8 Air quality

Executive summary

This chapter examines the potential effects of the scheme on air quality pollutant concentrations during both the construction and operational phases.

Ambient background concentrations in the general area of the scheme comply with the air quality objectives. However, monitoring at roadside locations reveals exceedances of the nitrogen dioxide annual mean objective in Huntingdon, Cambridge and along the existing A14 at sensitive receptor locations at the roadside.

The assessment of the construction phase of the scheme showed mitigation is required to reduce potential nuisance from dust at local residential properties and businesses. Mitigation proposed is based on industry best practice guidance for dust suppression and management. With this mitigation in place the impacts of the scheme are not expected to be significant.

The assessment of the operational phase of the scheme showed predicted concentrations of nitrogen dioxide (NO_2) and fine particulate matter (PM_{10}) were below objective levels in all future modelled scenarios, at all modelled receptors. A number of areas are predicted to experience a large improvement in air quality, most notably in Huntingdon and along the A14 between Swavesey and Huntingdon. This is a result of the majority of traffic being diverted away from these areas and on to the proposed new road.

Air quality management areas in the study area are predicted to experience improvements in air quality as a result of the proposed scheme as was anticipated in the joint air quality action plans (AQAP) produced by Cambridge City Council, South Cambridgeshire District Council and Huntingdonshire District Council.

With no exceedances of EU limit values being predicted across the study area as a result of the proposed scheme, it is considered that the scheme would not impact the Eastern Zone (UK0029) predicted date for compliance with the EU limit values (as set out in the *Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO_2) in Eastern (UK0029)* (Department for Environment, Food and Rural Affairs, September 2011)).

Based on professional judgement of suitably qualified and experienced specialists, as listed in *Appendix 6.1,* it is concluded that the scheme does not have a significant impact on air quality and does not affect the UK's ability to achieve compliance with the EU air quality Directive.

8.1 Introduction

8.1.1 This chapter examines the potential effect of the scheme on local and regional air quality during both construction and operational phases. A full description of the scheme area is included under *Chapter 3*. The scheme boundary is shown under *Figure 1.1*.

8.1.2 The scheme would remove a large proportion of traffic from sections of the existing A14. The existing A14 travels past the north of Cambridge and though the centre of Huntingdon. The scheme results in the removal of the majority of traffic and hence traffic related pollution from the main urban area of Huntingdon. The effect of the proposed scheme on the existing road network has been assessed in terms of future air quality.

8.1.3 Emissions from motor vehicle exhausts contain a number of pollutants including oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), carbon monoxide (CO), hydrocarbons, carbon dioxide (CO_2) and fine particulate matter (PM). The quantities of each pollutant emitted depend on the type of vehicle, quantity and type of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the air.

8.1.4 The air pollutants of concern in the context of this assessment are oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), fine particles (PM_{10}) and CO_2. The other pollutants mentioned above, namely CO and hydrocarbons have not been included in the assessment as they have not been identified as being at risk of exceeding the objectives in the area managed by Cambridge City, South Cambridgeshire and Huntingdonshire Councils[1]. The assessed pollutants are the most likely to be present at concentrations close to or above their objective values in areas where traffic emissions are the main source of air pollutants.

8.1.5 Emissions of $PM_{2.5}$ are not considered in this assessment, as monitoring of $PM_{2.5}$ in the Cambridge area, as well as in the rest of the UK, does not exceed the $PM_{2.5}$ pollutant threshold, indicating no risk of exceedance of the air quality limit value for this pollutant (European Commission, 2008) (Fine Particulate Matter ($PM_{2.5}$) in the United Kingdom (AQEG , 2012)). In addition, the accepted methodology for air quality assessment of trunk road schemes (as outlined below under method of assessment) does not require assessment of $PM_{2.5}$ (*Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 HA207/07 - Air Quality (DMRB HA207/07)* (Highways Agency et al., 2007)).

8.1.6 An assessment of the impacts on human health is provided in *Appendix 18.1*, which summarises and analyses health-related findings from this and other ES chapters.

Legislative and policy background

Policy plan and context

8.1.7 In the United Kingdom, objective levels for air quality pollutants are set in national legislation. Additionally limit values (pollutant concentrations not to be exceeded by a certain date) set by the European Union are used to inform compliance. Both of these are used within this assessment to inform significance of impact.

[1] Local authority air quality reports used are listed in the bibliography.

EU limit values

8.1.8 In May 2008, the *Council Directive (2008/50/EC) on Ambient Air Quality and Cleaner Air for Europe (Air Quality Directive)* (European Commission, 2008), came into force. The Directive sets 'limit values' and 'target values' for ambient concentrations of pollutants. The limit values defined in the directive are legal requirements and compliance with these is reported on an annual basis by the Department for Environment, Food and Rural Affairs (Defra). The Directive also covers the division of the UK into zones for the purpose of compliance reporting. The directives were transposed into national legislation in England by the Air Quality Standards Regulations 2010.

8.1.9 The scheme is located in the Eastern Zone (UK0029), as covered by the *Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO_2)* (Department for Environment, Food and Rural Affairs, September 2011)). Consideration of the EU limit values has been made with regards to the scheme to determine the air quality impacts on the EU limit values in the Eastern Zone. The *Interim Advice Note 175/13 Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans (IAN 175/13),* (Highways Agency, 2013a) has been used to inform the risk associated with the scheme with regards to the EU limit values. The methodology set out in the *Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Pat 1 'Air Quality (H207,07)' (IAN 174/13)* (Highways Agency, 2013b) takes into account the scheme's impact upon EU limit values when assessing overall significance.

UK objectives

8.1.10 The *Air Quality (England) Regulations 2000* (UK Government, 2000) and 2002 amendments set national air quality objectives for local authorities in England. The *National Air Quality Strategy* (Defra, 1997) was published and subsequently reviewed and revised in 2000, as the *Air Quality Strategy for England, Scotland, Wales and Northern Ireland Volume 2 (AQS)* (Defra, 2011) and an addendum to the Strategy was published in 2007. This set the strategy for meeting the air quality objectives. The Local Air Quality Management (LAQM) system assesses where the UK objectives may be exceeded. The impact of the scheme upon air quality concentrations in relation to the air quality objectives is used to inform the overall significance of the scheme as set out in *IAN 174/13* (Highways Agency, 2013b).

Air quality objectives and limit values

8.1.11 The air quality EU limit values and UK air quality objectives for NO_2 and PM_{10} which apply to the scheme are shown in *Table 8.1*. Both pollutants have objectives that are expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur after a prolonged period of exposure to elevated concentrations) and also have standards based on shorter term averages as (24-hour, 1-hour) due to the acute way in which they affect health or the natural environment (i.e. after a relatively short period of exposure). The air quality EU limit value for NO_x is also presented which applies at sites designated for the protection of vegetation and sensitive ecosystems only and does not apply to human health.

Table 8.1: Air quality standards

Pollutant	Averaging period	Limit value /objective
Human health		
Nitrogen dioxide (NO_2)	Annual mean	40µg/m^3
	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.8th percentile)
Particulate matter (PM_{10})	Annual mean	40µg/m^3
	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year (90.4th percentile)
Designated sites		
Nitrogen oxide (NO_x)	Annual mean	30 µg/m^3

Planning policy and guidance

8.1.12 The following presents the planning policies and guidance at national, regional and local levels that are relevant to air quality and can have an influence when considering the air quality impacts of the scheme.

Draft National Policy Statement for National Networks (2013)

8.1.13 *The Draft National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2013) set the Government's policies for the future development of nationally significant infrastructure projects on the national road and rail networks. In relation to air quality, the draft *NPSNN* identifies the need for an assessment to be included in an environmental statement and states the considerations that the Secretary of State should take into account when making a planning decision on such projects. It is noted that it requires the Secretary of State to give air quality considerations substantial weight where a project would lead to a significant air quality impact.

8.1.14 If a project was found to substantially affect the ability of a non-compliant area meeting the timescales for compliance as reported to the EU, the Secretary of State would potentially refuse the development permission.

8.1.15 The emphasis is placed on projects within or adjacent to air quality management areas (AQMAs), whether air quality standards are likely to be exceeded and whether significant impacts or deterioration in air quality are likely to be caused by the project in a zone/agglomeration[2] where there are already breaches of the air quality limit values. In those instances, the NPS advises that the applicant should collaborate with the relevant local authorities to agree on appropriate mitigation measures.

8.1.16 Mitigation measures may affect the project design and can include a wide range of improvement measures. The scheme lies within Eastern Zone (UK0029), which has been recording exceedances of the annual mean NO_2 limit value at locations close to London and Bury St Edmunds (Defra, 2011). Consideration of the impacts on air quality has been made when assessing significance as detailed in *IAN 174/13* (Highways Agency, 2013b).

National Planning Policy Framework (2012)

8.1.17 The *National Planning Policy Framework* (NPPF), (Department of Communities and Local Government, 2012) was published with the purpose of planning to achieve sustainable development. Paragraph 124 of the NPPF on air quality states that:

> "*Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan".*

8.1.18 The draft NPSNN is consistent with the NPPF.

[2] The UK has been divided into 43 zones and agglomerations as part of the *Council Directive (2008/50/EC) on Ambient Air Quality and Cleaner Air for Europe (European Commission, 2008)* in order to assess compliance with the air quality limit values.

8.1.19 In relation to air quality, the guidance refers to the significance of air quality assessments to determine the impacts of proposed developments in the area. It also makes reference to ensuring compliance with the air quality objectives and EU limit values. It also provides a flowchart method to assist local authorities to determine how considerations of air quality fit into the development management process. This flow chart is provided in *Box 1* of *Appendix 8.1*.

Local policy and guidance

8.1.20 The local policy and guidance, including air quality action plans (AQAPs) produced by the local authorities detailing their plans to improve air quality within the declared AQMAs has been taken into account as detailed in *IAN 174/13* (Highways Agency, 2013b). The local authorities in the region have worked together to produce one joint AQAP (Joint Councils Partnership, 2009) for all the AQMAs in the region. One of the key measures included in the AQAP is the support for the A14 Huntingdon bypass. It is noted in the AQAP how it will remove traffic from Huntingdon's AQMAs and improve flows in the A14 corridor AQMA. The measures within the three local authority plans have been considered where the scheme may impact upon these. Details of each policy which relates to air quality are provided within *Appendix 8.1*.

Ecological limit values

8.1.21 The EU has set a limit value for NO_x for the protection of vegetation as shown in *Table 8.1*. This limit value is 30µg/m^3 for the annual mean. This is the same as the *Air Quality Strategy* (Defra, 2011) objective. The limit value applies to locations more than 20km from towns with more than 250,000 inhabitants or more than 5km from other built-up areas, industrial installations or motorways. As monitoring sites need to be representative of an area of 1,000 square kilometres, the limit does not have a statutory basis in micro-scale environments such as those close to a road.

8.1.22 The United Nations Economic Commission for Europe (UNECE) and the World Health Organisation (WHO) set a critical level for NO_x for the protection of vegetation (WHO, 2005). In line with this, Natural England's policy is to apply the 30µg/m^3 criterion, on a precautionary basis, as a benchmark, in internationally and EU designated conservation sites and sites of special scientific interest (SSSI).

8.1.23 In addition, critical loads for nitrogen deposition have been set that represent (according to current knowledge) the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem. Details of the nitrogen deposition rates and critical loads used in this assessment are provided below (*paragraphs 8.2.28-8.2.33*) under method of assessment.

Dust

8.1.24 Dust is the generic term used in *British Standard BS 6069 Characterization of air quality, Glossary (Part Two)* (British Standards Institute, 1994) to describe particulate matter in the size range 1–75µm in diameter. Under provisions in the *Environmental Protection Act 1990* dust nuisance is defined as a statutory nuisance.

8.1.25 There are currently no formal standards or guidelines for dust nuisance in the UK. In addition, formal dust deposition standards are not specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. Legally, complaints about excessive dust deposition would have to be investigated by the local authority and any complaint upheld for a statutory nuisance to occur. However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

8.2 Method of assessment

Approach

8.2.1 The overall approach to the air quality assessment has been designed to meet the requirements for an air quality environmental statement set out in the *Draft NPSNN* (Department for Transport, 2013), namely:

- a review of the existing air quality conditions in the scheme study area;
- a forecast of air quality at the time of opening, assuming the scheme is not built (the 'future baseline' or 'do-minimum' scenario) and taking account of the impact of the scheme (the 'do-something' scenario);
- an assessment of any significant air quality effects, their mitigation and any residual effects, distinguishing between the construction and operational phases and taking account of the impact of road traffic generated by the scheme; and
- a clear indication of the scheme's potential to affect the UK's ability to comply with the *Air Quality Directive* (European Commission, 2008).

8.2.2 To this end, the following three assessments have been undertaken:

- a local air quality assessment for the existing A14 corridor, offline route and affected road network (defined below under guidance);
- a construction phase dust assessment; and
- a regional assessment, which involves a calculation of the total change in NO_x, PM_{10} and CO_2 pollutant emissions that would result from the scheme.

Guidance

8.2.3 The method for assessing the likely air quality effects from the scheme has followed the guidance described in *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1 HA207/07 - Air Quality (DMRB HA207/07)* (Highways Agency et al., 2007) as well as *Local Air Quality Management Technical Guidance (LAQM TG(09))* (Defra, February 2009b). The guidance in the following Interim Advice Notes (IAN) were also followed:

- *Interim Advice Note 170/12v3 Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3 Part 1 'Air Quality' (IAN 170/12v3)* (Highways Agency, 2013c);
- *IAN 174/13* (Highways Agency, 2013b); and
- *IAN 175/13* (Highways Agency, 2013a).

Study area

8.2.4 The study area (*Figure 8.6*) for the air quality assessment of the scheme is defined using two criteria, comprising:

- the traffic reliability area (TRA), which is defined by the traffic model and covers a wide area around the scheme where reliable traffic data is available; and
- the affected road network (ARN).

8.2.5 For the local air quality assessment, the ARN is defined in *Design Manual for Roads and Bridges Volume 11, Section 3, Part 1 Air Quality (DMRB HA207/07)* (Highways Agency et al., 2007) as those roads within the TRA which in the scheme opening year meet any of the criteria set out below. The criteria are change based, where change is based on the difference in opening year traffic data between the do-minimum and do-something for any scenario pair.

"Affected roads are those that meet any of the following criteria:

- *road alignment will change by 5m or more; or*
- *daily traffic flows (two way) will change by 1,000 Annual Average Daily Traffic (AADT) or more; or*
- *Heavy Duty Vehicles (HDV) flows (two way) will change by 200 AADT or more; or*
- *daily average speed (two way) will change by 10km/hr or more; or*
- *peak hour speed will change by 20km/hr or more."* (Highways Agency et al., 2007).

8.2.6 The assessment encompasses a 200m corridor either side of the roads along the ARN, within which human health receptors and sites designated for the protection of sensitive vegetation and ecosystems have been included[3].

8.2.7 For the regional air quality assessment the ARN is defined as those links within the TRA which in the scheme opening year or design year (+15 years) meet any of the criteria below:

- *"daily traffic flows (two way) will change by 10% AADT or more; or*
- *HDV flows (two way) will change by 10% AADT or more; or*
- *daily average speed (two way) will change by 20km/hr or more".* (Highways Agency et al., 2007).

8.2.8 The construction dust assessment study area includes a 200m buffer around any construction works, including haul routes, compound areas, soil storage areas and borrow pits.

Method of baseline assessment

8.2.9 Existing or baseline air quality refers to the concentration of relevant air pollutants that are already present in the environment – these are present from various sources, such as industrial processes, commercial and domestic activities, traffic and transboundary or natural sources.

8.2.10 A desk based review of the following data sources has been undertaken to determine the baseline conditions across the scheme study area;

- the LAQM website (Defra, 2014a); and
- local authority review and assessment reports[4].

8.2.11 Additionally NO_2 monitoring has been specifically undertaken for the purposes of this assessment to improve understanding of the existing air quality concentrations in the scheme study area.

8.2.12 Detailed dispersion modelling of NO_x and PM_{10} emissions was undertaken using the ADMS Roads (version 3.2.4.0) atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC) to predict baseline pollutant concentrations. Details relating to model inputs, including traffic data, receptors and meteorological data are described in more detail below, in *paragraphs 8.2.20* onwards, under methodology for local air quality assessment.

8.2.13 Modelling has been used to predict both long term NO_2 and PM_{10} objective concentrations and short term PM_{10} objective concentrations for all receptors selected in the operational assessment for the baseline year 2014.

[3] Receptors defined in *LAQMTG (09)* (Defra, February 2009a) include houses, schools, hospitals and care homes and designated sites as set out in *Annex F of DMRB HA207/07* (Highways Agency et al., 2007).

[4] Local authority reports were used and a full list of documents used is included within the bibliography

Method of construction phase assessment

8.2.14 Fugitive dust emissions arising from construction and demolition activities are likely to be variable in nature and would depend upon the type and extent of activity, soil type and moisture, road surface conditions and weather conditions.

8.2.15 Construction, demolition and earthwork activities as a result of the scheme may all have an impact on local air quality. Trackout of material onto local roads where it can be re-suspended may also affect air quality. Trackout refers to the transport of dust and PM_{10} from construction areas onto the road network.

8.2.16 To ensure that a reasonable worst case has been assessed for construction impacts, it has been assumed that construction impacts could arise concurrently at any time during the period of construction for the entire scheme rather than just within the envisaged period of construction for each of the six sections of the scheme described in Appendix. 3.2.

8.2.17 A qualitative assessment of the impacts of nuisance dust arising during construction has been undertaken, using guidance set out in paragraph 3.45 of DMRB HA207/07 (Highways Agency et al., 2007). Properties within 200m of dust producing activities have been identified and appropriate mitigation recommended where required.

8.2.18 The emissions from heavy goods vehicles (HGVs) associated with the construction of the scheme have been scoped out of the assessment due to the temporary nature of the works and the minimal impact the additional vehicles would have on overall pollutant concentrations.

8.2.19 The emissions from site equipment have been scoped out of the assessment due to the temporary nature of the works and the minimal impact the site equipment would have on overall pollutant concentrations.

Construction phase assessment significance criteria

8.2.20 The assessment of significance associated with construction related dust follows guidance in DMRB HA207/07 (Highways Agency et al., 2007).

Methodology for local air quality assessment

8.2.21 Detailed dispersion modelling of NO_x and PM_{10} emissions was undertaken using ADMS-Roads pollution model.

8.2.22 The inputs into the model included:

- affected road network;
- receptor locations;
- meteorological data; and
- traffic data and associated vehicle emissions.

Assessment scenarios

8.2.23 This assessment has been undertaken for the following scenarios:

- 2014 baseline;
- 2014 projected base year[5];
- 2020 (opening year) without the scheme (do-minimum);
- 2020 (opening year) with completed scheme (do-something);
- 2035 (design/future year) without the scheme (do-minimum); and
- 2035 (design/future year) with completed scheme (do-something).

8.2.24 With regard to local air quality, the opening year of the scheme (2020) is likely to be the worst case scenario as vehicle emission factors and background pollutant concentrations are anticipated to decrease over time due to improvements in fuel technologies (Defra, February 2009b).

Road network

8.2.25 The road network for input into the model has been developed using GIS software ArcMap. The design drawings of the scheme were converted from computer aided design software and used to create the road network in ArcMap.

8.2.26 Details such as road widths and heights, where there are flyovers and bridges, have been incorporated into the model. No terrain was required in the model as the area does not contain any complex terrain.

Receptors

Human health receptors

8.2.27 In accordance with *IAN 174/13* (Highways Agency, 2013b) this assessment includes all human sensitive receptors within 200m of the ARN that have a reasonable risk of exceeding an air quality threshold. *IAN 174/13* does not require modelling of every receptor, rather worst case locations can be selected. *IAN 174/13* indicates that, if the assessment results in exceedances of an air quality threshold, the assessment should be expanded to include all receptors that are at a reasonable risk of exceeding the air quality thresholds. *Table 7.5* of *Appendix 8.1* and *Figure 8.1* show the locations of receptors included within this assessment.

8.2.28 Receptor locations across the study area were taken from GIS data and were screened for receptors which are sensitive to air quality as defined in *LAQM TG(09)* (Defra, February 2009b). All receptors were modelled at a height of 1.5m, which is representative of a human receptor.

[5] The projected base year is produced as part of the future year NO_x and NO_2 sensitivity testing carried out for *IAN 170/12v3* (Highways Agency, 2013c). It has the base year traffic modelled using the opening year vehicle emission factors and opening year background concentrations.

Ecological receptors

8.2.29 Ecological receptors, which are designated for nature conservation importance internationally, as special areas of conservation (SAC) and special protection areas (SPA), and nationally, as sites of special scientific interest (SSSI), have been included where they are located within 200m of the ARN. This is a requirement of *DMRB HA207/07* (Highways Agency et al., 2007).

8.2.30 Effects at ecological receptors have been assessed in accordance with *Annex F of DMRB HA207/07* (Highways Agency et al., 2007). Ecological sites which have been assessed within the study area are listed in *Table 2.1 of Appendix 8.1* and shown on *Figure 8.2*. It is noted that Histon Road SSSI lies within 200m of the ARN for the opening and design year, however this is designated for geological features and is therefore not sensitive to changes in nitrogen and does not require assessment.

8.2.31 Receptors E1-E13 listed in *Table 2.1 of Appendix 8.1* have been included for the opening year (2020) as these are located within 200m of the ARN. All ecological receptors are included for the design year (2035) as these are within 200m of the ARN.

8.2.32 Receptor transects for each of the assessed designated sites up to 200m from the source have been included to allow assessment of the drop off in emissions and deposition at increasing distances from the road. All ecological receptor locations were modelled at a height of 0m.

8.2.33 Elevated levels of NO_x can have an adverse effect on vegetation, including leaf or needle damage and reduced growth. Deposition of pollutants derived from NO_x emissions can contribute to acidification and/or eutrophication of sensitive habitats leading to loss of biodiversity. The *Air Pollution Information System (APIS)* website (Centre for Ecology and Hydrology, 2014) contains critical loads for nitrogen deposition for those habitats considered sensitive to nitrogen and average nitrogen deposition rates for all designated sites in the UK. Critical loads, as well as existing nitrogen deposition rates at each of the designated sites assessed are presented in *Table 2.2 of Appendix 8.1*. The *DMRB HA207/07* (Highways Agency et al., 2007) indicates that nitrogen deposition rates should be reduced by 2% per year to obtain appropriate levels for assessment of the opening year and design year. Little Paxton Pits SSSI is designated for standing open water and does not therefore have an established critical load[6]. As such this site has not been included in the assessment of nitrogen deposition as it is unlikely to be sensitive to changes to nitrogen deposition.

[6] Critical loads - *" a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge*" (Centre for Ecology and Hydrology, 2014)

8.2.34 Following guidance in *IAN 174/13* (Highways Agency, 2013b), in the first instance, the magnitude of change in annual mean NO_x concentrations at the designated sites has been determined. Where this has indicated a potential significant effect, changes in nitrogen deposition have been included to further assist in the determination of significance at the designated sites.

Meteorological data

8.2.35 Hourly sequential meteorological data for the latest year of complete data (2013) from the Met Office station at Mildenhall located approximately 36km from the scheme were used in this assessment.

8.2.36 Sensitivity analysis of meteorological data (as requested by the local authorities) has been undertaken using multiple meteorological stations nearby and multiple meteorological years. Meteorological stations included Mildenhall, Bedford, Marham and Wattisham, where data for the years 2010 to 2013 were tested. Details of the sensitivity testing are included in *Appendix 8.1.* It was concluded that the data from Mildenhall 2013 would be most appropriate for this assessment as it is the closest and most representative of the scheme.

8.2.37 A wind rose derived from data obtained from the Mildenhall meteorological station area is shown in *Box 2 of Appendix 8.1*.

Traffic data

8.2.38 Traffic data have been provided for a large area around the scheme. Detailed traffic data have been provided for main roads up to 10km from the scheme.

8.2.39 The traffic reliability area (TRA) shown in *Figure 8.6* was defined through analysis of the traffic model. It was confirmed that the baseline year (2014) was representative of the traffic flows in 2013. The final ARN area was agreed with specialists in traffic modelling.

8.2.40 Traffic data were provided as annual average daily traffic (AADT) data along with vehicle class breakdown (motorcycle, car, light goods vehicles, other goods vehicles 1, other goods vehicles 2 and buses) and speeds. Daily flow profiles were provided and included in the model.

8.2.41 Emissions from traffic data were assessed using the latest version (v6.0.1) of the emission factor toolkit (EFT) (Defra, 2014b) for each of the assessment scenarios.

8.2.42 The traffic data included details of the traffic flow for each hour of the day on the main roads in the TRA; these were used to produce diurnal flow profiles in the model.

8.2.43 The cumulative impact of proposed developments such as Northstowe and Alconbury Weald are taken into account in the traffic model as discussed in *section 7.3 of the ES*.

Assessment of future NO_x and NO_2 concentrations

8.2.44 Due to the gap between current projected vehicle emission reductions and the projections on the annual rate of air quality improvement provided by Defra (Defra, February 2009b), the Highways Agency has provided a set of guidance for carrying out sensitivity analysis for future year NO_x and NO_2 concentrations.

8.2.45 This guidance is provided in *IAN 170/12v3* (Highways Agency, 2013c) and has been used in this assessment.

NO_x to NO_2 conversion

8.2.46 The model predicts NO_x roadside concentrations which comprise principally nitric oxide (NO) and nitrogen dioxide (NO_2). The emitted NO reacts with ozone in the atmosphere to form more NO_2 whilst NO_2 breaks down in sunlight to form NO. Since only NO_2 is associated with effects on human health, the air quality standards are based on NO_2 rather than NO_x or NO. Therefore, the amount of NO_2 needs to be calculated taking into account the atmospheric chemistry and the background concentrations of pollutants.

8.2.47 The approach for calculating the roadside conversion of NO_x to NO_2 has followed the guidance in *LAQM TG(09)* (Defra, February 2009b) and the *LAQM* website (Defra, 2014c). This approach allows the calculation of NO_2 from NO_x concentrations, taking into account the difference between ambient NO_x concentrations with and without the development, the concentrations of ozone and the different proportions of primary NO_2 emissions in different years. This approach is available as a spreadsheet calculator, with the most recent version having been released in June 2014 (v4.1) (Defra, 2014c).

Calculation of short term statistics

8.2.48 For NO_2, the hourly mean objective is 200µg/m^3, not to be exceeded more than 18 times per year. Analysis of UK continuous NO_2 monitoring data has shown that it is unlikely that the 1-hour mean objective would be exceeded where the annual mean objective is below 60µg/m^3. Therefore, potential exceedances of the 1-hour mean objective have been identified based on this criterion.

8.2.49 For PM_{10}, the daily mean objective is 50µg/m^3, not to be exceeded more than 35 times per year. The number of 24-hour mean exceeding 50µg/m^3 has been estimated using the following relationship, as detailed in the local air quality management technical guidance (Defra, February 2009b):

> *"No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206 / annual mean)"*

8.2.50 This relationship indicates that where the annual mean is above 32µg/m^3, it is possible that daily mean concentrations greater than 50µg/m^3 could occur more than 35 times in a calendar year.

Model verification

8.2.51 As part of the assessment, a comparison of estimated and measured NO_2 concentrations has been undertaken. This process is known as model verification. Verification has been undertaken for the base year, using the principles laid out in *section A3.223 of LAQM TG(09)* (Defra, February 2009b). Additional receptor points have been included within the baseline modelling to represent the location of diffusion tube and continuous monitoring sites within 200m of the affected road network to provide information for the verification exercise.

8.2.52 Model verification, can be undertaken where monitoring sites are located within the modelled area. The objectives of the model verification are to evaluate model performance, determine if model adjustment is required, and to provide confidence in the assessment.

8.2.53 *LAQM TG(09)* (Defra, February 2009b) suggests that if modelled annual mean NO_2 concentrations are within ±25% and preferably within ±10% of the monitored concentration and there is no systematic under or over prediction, then model adjustment is not considered necessary to further improve modelled results. *IAN 174/13* (Highways Agency, 2013b) notes the desirability of achieving ±10% verification where concentrations are close to or above the air quality threshold.

8.2.54 Modelled results may not compare as well at some locations for a number of reasons including;

- errors/uncertainties in traffic flow and speed data estimates;
- model setup (including street canyons, road widths, receptor locations);
- model limitations (treatment of roughness and meteorological data);
- uncertainty in monitoring data (notably diffusion tubes, e.g. bias adjustment factors and annualisation of short-term data); and
- uncertainty in emissions/emission factors.

8.2.55 The above factors were investigated as part of the model verification process to minimise the uncertainties as far as practicable.

8.2.56 Some monitoring locations are not suitable for model verification purposes as there may be specific local influences or they are located too close to the road where *LAQM TG(09)* (Defra, February 2009b) advises they should not be used. Therefore each site was examined and considered whether it was suitable for use in the verification study and some locations were consequently removed. For sites removed, the justification for the removal was provided.

8.2.57 As noted in *IAN 174/13* (Highways Agency, 2013b) areas where the concentrations are close to or above the air quality threshold should be within ±10% in the model verification. Any areas where this was not the case were investigated further and sensitivity analysis carried out to determine a worst case result and address any possible under or over prediction. The sensitivity testing involved applying additional verification factors to ensure a robust assessment was undertaken.

Compliance with local planning policies

8.2.58 Local planning policies related to air quality are listed in *Appendix 8.1*. The impacts of the scheme have been considered in relation to the local policies and comment made with regards to the schemes impact upon them.

Operational phase assessment criteria

8.2.59 Evaluation of the significance of the local air quality findings has been undertaken in accordance with *IAN 174/13* (Highways Agency, 2013b). This requires evaluation of NO_2 and PM_{10} (human health) and NO_x (limit value for vegetation). In addition, air quality has been evaluated against the risk of not complying with the *Air Quality Directive* (European Commission, 2008). *IAN 175/13* (Highways Agency, 2013a) guidance has been followed to inform if there is any likelihood of the scheme not complying with the *Air Quality Directive.*

8.2.60 The evaluation of the significance of nitrogen deposition results requires advice from an ecologist and therefore the significance of changes to air pollution at ecological designated sites is also discussed in *chapter 11* of this environmental statement on nature conservation.

8.2.61 The key criteria outlined in *IAN 174/13* (Highways Agency, 2013b) against which air quality should be considered are:

- *"Is there a risk that environmental standards will be breached?*
- *Is there a high probability of the effect occurring?*
- *Will there be a large change in environmental conditions?*
- *Will the effect continue for a long time?*
- *Will many people be affected?*
- *Is there a risk that protected sites, areas, or features will be affected?*
- *Will it be difficult to avoid, or reduce or repair or compensate for the effect?"*

8.2.62 To assess the magnitude of change at receptor locations, including ecological receptors, as a result of the scheme, *IAN 174/13* (Highways Agency, 2013b) provides criteria as shown in *Table 8.2*. These are based upon the fact that whilst modelled results are considered reasonably accurate, there is still an element of residual uncertainty, hereafter referred to as Measure of Uncertainty (MoU). This is due to inherent uncertainty in air quality monitoring, modelling and the input data used in the assessment.

8.2.63 Where predicted annual mean NO_2 concentrations are below the objective or the magnitude of change is <0.4µg/m^3 no significant adverse effects are likely.

Table 8.2: Magnitude of change criteria

Magnitude of change in concentration ($\mu g/m^3$)	Value of change in annual average NO_2 and PM_{10}
Large (>4)	Greater than full MoU value of 10% of the air quality objective ($4\mu g/m^3$)
Medium (>2 - 4)	Greater than half the MoU ($2\mu g/m^3$), but less than the full MoU ($4\mu g/m^3$) of 10% of the air quality objective
Small (>0.4 - 2)	More than 1% of objective ($0.4\mu g/m^3$) and less than half of the MoU i.e. 5% ($2\mu g/m^3$). The full MoU is 10% of the air quality objective ($4\mu g/m^3$)
Imperceptible (≤ 0.4)	Less than or equal to 1% of objective ($0.4\mu g/m^3$)

8.2.64 *IAN 174/13* (Highways Agency, 2013b) also provides guidelines to aid the interpretation of significance of public exposure. *Table 8.3* shows the guideline criteria used in this assessment.

Table 8.3: Guideline for number of properties constituting a significant effect

Magnitude of change in NO_2 ($\mu g/m^3$)	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)	1-10	1-10
Medium (>2 - 4)	10-30	10-30
Small (>0.4 - 2)	30-60	30-60

Methodology for the regional assessment

8.2.65 The regional assessment has calculated the total and the change in NO_x, PM_{10} and CO_2 emissions with and without the scheme in the opening year and the future assessment year in accordance with guidance provided in *DMRB HA207/07* (Highways Agency et al., 2007). The emissions were calculated using the emissions factor toolkit (Defra, 2014b).

8.2.66 The results of the assessment have been expressed as the mass emissions of pollutants (tonnes per year) for each scenario. The difference in emissions (expressed in tonnes per year) between the do-minimum and do-something scenarios is calculated to determine the impacts of the scheme on emissions.

Consultation

8.2.67 Consultations with the local authorities of Cambridge City Council (CCC), South Cambridgeshire District Council (SCDC) and Huntingdonshire District Council (HDC) were undertaken early in the EIA process to discuss the potential air quality impacts and gather initial views. Details on consultation and scoping consultees are included under *Chapter 5* and *Appendix 5.1*.

8.2.68 The overall approach and methodology was agreed with the local authorities.

Limitations

8.2.69 There are a number of limitations and uncertainties associated with modelling predictions. The model is required to simplify real world conditions based upon a series of algorithms and is dependant of input data.

8.2.70 There are transport data limitations which are discussed in *Chapter 7*. These limitations have been overcome as far as possible by verifying the modelled concentrations against monitoring results in appropriate locations.

8.3 Baseline conditions

8.3.1 All local authorities are required by the *Environment Act 1995 Part IV* to carry out a review and assessment of air quality. This involves examining current pollutant concentrations and comparing the concentrations with the objectives in the *AQS* (Defra, 2011).

8.3.2 Where the objectives are not likely to be achieved in all relevant locations, the authority must designate these areas as AQMAs by order. Relevant locations where objectives apply are defined in *LAQM TG(09)* (Defra, February 2009b). Locations are based on the objective averaging period. For example the annual mean applies at all locations where members of the public might be regularly exposed (building facades of residential properties, schools, hospitals, care homes, etc.). The 24 hour objectives would apply at all locations where the annual mean is applied as well as hotels and gardens. The one hour objectives would apply at any outdoor locations where members of the public are likely to spend one hour or longer.

8.3.3 The scheme is likely to affect air quality within the following local authority areas:

- Huntingdonshire District Council;
- South Cambridgeshire District Council; and
- Cambridge City Council.

8.3.4 All of these local authorities have designated AQMAs for the main pollutants of concern NO_2 and PM_{10}. The locations of AQMAs are shown on *Figure 8.3* and the AQMAs of relevance to the scheme are described in *Table 8.4*.

Table 8.4: Air quality management areas in the vicinity of the scheme

AQMA name	Description	Summary of latest monitoring results
Cambridge City Council		
Cambridge	An area encompassing the inner ring road and all the land within it (including a buffer zone around the ring road and its junctions with main feeder roads). Declared in 2004 due to exceedances of annual mean NO_2 objective.	In 2013 the annual mean objective for NO_2 was exceeded at five sites in Cambridge. The maximum recorded concentration was 42.6µg/m^3 on St Andrews Street. Concentrations within the AQMA are decreasing, following peaks recorded in 2010.
Huntingdonshire District Council		
Huntingdon	An area encompassing the southern part of the town centre, bounded largely by the A141 to the east, A141 to the north, A14 to the west and the river to the south. Declared after 2005 assessment due to exceedances of annual mean NO_2 objective. The area was amended in 2007 to include additional properties in the north (south of the A141), the east (north of the river) and to the south (in Godmanchester).	The continuous monitor in Huntingdon recorded 2013 annual mean NO_2 concentrations in excess of the objective. The annual mean was exceeded in one of the 5 diffusion tube sites in Huntingdon (43.1µg/m^3 at George Street).
St Neots	An area encompassing the junction of the High Street, St Neots, with New Street and South Street. Declared after the 2005 assessment due to exceedances of annual mean NO_2 objective. Further assessment in 2007 resulted in amendments to the AQMA to include a larger area along the high street, largely bound by the river to the east, either side of Huntingdon Road to the east, and extending to the north either side of New Street.	None of the 2013 annual mean NO_2 concentrations for any of the St Neots diffusion tubes exceeded the objective.

AQMA name	Description	Summary of latest monitoring results
Brampton	An area encompassing properties at Wood View, Nursery Cottages, Thrapston Road, Bliss Close and Flamsteed Drive close to the A14 in Brampton and Hinchingbrooke. Declared in 2006 due to exceedances of annual mean NO_2 objective. Amended in 2007 to include a larger area of the residential properties to the north of Bobs Wood, east of the A14, and properties to the north of the A14 (north of Wood View).	None of the 2013 annual mean NO_2 concentrations for any of the Brampton diffusion tubes exceeded the objective.
Hemingford – Fenstanton A14	An area encompassing a number of properties either side of the A14 between Hemingford and Fenstanton. Declared in 2006 due to exceedances of annual mean NO_2 objective.	None of the 2013 annual mean NO_2 concentrations for any of the Hemingford and Fenstanton diffusion tubes exceeded the objective.
South Cambridgeshire District Council		
A14 Corridor	An area along the A14 between Bar Hill and Milton. Declared in 2007 due to exceedances of annual mean NO_2 objective and from 2008 also due to daily mean PM_{10}. It was agreed with Defra that the boundary for NO_2 and PM_{10} would be the same. 2011 assessment indicated that the AQMA may need to be extended to the north of the A14 to incorporate Hill Farm Cottages at Swavesey.	Concentrations of NO_2 recorded since 2008 have fluctuated around the objective. Continuous monitoring at Bar Hill in 2011 recorded 43µg/m^3 but levels reduced to 39µg/m^3 in 2012 (the site at Bar Hill was closed in 2012). Results of NO_2 annual mean at the Impington site are below the objective. Results of bias adjusted diffusion tube data from 2013 indicated only one site where annual mean concentrations for NO_2 were slightly exceeded (42.4µg/m^3 at Hackers Farm, Lolworth). Concentrations of PM_{10} have been examined and due to poor data capture it has not been possible to determine the exact concentrations of PM_{10} within the AQMA.

8.4 Local air quality monitoring

8.4.1 Measurements of pollutant concentrations in the local area are undertaken using both continuous monitoring instruments and passive monitoring diffusion tubes. Results of local monitoring are available from the *UK air* website (Defra, 2014d) and from local authority air quality reports. Monitoring is carried out for all of the pollutants of concern for this assessment (NO_2 and PM_{10}). Monitoring was also specifically undertaken for the purposes of this assessment.

Continuous monitoring

8.4.2 Continuous monitoring is undertaken at nine sites (including roadside, rural and urban background sites) in the vicinity of the scheme. Details of relevant monitoring locations are presented in *Appendix 8.1* and shown on *Figure 8.4* in, for the years 2008 to 2013, where data is available.

8.4.3 The Huntingdon continuous monitor is located close to the main ring road around the town centre and has been operational since 2011. The results in 2011 indicated the air quality concentrations were just below the annual mean objective for NO_2 (37.6µg/m^3). In 2012 and 2013 the concentrations exceeded the objective for annual mean NO_2 (55.5µg/m^3 and 45.0µg/m^3 in 2012 and 2013 respectively). The peak in NO_2 during 2012 at this site appears to be a localised peak as there is no area wide trend for high results in 2012 seen in passive monitoring data. PM_{10} concentrations at the site have been around 10µg/m^3 below the objectives for each year of operation.

8.4.4 Continuous monitoring results from sites in the South Cambridgeshire area show that concentrations at all sites were below the objective for NO_2 in 2013. The highest measured concentrations in 2013 were at the Impington site with an annual average of 27.4µg/m^3 being recorded. This site is located at a roadside location on the A14. PM_{10} concentrations in the area have been below the objectives at all sites. The data for PM_{10} at Impington have been reviewed; they were found to contain potentially incorrect data and have therefore not been used in this assessment.

8.4.5 All five monitors in the Cambridge City area recorded decreasing NO_2 concentrations between 2008 and 2013. The most recent results indicate that only one site on Parker Street as exceeded the objective (46.3µg/m^3). The other sites recorded roadside concentrations in Cambridge as being between 27µg/m^3 and 38µg/m^3 in 2013. The range in results is due to sites being located at roads with very different traffic conditions. The Regent Street site recorded NO_2 concentrations reducing to below 40µg/m^3 for the first time in 2013. PM_{10} concentrations were all recorded as being below the objectives.

Diffusion tubes

8.4.6 NO_2 is monitored using diffusion tubes at 119 local authority sites across their administrative areas. Data for 2008-2013 at relevant diffusion tube sites have been reviewed and are summarised in *Appendix 8.1.*

8.4.7 The results from the diffusion tubes site in Huntingdon have generally show a reduction in concentrations between 2008 and 2013. Two sites continue to exceed the NO_2 annual mean objective in 2013 at George Street (kerbside location 43.1µg/m^3) and Pathfinder House (roadside location) where the continuous monitor is located (~50µg/m^3).

8.4.8 The results from the diffusion tubes sites in South Cambridgeshire indicate an overall downward trend in monitored NO_2 concentrations at all sites operating between 2008 and 2013. In 2013 only one site was recorded as having an exceedance of the annual mean objective for NO_2. This site was at Hackers Farm on the existing A14 (42.4µg/m^3 in 2013). This location is at a roadside site and not on the façade of the nearest property. The result at this location increased by around 1µg/m^3 from the previous year. At a nearby location on the existing A14 at Catchall Farm Cottages, the concentrations also increased slightly between 2012 and 2013. However, the concentrations which are monitored at the façade, and representative of public exposure are below the objective for annual mean NO_2 (26.1µg/m^3 in 2013).

8.4.9 The results from the diffusion tubes sites in Cambridge City indicated that five sites exceeded the annual mean objective in 2013. Concentrations at most locations across the city improved between 2008 and 2013. The local authority report these improvements as being due to changes in the traffic fleet with regards to greater uptake of public transport and cycling and a reduction in HGV trips.

8.4.10 No sites within the scheme area (scheme area in this context refers to the area where changes to traffic may occur across the wider road network as a result of the scheme) recorded annual mean concentrations above 60µg/m^3, therefore following advice from *LAQM TG(09)* no exceedances of the NO_2 hourly objective are anticipated.

8.4.11 In addition to local authority monitoring, multiple monitoring points specifically intended to provide data for the purposes of this assessment were used within the scheme area to aid understanding of current air quality conditions and to be used for model verification. The monitoring locations can be seen in *Appendix 8.1* and are shown on *Figure 8.4.* Some scheme specific monitoring locations overlap with local authority monitoring to allow for comparison of results and improve confidence in results which is considered to be best practice and follows *LAQM TG(09)* (Defra, February 2009b).

8.4.12 The monitored results have been annualised and bias adjusted in accordance with *LAQM TG(09)* (Defra, February 2009b) guidance. The details of this are provided in *Appendix 8.1.*

8.4.13 The results indicated four locations where the annual mean NO_2 objective was exceeded.

Background pollutant concentrations

Modelled concentrations

8.4.14 The Defra background air quality website (Defra, 2014e) includes estimated background air pollution concentrations for NO_x, NO_2 and PM_{10} for each 1km by 1km square covering the whole of England. Estimated pollutant concentrations are available for years 2010 to 2030.

8.4.15 The Defra background concentrations across the three local authorities where the scheme is located have been collated. The 2014 pollution concentration estimates for each borough are presented in *Table 8.5*. Maps showing the concentrations in each grid square are presented on *Figure 8.5*. As anticipated, the higher concentrations of air pollution are mainly found in the urban areas and along the existing major roads in the area. None of the background concentrations are above the objective concentrations for NO_2 or PM_{10} (40µg/m^3).

Table 8.5: Modelled background data (2014) for pollution concentration estimates

Local authority	NO_2			PM_{10}		
	Max (µg/m^3)	Min (µg/m^3)	Average (µg/m^3)	Max (µg/m^3)	Min (µg/m^3)	Average (µg/m^3)
Cambridge City	18.0	9.3	12.2	18.7	15.5	16.3
Huntingdon	24.1	6.5	7.7	20.9	13.7	16.4
South Cambridge	20.2	6.6	7.8	21.6	14.5	16.5

Monitored concentrations

8.4.16 Local authorities have been carrying out monitoring with diffusion tubes and automatic monitors in the scheme area. The nearest automatic monitor at a background location is at Orchard Park, Cambridge. Orchard Park is at an urban background location and is located in Cambridge to the south of the existing A14. This monitor recorded an annual mean NO_2 concentration of 21.7µg/m^3 and an annual mean PM_{10} concentration of 22µg/m^3 in 2013 as detailed in *Appendix 8.1*. No other automatic monitors at background locations are located within the scheme area. The closest automatic monitor at a background location outside the scheme area is at Wicken Fen which is a Defra owned automatic urban and rural network (AURN) site and is around 15km east of the scheme. Monitoring results from across the scheme area are presented in *Chapter 5 of Appendix 8.1*.

8.4.17 Monitored background concentrations from diffusion tubes across the scheme area indicate concentrations of NO_2 have been gradually reducing over the past six years across the region (refer to *Box 6*). The slight increase in concentrations observed in 2010 was a nationwide occurrence caused by the unusual meteorological effects experienced that year.

Background concentrations used for modelling purposes

8.4.18 Background concentrations used for modelling purposes have been taken from the Defra background mapping results. Comparison with the local authority monitoring data indicated a good relationship between the modelled results and the monitored data. All modelled results were within ±20% of observed concentration with six of the eight sites being within ±10%. Details of the comparison along with details of sites selected are included in *Table 6.1 of Appendix 8.1*.

8.4.19 Within the Defra background maps road sources are included. To avoid double counting of emissions from roads included within the model and within the background maps the Defra tool (Defra, 2014f) for sector removal was used to calculate the final background concentrations.

8.5 Potential impacts

Construction phase assessment

Construction dust

8.5.1 The construction dust assessment has been divided into six geographical sections to help describe the scheme impacts across the whole scheme area. These are the same as referred to in *Chapter 3,* the *Construction Information in Appendix 3.2* and which are shown on *Figure 3.1.*

8.5.2 The main fugitive dust producing activities can be divided into two types, due to the district localised effects from different activities as well as the similarities between on-site activities and potential mitigation measures. These are:

- impacts related to the borrow pits, compound areas and soil storage areas; and
- impacts related to the construction and demolition of roads, bridges and other road related infrastructure and trackout.

8.5.3 Following the guidance in *DMRB HA207/07* (Highways Agency et al., 2007), the number of sensitive receptors within 200m proximity to both the construction and demolition activities, have been identified for each of the construction sections. This is set out in *Tables 8.6 and 8.7.*

Table 8.6: Number of receptors within 200m of borrow pits, compound sites and soil storage areas within each of the six construction and demolition sections

Section	Number of receptors within 200m
1 - Alconbury to Brampton Hut	2
2 - A1/A14 Brampton Hut to East Coast mainline railway (ECML)	127
3 – A14 ECML to Swavesey	4
4 – A14 Swavesey to Girton	15
5 - Cambridge Northern Bypass	0
6 - Huntingdon A14 Viaduct demolition and A14 de-trunking	0

Table 8.7: Number of receptors within 200m of construction and demolition areas within each of the six construction, demolition and trackout sections

Section	Number of receptors within 200m
1 - Alconbury to Brampton Hut	1
2 - A1/A14 Brampton Hut to East Coast mainline railway (ECML)	10
3 – A14 ECML to Swavesey	7
4 – A14 Swavesey to Girton	42
5 - Cambridge Northern Bypass	491
6 - Huntingdon A14 Viaduct demolition and A14 de-trunking	728

8.5.4 For the first category (borrow pits, compound sites and soil storage areas) the section which has the highest number of receptors is section 2 A1/A14 Brampton Hut to ECML. The borrow pits and soil storage areas are in close proximity to the residential areas in Brampton. Sections 1, 3 and 4 also identified receptors which could be at risk of being impacted by the activities taking place. With no mitigation these sites could have negative impacts on the sensitive receptors, especially during drier months. Mitigation measures will be required to reduce the impact from dust.

8.5.5 The second category (construction, demolition and trackout) has two sections where there are larger numbers of residential properties within 200m of the activities. These are section 5 around the Cambridge Northern Bypass and section 6 in the centre of Huntingdon where the road viaduct would be removed and new roads built. All the other sections have fewer receptors within 200m which may be impacted by dust. With no mitigation, the impacts from the activities being undertaken in these sections could have negative impacts on the sensitive receptors, especially during the drier months. Mitigation measures would be required to reduce the impact from dust.

8.5.6 Overall it is identified that the scheme could impact upon receptors during the construction phase and mitigation is required to minimise the frequency and intensity of any dust episode.

Operational phase

Local air quality assessment

Affected road network

8.5.7 Following the *DMRB HA207/07* (Highways Agency et al., 2007) screening criteria, the ARN has been identified for the area around the scheme.

8.5.8 The 2020 ARN representing the area where qualifying changes in traffic characteristics would occur during the opening year is shown in *Figure 8.6*. The main areas where there are qualifying changes in traffic flow are located are around the north of Cambridge and around Huntingdon. The ARN extends south as far as A428 between Cambridge and Great Cambourne. To the north it extends to Alconbury along the A1.

8.5.9 The 2035 ARN which represents changes in traffic volumes 15 years after the scheme opens is a larger area, with more roads included to the south and north of the existing A14. The 2035 ARN is shown in *Figure 8.6*.

8.5.10 The ARN in both 2020 and 2035 includes roads in all the AQMAs across the scheme (with the exception of St Neots which is too distant from the scheme to experience a significant change in traffic). This allows the changes in air quality at these sensitive areas to be assessed. Worst case human receptors within 200m of the ARNs have been selected and included in the model. Ecological receptors within 200m of the ARN have also been assessed.

Compliance risk assessment

8.5.11 Where the ARNs overlap with Defra Pollution Climate Mapping (PCM) links, these have been selected and been used to create the compliance risk road network (CRRN) as outlined in *IAN 175/13* (Highways Agency, 2013a). Within this assessment the CRRN has been identified in three areas; the first is around the north of Huntingdon on the A141, the second is on the A1123 in St Ives and the third in Cambridge on the A1309 near J33 of the A14 and on the A1303 near Madingley. *Figure 8.7* shows the location of the A14 CRRN.

Traffic model verification and adjustment

8.5.12 The modelled annual mean NO_2 concentrations were compared to local monitoring data within the ARNs at 24 monitoring locations (both diffusion tube and automatic). Monitoring sites used for verification are detailed in *Table 7.1* and details of each site provided in *Appendix 8.1*. The sites used are located across the whole ARN area.

8.5.13 Once a final set of verification points was defined, it was clear that modelled results within Huntingdon town centre were under-predicting to a greater extent than across the rest of the ARN. It was concluded that a separate verification factor should be produced for Huntingdon town centre to address the under prediction. Four sites were available for the Huntingdon town centre verification which provided a verification factor of 2.53. The area where this verification factor was applied is provided in *Figure 8.8*. With this factor applied to the modelled results, the modelling predicted areas within Huntingdon which were exceeding the air quality objectives for annual mean NO_2. There is an under prediction at the Huntingdon continuous monitor which is likely to be due to high numbers of slow moving traffic and start stop emissions experienced at that location. This is likely to be a very localised issue at a worst case location in Huntingdon. A summary of verification results in Huntingdon is provided in *Table 8.8* and the full results are in *Appendix 8.1*.

8.5.14 The rest of the scheme with 20 verification points along the A14, A1 and other smaller roads in the ARN produced a separate verification factor of 1.08. This has been applied to all results within the rest of the ARN. A good agreement was reached with all except one of the sites being within ±25% of the monitored results. The one site where predicted concentrations were not within 25% of modelled concentrations was at Impington monitor where the model was found to be over predicting by 27%. This over prediction within an existing AQMA area indicates the assessment is providing worst case conservative results in that area. A summary of results of this verification is provided in *Table 8.8* and the full results are in *Appendix 8.1*.

8.5.15 The only area within an AQMA where the model is under predicting with the above verification factor is at Hackers Farm where the model under predicts at Hackers Farm by 16.6%. A sensitivity test was therefore carried out by applying a revised adjustment factor of 1.52 derived specifically from the Hackers Farm receptor to all receptors between junction 30 and 31 on the A14.

8.5.16 Verification of the modelled PM_{10} was not possible due to a lack of reliable roadside monitoring locations within the ARN. It should be noted again however that monitoring of PM_{10} concentrations across the scheme area are below the PM_{10} objectives.

Table 8.8: Summary of verification

	Huntingdon town centre verification	Rest of ARN area verification
Within +10%	2	7
Within -10%	0	6
Within ±10%	**2**	**13**
Within +10 to 25%	1	2
Within -10 to 25%	1	4
Within ±10 to 25%	**2**	**6**
Over +25%	0	1
Under -25%	0	0
Greater ±25%	**0**	**1**
Within ±25%	**4**	**19**
Total	**4**	**20**

Modelled concentrations

Assessment of future NO_x and NO_2

8.5.17 *IAN 170/12v3* (Highways Agency, 2013c) has been used to carry out sensitivity testing of future NO_x and NO_2 trends. As outlined within the *IAN*, the projection factors provided in *LAQM TG(09)* (Defra, February 2009b, Box 2.1) may be too optimistic and the long term trend factors provided with the *IAN* may be too pessimistic. The factors provided therefore need updating. As such the Highways Agency has produced an interim set of factors *Note on HA's Interim Alternatives Long Term Annual Projection Factors (LTTE6) for Annual Mean NO_2 and NO_x Concentrations between 2008 and 2030* (Highways Agency, 2013). The interim factors (*LTTE6*) take a conservative approach with regards to the improvements anticipated as a result of the introduction of Euro 6/VI vehicles to the fleet mix. The interim factors (*LTTE6*) do not take the most optimistic view of the benefits of Euro 6/VI. Additionally they do not include the benefits of Euro6/VI vehicles having an immediate impact upon emissions. Instead a more conservative approach is taken with the benefits starting to be realised around 2015. Due to this pessimistic approach taken in the *LTTE6* factors, it is the professional opinion of suitably qualified and experienced specialists (as listed in *Appendix 6.1*) that the interim factors are the most suitable for this assessment.

Human receptors

8.5.18 This section describes the predicted changes at human receptor locations as a result of the scheme in the opening year 2020 and future year 2035. The impact of the scheme on AQMAs is summarised in a *Table 8.9*.

Overview

8.5.19 The modelled results for the opening year of the scheme 2020 do not predict any exceedances of the air quality objectives for NO_2 and PM_{10}. *Figure 8.9* provides an overview of the modelled results showing those areas where the air quality concentrations are predicted to improve or worsen. The figures show clearly that the main improvements would be located along the current stretch of A14 between Swavesey and Huntingdon and in Huntingdon town centre as a result of traffic moving to the new bypass. These improvements are mainly in the more populated parts of the study area and result in a reduced population exposure to air pollutants.

8.5.20 The Huntingdon, Brampton and Hemingford to Fenstanton AQMAs all are predicted to have improvements in air quality concentrations. The scheme is likely to lead to a revocation of the AQMAs at these locations. The A14 Corridor AQMA also is predicted to have no exceedances of the air quality objectives in the opening year.

8.5.21 The results indicate the main residential areas across the scheme area will have improvements in air quality.

8.5.22 NO_2 concentrations do increase by a small amount (0.4 – 2µg/m^3) at some locations, particularly around the north of Cambridge across the scheme as shown in *Table 7.5 of Appendix 8.1*. PM_{10} concentrations follow a similar trend as NO_2 across the scheme area. There are no predicted exceedances of the daily mean PM_{10} objective in either 2020 or 2035 anywhere in the modelled area.

Alconbury to Brampton Hut

8.5.23 Along the A1 between Alconbury and Brampton Hut there are only a few receptor locations, which are located mainly in Alconbury. These locations are predicted to experience a small increase in NO_2 concentrations (0.4 – 2µg/m^3) in 2020, however the maximum predicted annual mean NO_2 concentration is well below the objective at 13µg/m^3. By 2035 the change in NO_2 concentration is negligible (0 – 0.4µg/m^3). No exceedances of PM_{10} objectives are predicted and the changes in this area are negligible.

8.5.24 All results in this area are in compliance with the objectives and limit values.

Ellington, Brampton, Buckden and the Offords

8.5.25 The predicted changes in NO_2 and PM_{10} concentrations are negligible in Ellington in 2020 and 2035.

8.5.26 Receptors in Brampton are predicted to experience improvements in NO_2 and PM_{10} concentrations at receptors along the A14 and B1514 in 2020 and 2035. Closer to the A1 there is a small increase in NO_2 concentrations in 2020, this change is reduced to a negligible level by 2035. PM_{10} concentration changes at the same location close to the A1 are negligible in 2020 and 2035. The biggest improvements are seen close to and within the AQMA where pollution concentrations are highest.

8.5.27 Receptors in Buckden on the A1 experience improvements in NO_2 and PM_{10} concentrations at locations closest to the road. Where the new road joins the A1 there are a few receptors that experience a worsening of pollution concentrations. The maximum change is 3.6µg/m^3 and 0.6µg/m^3 for NO_2 and PM_{10} respectively at a receptor (304) located off Brampton Road. However, the predicted concentrations at these receptors are well below the air quality objective levels at around 15µg/m^3.

8.5.28 The ARN in 2020 only includes the road leading to Offord D'Arcy, and the impact in this area for NO_2 and PM_{10} is negligible. The 2035 ARN covers both of the Offords. The impact in these locations for NO_2 and PM_{10} is negligible.

8.5.29 All results in this area are in compliance with the objectives and limit values.

Huntingdon and Godmanchester

8.5.30 Huntingdon and Godmanchester are the main areas where improvements in air quality as a result of the scheme are predicted to occur. The re-routing of traffic onto the new road takes traffic away from the urban areas. The largest improvements are along the existing A14 with the maximum improvement (6.3µg/m^3) in 2020 being at receptor 73 on Castle Moat Road which is close to the existing Huntingdon air quality continuous monitor. There are a number of other large improvements in NO_2 concentrations where concentrations of annual mean NO_2 fall by more than 4µg/m^3.

8.5.31 One location in Huntingdon is predicted to experience a small increase in annual mean NO_2 concentrations in 2020. This receptor is located at the junction of Edison Bell Way and Ermine Street. By 2035 the change is predicted to be negligible. Other receptors experience a negligible change.

8.5.32 The largest predicted improvements occur within existing AQMAs.

8.5.33 All results in this area are in compliance with the objectives and limit values.

St Ives, Fenstanton and Swavesey

8.5.34 The changes in NO_2 and PM_{10} concentrations are predicted to be negligible in St Ives in 2020 and 2035.

8.5.35 Most receptors in Fenstanton and along the A14 between Fenstanton and Godmanchester are predicted to have an improvement in NO_2 concentrations in 2020 and 2035. There are 12 receptors that are predicted to have a large (>4µg/m^3) improvement in annual mean NO_2 with most of these being within existing AQMAs. PM_{10} concentrations are also predicted to improve in these areas.

8.5.36 Changes in NO_2 and PM_{10} concentrations are predicted to be negligible in Swavesey in 2020 and 2035.

Dry Drayton, Elsworth, Graveley, Cambourne

8.5.37 The area between the scheme design and the A428 is mainly rural in nature with small villages. Several of the roads in this area were included in the 2035 ARN, as the changes in traffic flows in 2020 were not large enough to be included in the 2020 model. All the results in this area which included the villages of Dry Drayton, Elsworth and Graveley experienced a negligible change in annual mean NO_2 and PM_{10} concentrations.

8.5.38 The predicted changes in NO_2 and PM_{10} concentrations are negligible to small increases in Cambourne in 2020 and 2035.

8.5.39 All results in this area are in compliance with the objectives and limit values.

Bar Hill, Girton and the north of Cambridge City

8.5.40 The predicted changes in NO_2 and PM_{10} concentrations are negligible to small in Bar Hill in 2020 and 2035.

8.5.41 Along the A14 between junction 30 and 31, the maximum predicted annual mean NO_2 concentration in 2020 is 31.7µg/m^3 and the maximum PM_{10} concentration is 20.8µg/m^3. The changes predicted along this stretch of road correspond to a small increase in NO_2 and a negligible change in PM_{10} concentrations in 2020 and 2035.

8.5.42 As discussed in the verification section the model was found to be under predicting concentrations in this area. To ensure a conservative approach was taken, a sensitivity test was carried out and the predicted results were multiplied by the factor observed at Hackers Farm (1.52). These adjusted results indicated no exceedances of the annual mean NO_2 objective in 2020 or 2035. The maximum result of 38.3µg/m^3 was predicted at the worst case location at Hackers Farm in the do something 2020 scenario.

8.5.43 Along the A14 to the north of Cambridge, the predicted changes to annual mean NO_2 and PM_{10} are mainly negligible. There are three receptors where small increases in annual mean NO_2 are observed and two where small decreases are predicted. The predicted changes to other receptors moving north towards Histon and Girton are all negligible for NO_2 and PM_{10} in 2020. In 2035 in this area, results are similar, however, with the increased ARN there are more receptors to the south of the A14. The changes in concentration are mostly negligible in 2035: however there are some small increases in annual mean NO_2 around Kings Hedges Road and some medium increases on Madingley Road. The maximum increase on Madingley Road is 3.6µg/m^3 however the total annual mean concentration is still well below the objective at 16µg/m^3.

8.5.44 All results in this area are in compliance with the objectives and limit values.

AQMA results

8.5.45 The four AQMAs within the modelled area (St Neots and Cambridge City are outside of the ARNs) have the modelled results summarised in *Table 8.9*. The assessment identifies improvements in air quality in the Huntingdon AQMA. The Brampton AQMA also improve, concentrations are well below the objectives in 2020. The Hemingford to Fenstanton AQMA has improvements in NO_2 and PM_{10} concentrations. These AQMAs all experience improvements due to traffic being diverted from these areas and on to the proposed road. The A14 corridor AQMA is predicted to have no exceedances in the opening year 2020. The reduction in concentrations is due to vehicle fleet emission improvements and improvements in road design allowing improved flow and less congestion.

Table 8.9: Summary of AQMA modelled results

AQMA	Modelled results
Huntingdon	Concentrations of NO_2, are predicted in the majority to improve across most of the AQMA. The area around Castle Moat Road in 2020 records the highest annual mean concentrations in the modelled area at around 34µg/m^3. This is below the air quality objective for this pollutant. There is one location where a small increase in NO_2 is predicted. This is at the junction of Edison Bell Way and Ermine Street and will result in a concentration of 22µg/m^3, which is well below the objective. The main improvements in the AQMA are around the town centre one way system and along the A14. There are also improvements in the section of AQMA which extends towards Godmanchester.
Brampton	Concentrations in the Brampton AQMA are already below the air quality objectives. The modelled results indicate that the scheme would benefit air quality in this location with improvements between 3.6µg/m^3 and 1.7µg/m^3 being predicted in 2020. Resulting in concentrations well below the objective.
Hemingford – Fenstanton A14	With this section of the A14 becoming much less trafficked in 2020 as a result of the scheme, pollutant concentrations at this location have been predicted to improve in this AQMA. The concentrations have currently been monitored below the objectives and with the scheme they are predicted to reduce further. The scheme is predicted to improve NO_2 annual mean concentrations in the AQMA by between 2.8µg/m^3 and 6.2µg/m^3. There are no exceedances of objectives expected.
A14 corridor	No exceedances of either the NO_2 or PM_{10} objective are predicted in the opening year for the A14 corridor AQMA. Worst case sensitivity test having been undertaken the maximum annual mean NO_2 concentration predicted was 38.3µg/m^3. The annual mean NO_2 concentrations are expected to increase by a small amount as a result of the scheme. The PM_{10} annual mean concentrations remain well below the objective levels whilst the number of daily exceedances is not expected to change at worst case locations.

Ecological receptors

8.5.46 This section describes the predicted changes at ecological receptor locations as a result of the scheme in the opening year 2020 and future year 2035.

Annual mean NO_x concentrations

8.5.47 The modelled results for both the opening and future year of the scheme predict a reduction in annual mean NO_x concentrations at all designated sites assessed with the exception of Great Stukeley Railway SSSI. *Table 7.7 of Appendix 8.1* shows the predicted annual mean NO_x concentrations and *Table 7.8 of Appendix 8.1* shows the magnitude of change in concentrations as a result of the scheme.

8.5.48 The annual mean NO_x objective, is exceeded at three locations in the do-minimum scenario 2020 (Portholme SAC, Brampton Meadow SSSI and Hemingford Grey Meadow SSSI). Each exceedance is observed to occur at the closest point to the A14 (Portholme SAC 50m, Brampton Meadow SSSI 21m and Hemingford Grey Meadow SSSI 13m).

8.5.49 One location (Hemingford Grey Meadow SSSI) is predicted to exceed the annual mean NO_x objective in the do-minimum 2035 scenario but will be well below the objectives in the do something (20.9µg/m^3). Hemingford grey Meadow SSSI is located to the north of the new road and as such traffic volumes along the stretch of the A14 running adjacent to the SSSI will be reduced as a result of the scheme.

8.5.50 The impact of the scheme on air quality in all the designated sites except Great Stukeley Railway SSSI is a reduction in NO_x concentrations and there are no sites exceeding the annual mean NO_x objective in any of the future year do something scenarios (2020 and 2035).

8.5.51 The largest decrease in annual mean NO_x concentrations is predicted to occur at Hemingford Grey Meadow SSSI, where the magnitude of change is large. This is to be expected as this SSSI lies on the section of the existing A14 which will have significantly reduced flows with the scheme in operation.

8.5.52 As discussed above, a small increase in annual mean NO_x concentrations (0.4µg/m^3) is predicted at Great Stukeley Railway SSSI within 20m of the road, which is located to the north of Huntingdon. The predicted increase is negligible and the total NO_x concentration is well below the objective.

Nitrogen deposition

8.5.53 The modelled results for both the opening and future year of the scheme indicates a reduction in nitrogen deposition rates at all designated sites assessed with the exception of Great Stukeley Railway SSSI. *Table 7.9 to Table 7.12 of Appendix 8.1* shows the predicted total deposition rates and the change in total deposition as a result of the scheme at each of the designated sites for the opening year and future year, respectively. The largest reduction in total deposition rates occurs at Hemingford Grey Meadow SSSI with a predicted decrease of 1.04kgN/ha/yr, which is 5.2% of the lower critical load. As discussed above, this is due to the new bypass reducing traffic volumes along the stretch of the A14 running adjacent to the SSSI.

8.5.54 At the Great Stukeley Railway SSSI, predicted total deposition rates in the opening year are within the critical load range even with the increase as a result of the scheme. The increase in total deposition is very small, with a maximum predicted change of 0.2kgN/ha/yr. This is 0.1% of the lower critical load.

8.5.55 As shown in, *Table 7.7 of Appendix 8.1 it* is observed that predicted total deposition rates are greater than the critical load range for Madingley Wood SSSI in the opening year and Overhall Grove SSSI in the future year. It should be noted that this is due to background nitrogen deposition at these locations and does not occur as a result of the scheme. At Madingley Wood SSSI, the scheme results in a very small decrease in total nitrogen deposition rates. No change is predicted at Overhall Grove SSSI. Total deposition rates at all other sites, with the exception of Great Stukeley Railway SSSI, are below the critical load ranges.

Regional air quality assessment

8.5.56 This section describes the effect of the scheme on regional air quality across the scheme area. Total CO_2, NO_x and PM_{10} emissions for all assessed scenarios are presented in *Table 8.10*. The change in emissions as a result of the scheme is presented in *Table 8.11.*

Table 8.10: Total emissions for all assessed scenarios across the regional ARN

Pollutant	Baseline	DM 2020	DS 2020	DM 2035	DS 2035
	Units – tonnes/yr				
CO_2	482,436	495,824	530,087	549471	617709
NO_x	1,252	597	665	416	481
PM_{10}	72	62	65	70	77

Table 8.11: Change in emissions as a result of the scheme

Pollutant	Changes in emissions (tonnes/yr)	
	Opening year (2020)	Future year (2035)
CO_2	34,263	68,238
NO_x	68	65
PM_{10}	3	7

8.5.57 As shown in *Table 8.11*, the scheme results in an increase in emissions, including greenhouse gas emissions represented by assessed CO_2 emissions, on a regional scale. Factors that contribute towards the increase in emissions are the change in vehicle kilometres travelled, as the scheme is longer than the existing route, and the improvement of capacity along the network allowing greater volumes of traffic to travel through the scheme area as a result of the scheme. The likely magnitude of change to NO_x and PM_{10} and greenhouse gas emissions on a regional scale would be negligible. In 2012, the UK emitted a total of 1m tonnes of NO_x and 112,850 tonnes of PM_{10} from all sources (Defra 2013), in addition the UK's construction industry alone emits approximately 101.1m tonnes of carbon dioxide equivalent gases (2011 data, ONS) and the UK as a whole emitted 634.8m tonnes of carbon dioxide equivalent. The increase in emissions, for each assessed pollutants on a regional scale, as a result of the scheme is 0.01% or less of national emission totals.

Compliance with Air Quality Directive

8.5.58 *IAN 175/13* (Highways Agency, 2013a) has been followed for determining the schemes compliance with the *Air Quality Directive* (European Commission, 2008) and any risk the scheme would pose with regards to delaying compliance with the limit values within the Eastern Zone (UK0029).

8.5.59 The steps outlined in *IAN 175/13* (Highways Agency, 2013a) have been followed and a table recording the results has been provided in *Appendix 8.1*.

8.5.60 There are four areas where a CRRN has been identified as discussed and shown in *Figure 8.7*. The equivalent PCM result for each link in the opening year of design has been calculated. The PCM data were taken directly from the data provided by Defra as the opening year of the scheme matched one of the predicted future years.

8.5.61 The results of the compliance testing indicated the scheme to be low risk as defined within the IAN. None of the links were at risk of becoming non-compliant, the date for achieving compliance would not be affected and there would be no increase in the length of roads in exceedance in the zone.

Compliance with local planning policies

8.5.62 The local planning policies listed in *Appendix 8.1* and the actions and measures in the joint councils *AQAP* (Joint Councils Partnership, 2009) have been considered against the impacts resulting from the scheme.

8.5.63 The scheme is predicted to benefit air quality generally and within the AQMAs. Also there are no large increases in air quality concentrations or any areas of exceedance created at any locations across the scheme area. As such the scheme does not negatively impact on any of the local air quality related planning policies or measures within the *AQAP* (Joint Councils Partnership, 2009).

Evaluating significance

8.5.64 *IAN 174/13* (Highways Agency, 2013b) provides guidance on evaluating overall scheme significance. The overall significance of the scheme is based upon all elements of the scheme which have been assessed and the results discussed within this chapter. Below is a summary of the results split between the construction and operational phases.

8.5.65 The key criteria questions for evaluating significance are set out and results for each summarised.

Operational phase significance

Operational phase human receptors

8.5.66 In 2020, the scheme opening year, no exceedances of any of the air quality objectives for NO_2 or PM_{10} were predicted with or without the scheme. As such there is no requirement to fill in *table 2.1 from IAN 174/13* (Highways Agency, 2013b), as this is only concerned with receptor locations where the objectives are being exceeded.

8.5.67 The questions related to human health from *IAN 174/13* (Highways Agency, 2013b) are –

- *"Is there a risk that environmental standards will be breached?"*
    - The modelling results indicate there is not a risk of environmental standards for NO_2 or PM_{10} being breached in the scheme opening year. There are several areas where large improvements are observed as a result of the scheme.
- *"Will there be a large change in environmental conditions?"*
    - This question relates specifically to areas where there are predicted to be exceedances of an air quality objective. Also the change referred to is a large negative change. There are no large negative changes (>4µg/m^3) as a result of the scheme. There are 38 locations which experience an improvement in air quality of greater than 4µg/m^3.

- *"Will the effect continue for a long time and will many people be affected?"*
    - Each of these questions refers mainly to areas where there may be exceedances of the air quality objectives. As there are not any predicted exceedances for this scheme there is no length of time or number of receptors to consider here. There are considerably more areas of improvement expected as a result of the scheme, as a result the number of people experiencing air quality levels close to the objectives will reduce.
- *"Will it be difficult to avoid, or reduce or repair or compensate for the effect?"*
    - The scheme is not predicted to have any significant impacts which will need to be mitigated.

8.5.68 The findings from each of the key questions related to human health have provided evidence that the answers would result in a conclusion of 'not significant'.

Operational phase ecological receptors

8.5.69 The question related to ecological health from *IAN 174/13* (Highways Agency, 2013b) is–

- *"Is there a risk that designated sites, areas, or features will be affected?"*
    - Following *DMRB HA207/07* (Highways Agency et al., 2007) guidance, the effect of the scheme on annual mean NO_x concentrations at designated sites has been considered in the first instance, in establishing whether the scheme results in significant effects. Using the HA interim factors for future projections of NO_x concentrations, which are likely to present the most probable situation for the opening and future years, the precautionary annual mean NO_x objective (30µg/m^3) is met in the do-something scenario at all designated sites. Several of the sites have improvement in air quality as a result of the scheme.

8.5.70 The findings from the key question related to ecological health have provided evidence that the answer would result in a conclusion of 'not significant'.

Operational phase overall significance

8.5.71 *Table 8.13* summarises the overall significance taking into account effects on human and ecological receptors and the schemes potential impact upon EU compliance. The findings indicate that overall the scheme would have no significant impact on air quality.

Table 8.12: Operational phase overall significance

Key criteria questions	Yes / no
Is there a risk that environmental standards will be breached?	No
Will there be a large change in environmental conditions?	No
Will the effect continue for a long time?	No
Will many people be affected?	No
Is there a risk that designated sites, areas, or features will be affected?	No
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	No
On balance is the overall effect significant?	No

8.6 Mitigation

Mitigation for the construction phase

8.6.1 The assessment identified there are areas across the scheme where mitigation would be required to limit the impact from construction and demolition related dust. The mitigation measures to limit the impact would be applied at all sites where dust producing activities would be taking place. The methods of dust suppression will follow current construction and demolition site best practice. The details of this are set out in the Code of construction practice in *Appendix 20.2*.

8.6.2 Experience across a range of construction sites has shown that application of best practice mitigation measures would reduce dust impacts to a negligible level (IAQM, 2014). Therefore the resulting dust effects are unlikely to be significant with the appropriate mitigation measures.

8.6.3 It has been noted in the register of commitments that the number of vehicles required should be considered and kept to a minimum. In particular the number of vehicles using the existing roads and locations where construction vehicles pass close to receptors, the number and routes should be carefully managed.

8.6.4 Mitigation will be secured by way of requirements in the DCO and through contractual responsibilities placed by the Highways Agency on detailed design and construction contractors.

Mitigation for the operational phase

8.6.5 No significant impacts were identified as requiring mitigation in the operational phase. As such no mitigation is proposed.

8.6.6 The scheme is predicted to improve air quality in a number of areas including AMQAs across the scheme area.

8.7 Significance of effects

8.7.1 The overall residual significance for each phase of the scheme is summarised in *Table 8.14*. The scheme does not have a significant effect and low compliance risk against the EU limit values.

Table 8.13: Summary of effects

Description of effect	Significance	Mitigation	Residual effect
Construction phase			
Dust from construction and demolition	Significant	Best practice measures relating to management of dust from construction and demolition sites to be implemented via the CoCP and local environmental management plans (LEMPs)	Not significant
Operational phase			
Emissions from operational phase vehicles	Not significant	None required	Not significant

8.8 Summary and conclusion

8.8.1 The assessment has examined the potential effects of the scheme on air quality during both its construction and operational phases.

8.8.2 A review of the current air quality legislation and planning policies relevant to the scheme has been undertaken. This assessment covers each of the main areas highlighted as being essential for an air quality assessment within the *Draft NPSNN* (Department for Transport, 2013).

8.8.3 The baseline assessment demonstrates that there are existing air quality issues within the study area, with exceedances of the NO_2 annual mean objective being observed in Huntingdon, Cambridge and along the A14 corridor. No exceedances of PM_{10} were recorded in the baseline assessment.

8.8.4 Assessment of the construction phase of the scheme showed mitigation is required to reduce potential nuisance dust issues at local residential properties and businesses. This is a common finding from dust impact assessments and the mitigation measures applied are well tested and acknowledged as being effective (IAQM, 2014).

8.8.5 The regional assessment showed the scheme results in an increase in emissions, including greenhouse gas emissions represented by assessed CO_2 emissions, on a regional scale. Factors that contribute towards the increase in emissions are the change in vehicle kilometres travelled, as the scheme is longer than the existing route, and the improvement of capacity along the network allowing greater volumes of traffic to travel through the scheme area as a result of the scheme. The likely magnitude of change to NO_x and PM_{10} and greenhouse gas emissions on a regional scale would be negligible, on the basis that the UK's construction industry emits approximately 101.1m tonnes of carbon dioxide equivalent gases (2011 data, ONS) and the UK as a whole emitted 634.8m tonnes of carbon dioxide equivalent.

8.8.6 Assessment of the scheme opening and design years showed predicted concentrations of both NO_2 and PM_{10} were below objective levels in all scenarios. As no exceedances of air quality objectives were observed across the scheme area at human or ecological receptors therefore no mitigation was required for the operational phase.

8.8.7 With no exceedances of limit values being observed across the scheme area it has also been shown that the scheme is not likely to impact upon the Eastern Zone (UK0029) predicted date for compliance with the EU limit values (as set out in the *Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO_2) in Eastern (UK0029)* (Department for Environment, Food and Rural Affairs, September 2011)).

8.8.8 A number of areas were shown to experience a large improvement in air quality concentrations across the scheme area, most notably in Huntingdon town centre and at residential properties along the A14 between Swavesey and Huntingdon. AQMAs in the study area are predicted to experience improvements in concentrations as was anticipated in the joint AQAP produced by the joint councils across the region.

8.8.9 Based upon the professional judgement of suitably qualified and experienced specialists, as listed in *Appendix 6.1,* it has been shown that overall the scheme provides greater benefits to the region with respect to air quality pollutant concentrations, than without it. With the proposed mitigation enforced during the construction phase, the scheme will have no significant impacts upon air quality.

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