL51 9SR (22/01272/FUL)	The air quality assessment of the Scheme has predicted an imperceptible change in pollutant concentrations on The Green, there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Uckington Farm, The Green, Uckington, Cheltenham, Gloucestershire, GL51 9SR (22/01163/FUL)	The air quality assessment of the Scheme has predicted an imperceptible change in pollutant concentrations on The Green, and the development is set back from the road. There is no likely risk of significant effects at this site.	Development is too small to impact significantly on the Scheme in terms of trip generation. Demolition and clearance works at the RFFP are in proximity to Scheme works on the A4019 and may contribute additive cumulative effects where construction overlaps. It is assumed that appropriate best practice mitigation measures will be applied at this development site, so it would be unlikely to affect air quality at receptors within the air quality study area.

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
16/02000/OUT (Elms Park) – relating to land allocated under Policy A4 – North West Cheltenham Development Area	It is assumed that this site would have no more than 20 residential receptors in opening year and will be fully operational with 4115 residential receptors and 23 ha business development by 2042. No significant air quality effects from the M5 J10 Scheme were identified in para 5.7.14 The developers should be taking into account the air quality changes as a result of the Scheme on the local roads when designing the masterplan for the development.	The operational traffic forecast for this site has been included in the traffic model scenario DS with the strategic development sites (in 2027 and 2042), where no significant air quality effects were identified in para 5.7.28 and following. Construction overlap with M5 J10 works is anticipated in terms of enabling works and infrastructure works. It is assumed that appropriate best practice mitigation measures will be applied at this development site, so it would be unlikely to affect air quality at receptors within the air quality study area.
20/00759/FUL (Swindon Farm) – relating to part of the land allocated under Policy A4 – North West Cheltenham Development Area	It is assumed that this site would have 25% of the homes occupied at the start of Scheme construction, no more than 75% of full allocation of 266 residential properties occupied by opening year and will be fully operational by 2042. The developers should be taking into account the air quality changes as a result of the Scheme on the local roads when designing the masterplan for the development.	The operational traffic forecast for this site has been included in the traffic model scenario DS with the strategic development sites (in 2027 and 2042), where no significant air quality effects were identified in para 5.7.28 and following. Construction overlap with M5 J10 works is anticipated in terms of enabling works, infrastructure and residential development, with the realisation of the full RFFP being partly dependent on transport infrastructure improvements, which are to be delivered by the Scheme. It is assumed that appropriate best practice mitigation measures will be applied at this development site, so it would be unlikely to affect air quality at receptors within the air quality study area.
Gallagher Retail Park, Tewkesbury Road, Uckington, Cheltenham, Gloucestershire, GL51 9RR (17/00827/FUL,	No new sensitive receptors are included with these retail developments.	Potential additional traffic attributed to retail developments are incorporated in general growth within traffic model.

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
17/01459/FUL & 21/02120/FUL)		
Carpetright Plc, Unit M, Gallagher Retail Park, Tewkesbury Road, Cheltenham, Gloucestershire, GL51 9RR (19/00113/COU)	No new sensitive receptors are included with this change of use for retail development.	Potential additional traffic attributed to change of use at retail development are incorporated in general growth within traffic model.
Land north-west Manor Road, Runnings Road, Cheltenham, Gloucestershire, (19/01260/OUT)	No new sensitive receptors are included with this development of light industrial units.	Potential additional traffic attributed to development are incorporated in general growth within traffic model.
Land Known as Evergreen Spiritual Pathways, The Green Uckington, Cheltenham, Gloucester, GL51 9SS (22/00164/PIP)	The air quality assessment of the Scheme has predicted an imperceptible change in pollutant concentrations on The Green, there is no likely risk of significant effects at this site.	Development is too small to impact on the Scheme.
Home Farm, Quat Goose Lane, Cheltenham, Gloucestershire, GL51 9RP (23/00354/OUT) – relating to land allocated under Policy A4 – North West Cheltenham Development Area	180 residential receptors are included in this development, but they are not located within the air quality study area.	The operational traffic forecast for this site has been included in the traffic model scenario DS with the strategic development sites (in 2027 and 2042), where no significant air quality effects were identified in para 5.7.28 and following.
Douglas Equipment, Village Road, Cheltenham, Gloucestershire, GL51 0AB, (22/00474/FUL)	71 residential receptors are included in this development, but they are not located within the air quality study area.	Potential additional traffic attributed to development are incorporated in general growth within traffic model.
Wingmoor Farm East - a strategic waste management development site, Orchard Rd, Bishops Cleeve, Cheltenham GL52 7DG Gloucestershire Waste Core Strategy allocation	No new sensitive receptors are included with this strategic waste management development site.	Potential additional traffic attributed to this site is incorporated in the traffic forecasting model.
The Park – a strategic waste management development site, Unit 6, The Aerodrome, Stoke Rd, Cheltenham GL52 7RS Gloucestershire Waste Core Strategy allocation	No new sensitive receptors are included with this strategic waste management development site.	Potential additional traffic attributed to this site is incorporated in the traffic forecasting model.

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
Wingmoor Farm West - a strategic waste management development site, Lowdilow Ln, Cheltenham GL52 7RS Gloucestershire Waste Core Strategy allocation	No new sensitive receptors are included with this strategic waste management development site.	Potential additional traffic attributed to this site is incorporated in the traffic forecasting model.
Joint Core Strategy Policy SD5 - Safeguarded land to the north-west of Cheltenham	It is assumed that this site would have no residential receptors in opening year and will be fully operational with full residential occupancy by 2042. No significant air quality effects from the M5 J10 Scheme were identified in para 5.7.14 The developers should be taking into account the air quality changes as a result of the Scheme on the local roads when designing the masterplan for the development.	The operational traffic forecast for this site has been included in the traffic model scenario DS with the strategic development sites (in 2027 and 2042), where no significant air quality effects were identified in para 5.7.14 . Construction overlap with M5 J10 works is anticipated in terms of enabling works and infrastructure works. It is assumed that appropriate best practice mitigation measures will be applied at this development site, so it would be unlikely to affect air quality at receptors within the air quality study area.
22/01817/OUT and 22/01107/OUT – relating to land allocated under Policy A7 – West Cheltenham Development Area	It is assumed that this site would have no residential receptors in opening year and will be fully operational with 1100 residential receptors by 2042. No significant air quality effects from the M5 J10 Scheme were identified in para 5.7.14 The developers should be taking into account the air quality changes as a result of the Scheme on the local roads when designing the masterplan for the development.	The operational traffic forecast for this site has been included in the traffic model scenario DS with the strategic development sites (in 2027 and 2042), where no significant air quality effects were identified in para 5.7.14). Construction overlap with M5 J10 works is anticipated in terms of enabling works and infrastructure works. It is assumed that appropriate best practice mitigation measures will be applied at this development site, so it would be unlikely to affect air quality at receptors within the air quality study area.
Phase 1 Land at Old Gloucester Road, Cheltenham,	The RFFP is for 85 homes and it is assumed that there will be some construction overlap with the Scheme, with up to 50% of the	Potential additional traffic attributed to development are incorporated in general growth within traffic model.

Location	Impact of M5 J10 Scheme on this development Reason	Impact of this development on M5 J10 Scheme Reason
Gloucestershire (21/00872/REM) Relating to part of the site allocated under HD8 – land to the north of Gloucester Road, Cheltenham Plan Allocation for 175 homes	RFFP constructed by Scheme opening year. It is assumed that the remaining 50% of the RFFP will be constructed early in the Scheme operational phase, with the full balance of the policy allocation (to 175 homes) built by 2042. The air quality assessment of the Scheme has predicted a decrease in pollutant concentrations along B4634, there is no likely risk of significant effects at this site.	

5.10.10 No significant residual inter-project cumulative effects were identified.

5.11 Assumptions and limitations

5.11.1 Any air quality model has inherent areas of uncertainty, including:

- The traffic data used in the air quality model.
- The suitability of emissions data.
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere.
- The suitability of background concentrations.
- The suitability of meteorological data.
- Uncertainty associated with traffic data has been minimised by using a validated traffic model with data only used from within the defined traffic reliability area (TRA). All links which meet the DMRB LA 105 traffic scoping criteria are located within the TRA.
- Uncertainties associated with emissions data have been minimised by using the most up to date speed-band emission factors available at the time the air quality modelling was undertaken, and by using National Highways LTTE6 projection factors as referenced in DMRB LA 105 (paragraph 2.47 – 2.55).
- Uncertainties associated with model algorithms and empirical relationships have been minimised by using algorithms and relationships that have been independently validated and judged as fit for purpose.
- Another uncertainty is with using historical meteorological data to estimate future concentrations. The key limiting assumption is that conditions in the future will be the same as in the past; however, in reality no two years are the same. In line with best practice, the base year meteorology (as used in the model verification and adjustment process) has been used in future year modelling to allow any adjustments to be applied in future cases.

5.11.2 Given the above, the approach taken for this assessment is considered to be robust and is in line with good practice.

5.12 Chapter summary

Baseline

5.12.1 There is one AQMA within 200m of the air quality ARN, Cheltenham AQMA 2020 focused on an area north west of the town centre. Baseline air quality monitoring data indicates that the only exceedances of the annual mean AQS objective for NO_2 within the study area were located within the Cheltenham AQMA. There are no estimated exceedances of

the annual mean NO_2 air quality limit value in the Defra PCM model links within the ARN in 2019, although the A40 between Arle Court and Princess Elizabeth Way, which intersects with the ARN, exceeded the limit value in 2018.

Construction

5.12.2 Any air quality effects due to construction would be temporary and could be suitably minimised by the application of standard and appropriate mitigation measures. The Construction Dust Assessment identifies the site as high risk and suitable dust mitigation measures are detailed under the potential mitigation measures section. With adoption of suitable and appropriate mitigation, there is unlikely to be a significant effect on air quality due to the construction of the Scheme.

5.12.3 Construction traffic and local traffic management have been examined and a potential significant adverse effect on air quality is considered unlikely, as the projected changes in traffic during construction are below the DMRB LA 105 traffic scoping criteria and are temporary in nature.

Operation

5.12.4 Air quality modelling has indicated that the Scheme would not have an overall significant adverse effect on human health receptors or on designated habitats in the opening year.

5.12.5 The majority of human health receptors modelled within the air quality study area were found to experience decreases in annual mean NO_2 concentrations with the Scheme as a result of decreases in traffic flows. This is due to the improved connectivity between the SRN and the local transport network in west and north-west Cheltenham with the Scheme.

5.12.6 In the opening year, there are expected to be exceedances of the annual mean NO_2 AQS objective at three human health receptors without the Scheme in place, however with the Scheme, all three receptors are expected to have a decrease in concentrations. There is not expected to be an overall significant adverse effect.

5.12.7 Increases in annual mean NO_2 concentrations, mostly as a result of increases in traffic flows with the Scheme, were identified at 28 receptors near to roads within the air quality study area including: Stoke Road between A4019 and Bishops Cleeve, A38 between B4213 and Gupshill Roundabout south of Tewkesbury, A40 between M5 J11 and the A417, M5 between Junction 11 and Junction 10, A4019 between Junction 10 and the A38, and A4019 between B4634 and Manor Road, these are discussed in more detail in paragraphs 5.7.26 – 5.7.21.

5.12.8 There are a further 46 receptors across the air quality study area where decreases in pollution concentrations are forecast as a result of the Scheme, and a further 13 receptors where the changes are imperceptible, in accordance with DMRB LA 105 on significance assessment.

5.12.9 No exceedances of the PM_{10} and $PM_{2.5}$ air quality objectives were identified in the base year, 2019. It is considered unlikely that there would be any exceedances in the opening year with the Scheme.

5.12.10 All of the designated habitat receptors modelled within the air quality study area would experience a decrease in nitrogen deposition rates with the Scheme as a result of decreases in traffic flows.

Appendices

Appendix 5.1 Air Quality Emission Modelling

Appendix 5.1 - Air Quality Emission Modelling is provided as a separate document (application document TR010063 – APP 6.15).

Appendix 5.2 Air Quality Chapter Figures

Appendix 5.2 - Air Quality Chapter Figures is provided as a separate document (application document TR010063 – APP 6.15).

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