

**M54 to M6 Link Road**

**TR010054**

**Volume 6**

**6.1 Environmental Statement**

**Chapter 14 – Climate**

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed  
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**The Infrastructure Planning  
(Applications: Prescribed Forms and  
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**M54 to M6 Link Road  
Development Consent Order 202[ ]**

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**6.1 Environmental Statement  
Chapter 14 Climate**

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## Table of contents

<b>Chapter</b>	<b>Pages</b>
<b>14 Climate</b> .....	<b>14-1</b>
14.1 Introduction .....	14-1
14.2 Legislative and policy framework.....	14-1
14.3 Assessment methodology .....	14-4
14.4 Assessment assumptions and limitations.....	14-12
14.5 Study area.....	14-13
14.6 Baseline conditions .....	14-13
14.7 Potential impacts.....	14-14
14.8 Design, mitigation and enhancement measures .....	14-17
14.9 Assessment of likely significant effects .....	14-20
14.10 Monitoring .....	14-24
14.11 References.....	14-25

### List of Tables

Table 14.1: NPSNN policies relevant for the climate assessment .....	14-2
Table 14.2: Measure of likelihood for CCR assessment .....	14-8
Table 14.3: Measure of consequence for CCR assessment.....	14-9
Table 14.4: Significance criteria for CCR assessment.....	14-9
Table 14.5: Likelihood criteria for ICCI assessment.....	14-10
Table 14.6: Consequence criteria for ICCI assessment.....	14-10
Table 14.7: Significance criteria for ICCI assessment.....	14-11
Table 14.8: Scoping opinion and response.....	14-11
Table 14.9: GHG emission sources: construction phase .....	14-15
Table 14.10: GHG emission sources: operation, maintenance and use of the Scheme .....	14-16
Table 14.11: GHG mitigation measures.....	14-17
Table 14.12: Climate change resilience mitigation measures .....	14-19
Table 14.13: Emissions breakdown by construction activity .....	14-20
Table 14.14: Comparison of road user emissions – ‘DM’ vs ‘DS’ scenarios .....	14-21
Table 14.15: Construction and operation emissions in comparison to national carbon budgets.....	14-22

**List of Appendices [TR010054/APP/6.3]**

- Appendix 14.1: Climate Resilience Baseline
- Appendix 14.2: Climate Impacts and Effects

## 14 Climate

### 14.1 Introduction

- 14.1.1 This chapter assesses the potential climate impacts associated with the construction and operation of the Scheme, following the methodology set out in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1, Air Quality (Ref 14.1) and in line with the relevant Institute of Environmental Management and Assessment (IEMA) guidance (Ref 14.2; Ref 14.3). This chapter summarises the regulatory and policy framework related to climate, details the methodology followed for the assessment and describes the existing environment in the area surrounding the Scheme. Following this, the design and mitigation and residual effects of the Scheme are presented.
- 14.1.2 This chapter of the Environmental Statement (ES) has been prepared by competent experts with relevant and appropriate experience. The technical lead for the climate assessment has 18 years of relevant experience and has professional qualifications as summarised in Appendix 1.1 [TR010054/APP/6.3].

### 14.2 Legislative and policy framework

#### Legislation

- 14.2.1 The Climate Change Act 2008 (Ref 14.4) set out a legally binding target for the UK Government to reduce national greenhouse gas (GHG) emissions from 1990 levels by at least 80% by 2050. This target is supported by a series of five-year carbon budgets and an independent committee to monitor progress (Ref 14.5).
- 14.2.2 An update to the Climate Change Act 2008 was published in 2019 (Climate Change Act 2008 (2050 Target Amendment) Order 2019) (Ref 14.6), which is an amendment revising the previous 2050 GHG target of an 80% reduction of GHG emissions compared to 1990 levels to a net zero carbon target. Achieving this will require future GHG emissions to be aligned (avoided or offset) with any future new or revised carbon budgets that may be set out by Government to achieve the target of net zero carbon by 2050.
- 14.2.3 The Climate Change Committee (CCC) recently stated that, “[It]... will revise its assessment of the appropriate path for emissions over the period to 2050 as part of its advice next year (2020) on the sixth carbon budget” (Ref 14.7). Therefore, the current carbon budgets have been considered when determining the significance of GHG emissions from the Scheme.
- 14.2.4 Whilst some tightening of the current carbon budgets is likely to occur when they are reviewed and revised in 2020, to reflect the recent commitment to a net zero carbon economy by 2050, the CCC has indicated that the trajectory will be steeper overtime; therefore it is the later carbon budgets rather than near term ones which will see a greater impact.

## Planning Policy

14.2.5 The primary basis for deciding whether or not to grant a Development Consent Order (DCO) is the National Policy Statement for National Networks (NPSNN)<sup>1</sup> (Ref 14.8) which sets out policies to guide how DCO applications would be decided and how the impacts of national networks infrastructure should be considered. Table 14.1 identifies the NPSNN policies relevant to the climate assessment and where in this ES chapter information is provided to address these policy requirements.

**Table 14.1: NPSNN policies relevant for the climate assessment**

NPSNN para.	Requirement of the NPSNN	Location where information addresses policy requirements
4.40	Applicants must consider the impacts of climate change when planning location, design, build and operation. Any accompanying environment statement should set out how the proposal would take account of the projected impacts of climate change.	Section 14.8 'Design mitigation and enhancement measures' and Section 14.9 'Assessment of likely significant effects' consider how the Scheme would account for the projected impacts of climate change.
4.41	Where transport infrastructure has safety-critical elements and the design life [Scheme lifetime] of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood) against the 2080 projections at the 50% probability level.	New climate projections (UKCP18) have been released since the publication of the NPSNN. Section 14.6 'Baseline conditions' demonstrates the application of the updated UK Climate Projections (UKCP18) Representative Concentration Pathway (RCP) 8.5 scenario against the 2080 projections at the 50% probability level. RCP8.5 is the most similar to the high emissions scenario in UKCP09 in terms of temperature.
4.42	The applicant should take into account the potential impacts of climate change using the latest UK Climate Projections available at the time and ensure any environmental statement that is prepared identifies appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure.	Section 14.6 'Baseline conditions' demonstrates the application of the latest UK climate projections – UKCP18. Section 14.8 'Design mitigation and enhancement measures' identifies mitigation and adaptation measures.
4.43	The applicant should demonstrate that there are no critical features of the design of new national networks infrastructure which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections. Any potential critical features should be assessed taking account of the latest credible scientific evidence on, for example, sea level rise and on the basis that necessary	Section 14.6 'Baseline conditions' considers potentially critical features of the design which may be seriously affected by climate change beyond that projected in the latest UK climate projects.

<sup>1</sup> Although other policies can have weight as relevant and important matters in decision making. See Case for the Scheme for more information [TR010054/APP/7.2].

NPSNN para.	Requirement of the NPSNN	Location where information addresses policy requirements
	action can be taken to ensure the operation of the infrastructure over its estimated lifetime through potential further mitigation or adaptation.	
4.44	Any adaptation measures should be based on the latest set of UK Climate Projections, the Government's national Climate Change Risk Assessment and consultation with statutory consultation bodies. Any adaptation measures must themselves also be assessed as part of any environmental impact assessment and included in the environment statement, which should set out how and where such measures are proposed to be secured	Section 14.8 'Design mitigation and enhancement measures' considers identification and implementation of adaptation measures.
5.17	Carbon impacts would be considered as part of the appraisal of scheme options (in the business case), prior to the submission of an application for DCO. Where the development is subject to EIA [Environmental Impact Assessment], any Environmental Statement would need to describe an assessment of any likely significant climate factors in accordance with the requirements in the EIA Directive, for road projects applicants should provide evidence of the carbon impact of the project and an assessment against the Government's carbon budgets.	Section 14.3 'Assessment methodology' and Section 14.9 'Assessment of likely significant effects' considers the carbon impacts of the Scheme and compares them against the Government's carbon budgets.

14.2.6 An assessment of the Scheme's conformity with the relevant paragraphs and provisions for climate in the NPSNN is presented in the NPSNN Accordance Table, Appendix A of the Case for the Scheme [TR010054/APP/7.2].

14.2.7 Other relevant legislation and policies have been considered as part of the climate assessment where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for significant environmental effects; and required mitigation. These policies are outlined below:

- In accordance with the National Planning Policy Framework (NPPF), the NPSNN policies relating to the applicant's assessment are the primary source of policy guidance regarding this climate assessment. The NPPF was revised in 2019 (Ref 14.9), but the requirements which relate to this assessment have not substantively changed, and the NPSNN remains the primary source of policy guidance.
- The West Midlands Strategic Transport Plan (Ref 14.10).
- Staffordshire Local Transport Plan 2011-2026 (Ref 14.11).
- A Local Plan for South Staffordshire (Ref 14.12).

14.2.8 These policies identify the need for the consideration of the impacts of climate change throughout the development process. Impacts identified include a greater incidence of extreme weather conditions, such as hotter summers and milder and wetter winters, leading to increased road surface deformation and increased flood risk.

- 14.2.9 Development priorities for mitigation and adaptation to climate change highlighted within these policies include:
- the reduction of transport related environmental impacts, including GHG emissions;
  - the maintenance and development of transport infrastructure for greater reliability and resilience to climate change impacts;
  - ensuring that all new developments are located and designed to maximise energy efficiency, and incorporate the best environmental practice and sustainable construction techniques appropriate to the size and type of development;
  - minimises the consumption and extraction of minerals by making the greatest possible reuse and recycling of materials in new construction;
  - mitigation against the worst effects of climate change; and
  - guidance against development in known areas of flood risk as identified in the Strategic Flood Risk Assessment, Surface Water Management Plan and consistent with NPPF.
- 14.2.10 These policy objectives have been accounted for in the design of the Scheme and through the assessment of GHG emissions and climate change resilience (CCR) reported within this chapter.

### 14.3 Assessment methodology

#### General approach

- 14.3.1 To align with the requirements of the NPSNN and the EIA Directive (Ref 14.13), the climate assessment includes the following elements:
- GHG impact assessment: the effect on the climate of GHG emissions arising from the Scheme, including how the Scheme would affect the ability of government to meet its carbon reduction plan targets;
  - CCR assessment: the resilience of the Scheme to climate change, including how the Scheme design would be adapted to take account for the projected impacts of climate change; and
  - in-combination climate impacts (ICCI) assessment: the combined effects of the impacts of the Scheme and potential climate change impacts on the receiving environment.
- 14.3.2 Key methodology documents of relevance to the climate assessment are as follows:
- DMRB LA 114 Climate (Ref 14.27);
  - DMRB, Volume 11, Section 3, Part 1, Air Quality (Ref 14.1); and
  - Carbon Tool – The Highways England’s carbon emissions calculation tool (Ref 14.14) has been developed to enable the better management of carbon emissions associated with the strategic road network.

14.3.3 The assessment has also referenced guidance and advice contained within the following documents:

- World Business Council for Sustainable Development and World Resources Institute Greenhouse Gas Protocol (Ref 14.15);
- Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref 14.2);
- Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Ref 14.3);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (Ref 14.16); and
- PAS 2080:2016 Carbon Management in Infrastructure (Ref 14.17).

#### **Establishment of the baseline conditions**

14.3.4 The baseline conditions for the GHG impact assessment were determined using modelled volumes of traffic currently on the existing road network, and its predicted future use (accounting for increases in traffic and associated congestion) through to year 2083 (assuming a Scheme lifetime of 60 years).

14.3.5 Data was gathered from the following sources to determine the baseline conditions for the CCR and ICCI assessments:

- UKCP18 (Ref 14.18) – to identify the relevant climate projections for the appropriate geographic area of the Scheme.
- UK Climate Change Risk Assessment 2017 Evidence Report (Ref 14.19) – to identify the climate change risks relevant to the Scheme and geographic area of the Scheme.
- The Met Office historic climate data (Ref 14.20) – to identify the historic trends of relevant climate parameters for the appropriate geographic areas of the Scheme.

#### **Greenhouse gas impact assessment**

14.3.6 All GHG emissions contribute to global climate change. The UK has legally binding GHG reduction targets and therefore the level of significance has considered how the Scheme would contribute to the UK's ability to achieve its carbon reduction targets and meet the carbon budgets.

14.3.7 Whilst the scope of the assessment covers the lifecycle stages of the project, the GHG assessment comprises two parts reflecting both the level of certainty of future activity and GHG emissions, and the extent that the predicted GHG emissions would be additional to the existing GHG inventory:

- the first considers the construction of the Scheme itself; the majority of GHG emissions from which would be additional to the existing national GHG emissions inventory and are compared to the relevant UK carbon budgets; and
- the second considers the operation (including maintenance) and 'use' of the Scheme; comprising GHG emissions resulting from energy use, such as road

lighting and the impact from a variation in vehicle journeys travelling on the Scheme and the surrounding area. As at least part of the GHG emissions associated with the operation of the Scheme would have been displaced from other parts of the road network (e.g. road users), they are not considered additional to the GHG inventory.

14.3.8 GHG emissions from construction have been calculated in line with the World Business Council for Sustainable Development/World Resources Institute Greenhouse Gas Protocol guidelines (Ref 14.15), supplemented by the use of Highways England's Carbon Reporting Tool (Ref 14.14). Data input to the carbon emissions calculation tool was based on the following set of standard data quality principles detailed in the GHG Protocol guidelines; which has been applied so that the results from the GHG assessment are as representative as possible:

- Age – the GHG assessment is based on activity data and GHG emissions factors applicable to the study period.
- Geography – activity data reflects the design of the Scheme. GHG emissions factors in the Carbon Tool are representative of the UK construction industry and UK transport sector.
- Technology – the default solution was to apply data which is representative of the UK construction industry and transport sector.
- Methodology – activity data was gathered directly from the Scheme's engineering and design teams to enable consistency and completeness of data collection.
- Competency – activity data was generated by the engineering and design teams in-line with applicable industry standards.

14.3.9 GHG emissions outputs from the Carbon Tool have been reported as tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e) and have considered the following gases:

- carbon dioxide (CO<sub>2</sub>);
- methane (CH<sub>4</sub>);
- nitrous oxide (N<sub>2</sub>O);
- sulphur hexafluoride (SF<sub>6</sub>);
- hydrofluorocarbons (HFCs); and
- perfluorocarbons (PFCs)<sup>2</sup>.

14.3.10 GHG calculations performed without the use of the Highways England Carbon Tool also consider nitrogen trifluoride, which was added to the list of six Kyoto Protocol GHGs in 2018.

14.3.11 GHG emissions arising from construction and maintenance have been assessed within the Carbon Tool using a calculation-based methodology as per the below equation (aligned with the GHG Protocol guidelines):

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<sup>2</sup> Calculations performed using the Highways England Carbon Tool only account for the six Kyoto Protocol GHGs defined prior to the addition of nitrogen trifluoride (NF<sub>3</sub>) in 2018.

**Activity data x GHG emissions factor = GHG emissions value**

- 14.3.12 The emissions factors used have been selected from the Department for Environment, Food and Rural Affairs (Defra) and Department of Business, Energy and Industrial Strategy's UK Government GHG Conversion Factors for Company Reporting (Ref 14.21) and the Inventory for Carbon and Energy Database (Ref 14.22).
- 14.3.13 Road user emissions have been calculated following the guidance provided in DMRB Volume 11, Section 3, Part 1, HA 207/07 – regional assessment methodology (Ref 14.1). This methodology estimates the contribution from traffic on the road, also referred to as 'road user carbon'.
- 14.3.14 The uptake of lower carbon fuels, electric vehicles and increased vehicle technology are not accounted for within the assessment of operational GHG emissions; however, it is accepted that such technological advances and changes are likely to beneficially contribute to reducing GHG emissions in the future.
- 14.3.15 The GHG emissions operational assessment adopts a scenario-based assessment, with the quantification of different scenarios to provide a range for the potential additional GHG emissions associated with Scheme operation. These scenarios include:
- a 'do-minimum' (DM) scenario whereby the Scheme is not implemented; and
  - a 'do-something' (DS) scenario whereby the Scheme goes ahead and the GHG emissions reductions from embedded mitigation measures are taken into account.
- 14.3.16 A comparison of the GHG emissions for the DM and DS scenarios have been undertaken between the year of scheme opening (2024) and for the lifetime year (2084), 60 years on from the opening year, in line with DMRB guidance (Ref 14.1).
- 14.3.17 It is very unlikely that the Scheme would be demolished after its Scheme lifetime, as the road would have become an integral part of nationally important infrastructure. The end of life assessment of the demolition and decommissioning phase has, therefore, been scoped out of the assessment. This approach was confirmed in the Scoping Opinion, refer to Appendix 4.1 [TR010054/APP/6.3].

**Climate change resilience assessment**

- 14.3.18 The identification and assessment of CCR within EIA is an area of emerging practice. There is no single prescribed format for undertaking such assessments; therefore, the approach adopted to undertaking and reporting the assessment has drawn on good practice from other similar developments and studies.
- 14.3.19 The assessment has considered the strategic aims and objectives encompassed within the national and local policies and strategies summarised in Section 14.2, which collectively seek to minimise the adverse impacts of climate change whilst requiring new development to take climate change considerations into account.
- 14.3.20 An assessment of CCR has been undertaken for the Scheme to identify potential climate change impacts, and to consider their potential consequence and likelihood

of occurrence, taking account of the measures incorporated into the design of the Scheme.

- 14.3.21 The assessment has included all infrastructure and assets associated with the Scheme and has assessed resilience against both gradual climate change and the risks associated with an increased frequency of extreme weather events, referencing UKCP18 data (Ref 14.18).
- 14.3.22 The types of receptors considered vulnerable to climate change are:
- construction phase receptors (i.e. workforce, plant and machinery);
  - the highway assets and their operation, maintenance and refurbishment (i.e. pavements, structures, earthworks and drainage, technology assets, etc.); and
  - end-users (i.e. members of public and commercial operators etc).
- 14.3.23 The 60-year Scheme lifetime includes its construction and operational phases. As the construction phase would be much shorter in duration than the operational phase, and would be undertaken within the next ten years, future climate change is less relevant to the assessment of construction impacts and effects. Accordingly, the construction assessment has followed a descriptive based approach.
- 14.3.24 For the operational assessment, the likelihood and consequence of impacts and effects on receptors has been assessed based on a future time frame of operation (2080s).
- 14.3.25 Criteria used to determine the likelihood of an event occurring, based on its probability and frequency of occurrence, are detailed in Table 14.2.

**Table 14.2: Measure of likelihood for CCR assessment**

Likelihood Category	Description (probability and frequency of occurrence)
Very high	The event* occurs multiple times during the lifetime of the Scheme (60 years) e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of the Scheme (60 years) e.g. approximately once every five years, typically 12 events;
Medium	The event occurs limited times during the lifetime of the Scheme (60 years) e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of the Scheme (60 years) e.g. once in 60 years.
Very low	The event may occur once during the lifetime of the Scheme (60 years).

\* The event is defined as the climate event (such as heatwave) and the hazard (such as overheated electrical equipment) occurring in combination

- 14.3.26 The consequence of an impact has been measured using the criteria detailed in Table 14.3.

**Table 14.3: Measure of consequence for CCR assessment**

Consequence of impact	Description
Very large adverse	National level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	National level disruption to strategic route(s) lasting more than 1 day but less than 1 week; or Regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Disruption to an isolated section of a strategic route lasting less than 1 day.

- 14.3.27 The identification of likely significant effects on receptors has been undertaken using professional judgement, based on knowledge and experience of similar schemes, by combining the measure of likelihood with the predicted consequence of impact, as shown in Table 14.4.

**Table 14.4: Significance criteria for CCR assessment**

Measure of consequence	Measure of Likelihood				
	Very low	Low	Medium	High	Very High
Negligible	NS	NS	NS	NS	NS
Minor	NS	NS	NS	NS	NS
Moderate	NS	NS	S	S	S
Large	NS	NS	S	S	S
Very Large	NS	S	S	S	S

(NS = Not significant, S = Significant)

### In-combination climate change impact assessment

- 14.3.28 An ICCI assessment has been undertaken to evaluate the combined impacts of future climate change and those associated with the Scheme.
- 14.3.29 Projected changes to average climatic conditions, as a result of climate change, and an increased frequency and severity of extreme weather events have the potential to impact the ability of the surrounding natural environment to adapt to climate change.
- 14.3.30 Temperature and precipitation variables have been obtained from UKCP18 and analysed to identify potential climate hazards that may impact receptors.
- 14.3.31 The likelihood has been defined using the criteria outlined in Table 14.5, using UKCP18 data and professional judgement.

**Table 14.5: Likelihood criteria for ICCI assessment**

Likelihood of impact occurring	Confidence of climate hazard occurring	
	Low	High
Low	Low	Medium
High	Medium	High

14.3.32 The consequence of in-combination climate change impacts has been based on the change to the significance of the effect of the Scheme on the resource or receptor within each relevant environmental discipline, taking into account existing mitigation measures reported within each relevant assessment, as shown in Table 14.6.

**Table 14.6: Consequence criteria for ICCI assessment**

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the Scheme causes the significance of the impact of the Scheme on the resource/ receptor, as defined by the topic, to increase from moderate to major.
Medium	The climate change parameter in-combination with the effect of the Scheme causes the significance of the impact of the Scheme on the resource/receptor, as defined by the topic, to increase from low to moderate.
Low	The climate change parameter in-combination with the effect of the Scheme causes the significance of the impact of the Scheme on the resource/ receptor, as defined by the topic, to increase from negligible to low.
Very Low	The climate change parameter in-combination with the effect of the Scheme does not impact the significance of the impact of the Scheme on the resource/receptor, as defined by the topic.

14.3.33 The significance of effects has been determined through combining likelihood and consequence, as presented in Table 14.7.

14.3.34 In accordance with the methodology set out within Chapter 4: Environmental Assessment Methodology, the following criteria is applied:

- ‘Moderate’ or ‘major’ effects are deemed to be ‘significant’.
- ‘Minor’ effects are considered to be ‘not significant’, although they may be a matter of local concern; and
- ‘Negligible’ effects are considered to be ‘not significant’.

**Table 14.7: Significance criteria for ICCI assessment**

Consequence	Likelihood		
	Low	Medium	High
Very Low	Negligible	Negligible	Minor
Low	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
High	Moderate	Major	Major

### Scoping response

14.3.35 The proposed scope of the climate assessment was detailed in the EIA Scoping Report (Ref 14.23) submitted to the Inspectorate on 11 January 2019. (Refer to Chapter 1: Introduction). An overview of the Inspectorate’s Scoping Opinion (Appendix 4.1 [TR010054/APP/6.3]) in relation to climate is presented in Table 14.8. Where the assessment has been undertaken in accordance with the scoping opinion point, a response and the relevant ES section is provided; where an alternative approach has been agreed with the relevant stakeholders, an explanation is provided.

**Table 14.8: Scoping opinion and response**

Scoping Opinion	Where addressed in the ES
<b>The Inspectorate</b>	
Given the low-level likelihood that the Proposed Development would be demolished after its design life [Scheme lifetime], the Inspectorate agrees that this matter may be scoped out of the assessment. The Inspectorate refers the Applicant to the comments in Paragraph 3.3.3 of this Opinion regarding the dismantling/replacement of particular elements of the Proposed Development. Comment on Paragraph 3.3.3 - However, the Inspectorate considers that any decommissioning associated with dismantling and replacing particular elements of the Proposed Development (e.g. lighting columns) once they reach the end of their design life [Scheme lifetime] should be assessed if significant effects are likely to occur. The design life [Scheme lifetime] should be specifically defined for these elements.	Noted. Impacts associated with decommissioning have been scoped out of this assessment. Section 14.7 ‘Potential impacts’ and Section 14.9 ‘Assessment of likely significant effects’ consider the impacts associated with maintenance and replacing particular elements of the Scheme (e.g. lighting columns).
The ES should consider the potential for climate assessments to be used to inform and influence assessments made, and mitigation measures proposed, within other ES aspect areas (for example, drainage and effects on ecological receptors).	This is considered through the in-combination climate change impacts assessment presented in Section 14.9 ‘Assessment of likely significant effects’.
The Applicant should ensure that relevant consultation bodies are consulted regarding the potential for climate change effects to ensure a robust assessment and maximise the effectiveness of any proposed mitigation measures	Section 14.3 ‘Assessment methodology’ considers responses provided by consultation bodies regarding the potential for climate change effects to ensure a robust

Scoping Opinion	Where addressed in the ES
	assessment and maximise the effectiveness of proposed mitigation measures.

## Consultation

14.3.36 The Preliminary Environmental Information (PEI) Report for this Scheme (Ref 14.24) was published in May 2019 as part of the statutory consultation. The PEIR presented the environmental information collected, together with the preliminary findings of the assessment of likely significant environmental effects of the Scheme at the time. Comments received during public consultation and the associated responses, are detailed within the Consultation Report [TR010054/APP/5.1]. No comments have been provided by stakeholders that directly relate to the climate assessment, however some comments received indirectly relate to GHG emissions and climate resilience impacts (e.g. land drainage, flood risk, material use and waste).

## 14.4 Assessment assumptions and limitations

- 14.4.1 The assessment has been based on information obtained from the appointed buildability contractor for the Scheme in respect of energy use, types and quantities of materials used and waste relating to the preliminary design of the Scheme, as described in Chapter 2: The Scheme. Where information was not available, assumptions based on professional judgement have been made. These assumptions are consistent with those made by other topics for their assessments presented within this ES.
- 14.4.2 GHG emissions from the end of life stage (decommissioning) of the Scheme have been scoped out of the assessment due to the anticipated operational length of the Scheme. The replacement of particular elements of the Scheme is included as part of the maintenance lifecycle stage of the GHG assessment.
- 14.4.3 The assessment uses the Scheme lifetime (60 years) and its lifecycle stages to determine the relevant periods over which the climate projections are selected to ensure climate projections are considered for the whole of the Scheme lifetime.
- 14.4.4 Climate change, by its very nature, is associated with a range of assumptions and limitations. To overcome these issues, current climate change data and science is being incorporated into the assessment, and proven effective approaches undertaken for similar project types are being replicated.
- 14.4.5 Limitations associated with the approach to be taken for the climate resilience assessment relate to uncertainties inherent within UK Climate Projections (UKCP18 data) (Ref 14.18). By its very nature, climate change is associated with a range of assumptions and limitations. UKCP18 are currently the leading climate change projections for the UK.
- 14.4.6 Assessments being made in relation to climate change risk and impact likelihood and severity are relying on professional judgement and evidence gathered through other EIA discipline assessments.

## 14.5 Study area

### **Greenhouse gas impact assessment**

- 14.5.1 The study area adopted for the GHG impact assessment covers all direct GHG emissions (those arising from construction and operational activities undertaken within the Scheme boundary) and indirect GHG emissions (those associated with construction materials and the transportation of materials and waste).
- 14.5.2 The assessment of construction GHG emissions focusses on construction activities. The spatial extent of this assessment therefore comprises the area of construction works falling within the Scheme boundary.
- 14.5.3 The study area for the assessment of operational GHG emissions includes both direct emissions arising from energy use within the Scheme boundary as well as emissions from road users on the road network within and beyond the Scheme boundary, based on the extents of the Scheme's traffic model contained in the Transport Assessment Report [TR010054/APP/7.4].

### **Climate change resilience assessment**

- 14.5.4 The study area for the CCR assessment comprises the Scheme boundary which captures all assets and infrastructure associated with the Scheme, including all temporary works.

### **In-combination climate change impact assessment**

- 14.5.5 The study area for the ICCI assessment comprises the Scheme boundary and the surrounding environment that is predicted to be impacted by the Scheme, as defined within the environmental topic chapters.

## 14.6 Baseline conditions

### **Greenhouse gas impact assessment**

#### *Current baseline*

- 14.6.1 The baseline conditions for the GHG impact assessment comprise those with the DM scenario whereby the Scheme does not go ahead, but accounts for the future use and maintenance of the existing road network.
- 14.6.2 The baseline conditions for the DM scenario were identified based on the modelling volumes of traffic currently on the existing road network, and its predicted use (accounting for increases in traffic and associated congestion) through to year 2039 (the design year for the Scheme). This established the baseline against which the Scheme was subsequently compared, in order to identify any variation in GHG emissions over time.

#### *Future baseline*

- 14.6.3 The opening year baseline (2024) consists of GHG emissions from road users along with emissions arising from operational energy use (e.g. for lighting, signs and other mechanical and electrical sources).

- 14.6.4 The data related to the current and future baselines noted above are presented as part of Section 14.9 'Assessment of likely significant effects' and detailed in Table 14.14.
- 14.6.5 As noted in Section 14.3 'Assessment methodology', technological advances and decarbonisation of the grid are expected to beneficially reduce GHG emissions in the next 20 to 30 years; however, these reductions have not been taken into account within the assessment.

#### **Climate change resilience and in-combination climate change impact assessments**

- 14.6.6 A review of relevant information sources has been undertaken to establish existing and future baseline data and current understanding with regards to climate and extreme weather impacts. A summary is provided in the following paragraphs, with more detailed information in Appendix 14.1 [TR010054/APP/6.3].
- 14.6.7 The Scheme sits within the Met Office 'Midlands' district region. Climate observations for this region, presented as 10-year averages between 1969 and 2018, identify gradual warming, with an increase of 1.03 °C in mean maximum annual temperatures between the periods 1969-1978 and 2009-2018. Mean annual rainfall has increased by 8.1% between the same periods.
- 14.6.8 The UKCP18 for the 25 km<sup>2</sup> grid square within which the Scheme is located suggest an increase in mean summer and winter air temperatures, while precipitation rates are expected to become more seasonal, with increased precipitation expected in winter and decreased precipitation in summer.

### **14.7 Potential impacts**

- 14.7.1 To assess the GHG emissions arising from the construction and operation of the Scheme, a lifecycle assessment approach has been applied using available design, construction and transportation data. The key GHG emission sources considered in the assessment are described in the following section for both the construction and operation phases of the Scheme.

#### **Construction**

##### *Greenhouse gas impact*

- 14.7.2 Potential likely impacts during the construction of the Scheme are presented in Table 14.9 and have been categorised in line with the Highways England Carbon Tool (Ref 14.14) and guidance set out in PAS 2080: 2016 (Ref 14.17).

**Table 14.9: GHG emission sources: construction phase**

PAS 2080 lifecycle stage	Carbon tool reporting category	Activity	Description of emission sources
Pre-construction stage	Fuel, electricity and water	Energy and water consumption used for enabling works to prepare the site for construction.	GHG emissions from fuel consumed by construction vehicles and plant use.
	Land use change	Site clearance, for example, the removal of vegetation for replacement with another land use.	Losses of carbon sink i.e. removal of a natural environment that has the ability to absorb GHG emissions.
Product stage	Embodied carbon in raw materials	Use of products and/or materials required to build the Scheme.	Embodied GHG emissions within the construction materials.
Construction process stage	Fuel, electricity and water	Energy and water consumption used for the construction of the Scheme.	GHG emissions from grid electricity to power auxiliary facilities. GHG emissions from fuel consumed by construction vehicles and plant. GHG emissions from the provision of water and treatment of wastewater.
	Business and employee travel	Transportation of construction workers to the site.	GHG emissions arising from the fuel consumed for worker commuting to and from the construction site.
	Materials transport	Transportation of construction materials to site.	GHG emissions arising from the fuel consumed for transportation of construction materials to site.
	Waste and waste transport	Waste generated and transported during the construction phase.	GHG emissions arising from the treatment of waste. GHG emissions arising from the transportation of the waste to treatment/ disposal facility.

*Climate change resilience*

14.7.3 During construction, receptors are likely to be vulnerable to a range of short term climate risks. Potential impacts during the construction phase could include:

- inaccessible construction site(s) due to severe weather events associated with flooding, snow and ice, and storms restricting working hours and delaying operations;
- health and safety risks to the workforce during severe weather events;
- increased frequency and severity of unsuitable conditions, for example due to very hot weather or very wet weather during construction activities involving

laying pavement materials and the delivery of construction plant, thereby increasing the need to repeat certain works; and

- increased frequency and severity of damage to construction materials, plant and equipment, including damage to temporary buildings/facilities such as offices, compounds, material storage areas and worksites, temporary access, temporary bridges and haul routes.

## Operation

### *Greenhouse gas impact*

14.7.4 Potential likely impacts during the operation of the Scheme, use of the Scheme by motorised vehicles and maintenance of the Scheme are presented in Table 14.10.

**Table 14.10: GHG emission sources: operation, maintenance and use of the Scheme**

PAS 2080 lifecycle stage	Activity	Description of emission sources
Operational stage (Operation of Infrastructure)	Operation of the associated road and sign lighting, overhead gantries, pedestrian crossings etc. Planting of new vegetation.	GHG emissions from energy consumer (grid electricity and other fuel use). Sequestration of GHG emissions by the newly planted vegetation.
Operational stage (Operational use)	Vehicle journeys on the public road network.	GHG emissions from vehicle use.
Operational stage (Maintenance)	Maintenance including re-surfacing	Embodied GHG emissions within materials.

### *Climate change resilience*

14.7.5 Once operational, the Scheme has the potential to be impacted by a changing climate and in particular, more frequent severe weather events in the medium to long term.

14.7.6 Potential impacts on the Scheme likely to occur during the operational phase include:

- material and asset deterioration due to high temperatures;
- overheating of electrical equipment, for example information and communication systems;
- health and safety risks to road users;
- changes in travel patterns of network users;
- longer vegetation growing seasons resulting in increased periods of leaf fall and increased maintenance and management requirements;
- damage to roads from periods of heavy rainfall;

- flood risk (surface, groundwater, fluvial and snow/ice melt) on the network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding;
- increased slope instability due to prolonged or heavy precipitation leading to subsidence;
- storm damage to structures; and
- inaccessibility of the network during severe weather events.

## 14.8 Design, mitigation and enhancement measures

### Greenhouse gas impact

- 14.8.1 Mitigation measures would be implemented to reduce emissions across the lifecycle of the Scheme. Key sources of GHG emissions during Scheme construction would be from construction activities and carbon embedded in construction materials. Measures to mitigate the potential impact of GHG impacts are summarised in Table 14.11.
- 14.8.2 Highways England is committed to reducing carbon emissions from activity on its network by implementing the following mitigation hierarchy:
- 1) Avoidance and prevention – to maximise potential for reusing and/or refurbishing existing assets.
  - 2) Reduction – through the application of low carbon solutions including technologies, materials and products to minimise resource consumption.
  - 3) Remediation – applied to further reduce carbon through on or off-site offsetting or sequestrations.

**Table 14.11: GHG mitigation measures**

Lifecycle stage	Mitigation measures	Delivery mechanism	Embedded / Essential	Method of reduction
Construction	<p>The construction contractor would develop and implement a plan to reduce energy consumption and associated carbon emissions. This could include the consideration of renewable and/or low or zero carbon energy sources and record percentage of savings implemented.</p> <p>Highways England is committed to reducing carbon emissions and works closely with suppliers to reduce emissions from network related activity. Energy consumption and materials use would be recorded and reported on an ongoing basis during the construction phase of the</p>	<p>Outline Environmental Management Plan (OEMP), [TR010054/APP/6.11] which would be developed into a Construction Environmental Management Plan (CEMP) by the construction contractor.</p>	Essential	Avoid/prevent

Lifecycle stage	Mitigation measures	Delivery mechanism	Embedded / Essential	Method of reduction
	Scheme using the Highways England Carbon Reporting Tool.			
	Where practicable, measures would be implemented to manage material resource use during construction including: <ul style="list-style-type: none"> <li>using materials with lower embodied GHG emissions and water consumption;</li> <li>using sustainably sourced materials; and</li> <li>using recycled or secondary materials.</li> </ul>	OEMP [TR010054/APP/6.11] which would be developed into a CEMP by the construction contractor.	Essential	Avoid/prevent  Reduce
	Trees, shrubs and hedgerows planted as part of the landscape design would offset some of the carbon emissions associated with land use change and subsequent loss of carbon sink (refer to Chapter 7: Landscape and Visual for details of Scheme landscape planting design).	OEMP [TR010054/APP/6.11] and the Environmental Mitigation Schedule (refer to Appendix 2.1 [TR010054/APP/6.3])	Essential	Remediate
Operation	Lighting of new and improved sections of road within the Scheme has been confined to locations where road safety is a priority.	Environmental Mitigation Schedule (refer to Appendix 2.1 [TR010054/APP/6.3])	Embedded	Reduce
	Energy efficient road lighting would be implemented to minimise operational energy consumption.	Environmental Mitigation Schedule, refer to Appendix 2.1 [TR010054/APP/6.3])	Embedded	Reduce

14.8.3 No other operational mitigation measures have been proposed. It is not practical to monitor GHG emissions from road users during the operational phase of the Scheme as Highways England does not have direct control over road user emissions.

### Climate change resilience

14.8.4 A number of general mitigation and adaptation measures to address the potential impacts associated with climate change events have been considered, many of which have been identified within other discipline chapters within this ES and through the development of the Scheme design. The assessment identifies and takes into account existing resilience measures for each climate variable and associated impacts either already in place, or in development for infrastructure and assets.

14.8.5 A series of mitigation measures integrated into the Scheme design are summarised in Table 14.12.

**Table 14.12: Climate change resilience mitigation measures**

Lifecycle stage	Mitigation measure	Delivery mechanism	Embedded/ additional
Design	<p>Flood alleviation measures have been considered as part of the drainage design to improve the resilience of the Scheme to potential flooding events as a result of climate change. For example, Sustainable Drainage Systems (SuDs) would be implemented where appropriate and runoff would be conveyed via filter drains and attenuation ponds. The climate change allowance for SuDS features as part of the Scheme design would be 40% (as an addition to a 100-year storm event).</p> <p>The Scheme has been designed to accommodate a 1 in 100-year flood event (with a climate change allowance of 50% added) without flooding the carriageway.</p>	OEMP [TR010054/APP/6.11]	Embedded
Construction	<p>The Scheme has been designed to improve its resilience to climate change through a range of design and material specification measures including where practicable: the use of construction materials with superior properties (such as increased tolerance to fluctuating temperatures), and incorporation of current road design standards and future climate change allowances.</p>	OEMP [TR010054/APP/6.11] which would be developed into a CEMP by the construction contractor.	Embedded
Operation	<p>The Scheme drainage strategy takes into account the potential effects of climate change (refer to refer to Chapter 13: Road Drainage and the Water Environment, and the Drainage Strategy in Appendix 13.2 [TR010054/APP/6.3]).</p> <p>A range of measures would be put in place to improve the resilience of the Scheme to climate change during the Scheme operation, including maintenance plans for drainage systems to allow them to operate effectively.</p> <p>Implementation of emergency systems and response plans, including the identification of suitable network redundancies and diversion routes, to respond to severe weather events would further increase the resilience of the Scheme to extreme weather conditions.</p>	Handover Environmental Management Plan (HEMP) (upon completion of Scheme construction, the CEMP would be converted into the HEMP)	Embedded

## 14.9 Assessment of likely significant effects

### Greenhouse gas impact assessment

- 14.9.1 Of the lifecycle stages scoped into the assessment as shown in Table 14.9, the embodied carbon associated with the use of materials is the biggest contributor to the carbon footprint of the Scheme. Materials such as steel, concrete and bitumen can have high embodied carbon contents depending on the specifications used. The assessment has reviewed the materials proposed to be used (refer to Chapter 10: Material Assets and Waste) and calculated the associated carbon emissions from their production, as well as their transport to site.
- 14.9.2 Construction activities would also contribute to GHG emissions due to associated plant use, which requires fuel such as diesel. The treatment, disposal and associated transportation of waste material from the site also has the potential to contribute to the GHG construction footprint.
- 14.9.3 Transportation of materials to the site would contribute to the construction GHG footprint. At this stage, data regarding the precise material source locations of materials are uncertain, and therefore transportation distances to site for material sources are also uncertain. Professional judgement and conservative estimates have been used to calculate GHG emissions associated with material transportation to site, in this case a distance of 50 km from the site has been assumed.
- 14.9.4 Land use change would also contribute to the construction GHG footprint as although some mitigation such as planting would take place, the loss of carbon sink associated with land clearance would not be balanced out by the carbon sink gain from such landscape planting mitigation.
- 14.9.5 Table 14.13 contains the breakdown and comparison of emissions from each assessed activity during the Scheme construction stage<sup>3</sup>.

**Table 14.13: Emissions breakdown by construction activity**

Reporting category	Emissions (tCO <sub>2</sub> e) (approximate)	% construction emissions <sup>4</sup>
Land clearance (loss of carbon sink)	1,880	2%
Embodied carbon in raw materials and transportation of materials to site <sup>5</sup>	49,620	61%
Fuel used on site	4,250	5%
Worker travel	2,420	3%
Transport of materials & waste	15,940	19%
Disposal of construction waste	7,780	10%
Total	81,890	100%

<sup>3</sup> Each figure is rounded to the nearest 10 tCO<sub>2</sub>e

<sup>4</sup> Sum of percentages reported may not equate to 100% due to rounding.

<sup>5</sup> Any calculations performed using the Highways England Carbon Tool only account for the six Kyoto Protocol GHGs defined prior to the addition of nitrogen trifluoride (NF<sub>3</sub>) in 2018.

- 14.9.6 A construction emissions benchmark has been created based on various other Highways England schemes, normalised by road length, which gives a range of 19,090 tCO<sub>2</sub>e to 35,900 tCO<sub>2</sub>e per km of road. Construction emissions associated with the Scheme fall slightly towards the lower end of the scale, at 23,400 tCO<sub>2</sub>e per km of road.
- 14.9.7 A comparison of operational road user GHG emissions between the DM and DS scenarios for the Scheme opening year (2024) and the design year (2039) are presented in Table 14.14<sup>6</sup>.

**Table 14.14: Comparison of road user emissions – ‘DM’ vs ‘DS’ scenarios**

Reporting category	Year of Scheme opening (tCO <sub>2</sub> e)	Design year (tCO <sub>2</sub> e)
Do-minimum (DM)	7,331,760	8,025,160
Do-something (DS)	7,345,560	8,040,150
Variation (DS-DM)	13,800	14,990

- 14.9.8 Table 14.14 indicates that in the year of Scheme opening, GHG emissions would be approximately 13,800 tCO<sub>2</sub>e higher than the DM scenario, whilst for the design year (2039), GHG emissions with the Scheme would be approximately 14,990 tCO<sub>2</sub>e higher than the DM scenario. The increase in emissions here is due to the increase in vehicle kilometres travelled as a result of the Scheme.
- 14.9.9 The extent of the projected uptake of lower carbon fuels, electric vehicles (EVs) and improved vehicle technology since the UK Government published the ‘Road to Zero’ Strategy (Ref 14.25) is not currently fully captured in the modelling scenarios of future road traffic emissions. The new strategy sets out aspirations that by 2030 between 50% and 70% of new car sales and 40% of van sales will be ultra-low emission vehicles and that by 2040 all new petrol and diesel cars and vans will be zero carbon.
- 14.9.10 Within the future road traffic modelling scenarios, increasing proportions of EVs are considered up until 2030, from which point the 2030 level of EV usage is assumed. Therefore, from 2030 onwards vehicle emissions are likely overestimated as EV uptake is expected to increase beyond this time.
- 14.9.11 In addition, future decarbonisation of the grid would have an impact upon the GHG emissions associated with the operation of the Scheme. According to the Department for Business Energy and Industrial Strategy (BEIS) Updated Energy and Emissions Projections 2018 (Ref 13.26), up to 300 Tera Watt hours (TWh) could be generated by low carbon energy sources (renewables and nuclear) by 2035, with less than 100 TWh generated using natural gas and from imports. Only tailpipe emissions are considered within the future road traffic modelling scenarios, so emissions data relating to electricity production and decarbonisation of the grid are not considered.

<sup>6</sup> Each figure is rounded to the nearest 10 tCO<sub>2</sub>e.

- 14.9.12 The operational GHG emissions reported herein are, therefore, a worst-case scenario and are likely to be mitigated by existing plans and initiatives to decarbonise the grid and electrify road transport.
- 14.9.13 In line with the requirement of the NPSNN, Table 14.15 provides an assessment of the Scheme’s GHG emissions impact against the UK Government’s five-year carbon budgets.
- 14.9.14 The UK Government has currently passed into law the carbon budgets up to 2032:
- 3<sup>rd</sup> carbon budget (2018 to 2022) 2,544 MtCO<sub>2</sub>e.
  - 4<sup>th</sup> carbon budget (2023 to 2027) 1,950 MtCO<sub>2</sub>e.
  - 5<sup>th</sup> carbon budget (2028 to 2032) 1,725 MtCO<sub>2</sub>e.
- 14.9.15 Whilst some tightening is likely to occur when the carbon budgets are reviewed and revised in 2020, to reflect the recent commitment to a net zero carbon economy by 2050, the CCC has indicated that the trajectory will be steeper over time; therefore it is the later carbon budgets rather than near term ones which will see a greater impact. We do not expect therefore that the near-term carbon budgets will be significantly different to those currently published.
- 14.9.16 The carbon assessment has considered emissions from the Scheme in two separate phases, emissions during construction and emissions during operation. Construction of the Scheme is a short-term activity that runs from 2021 to 2024. Emissions from construction therefore fall within the nearer term third carbon budget. Emissions from the operation of the Scheme will fall into the third, fourth, fifth and subsequent future budgets once set through to 2050. Table 14.15 presents the net tCO<sub>2</sub>e associated with Scheme operation during each of these carbon budget periods<sup>7</sup>.

**Table 14.15: Construction and operation emissions in comparison to national carbon budgets**

Project stage	Estimated total GHG emissions over relevant carbon budgets (tCO <sub>2</sub> e) (DS Scenario)	Net GHG emissions over relevant carbon budgets (tCO <sub>2</sub> e) (DS - DM)	Net GHG Scheme GHG emissions per relevant carbon budget (tCO <sub>2</sub> e)		
			3 <sup>rd</sup> (2018 to 2022)	4 <sup>th</sup> (2023 to 2027)	5 <sup>th</sup> (2028 to 2032)
Construction	81,890	81,890	33,390	48,500	N/a
Operation	60,439,970	121,730	N/a	45,060	76,680
Total	60,525,100	206,860	33,390	93,550	76,680

- 14.9.17 Operational emissions calculated for the years within each carbon budget period include the vehicle use emissions for each specific year, plus the average annual GHG emissions associated with maintenance and operational energy use.

<sup>7</sup> Each figure is rounded to the nearest 10 tCO<sub>2</sub>e

- 14.9.18 This assessment has established that during the period when carbon emissions from the Scheme would be at their highest level (short- and near-term construction activity and the first year of operation), the Scheme would only contribute to 0.0013% of the UK's carbon budget for the third carbon budget period. The Scheme's carbon emissions would equate to 0.0048% of the UK's carbon budget for the fourth carbon budget period and 0.0043% of the UK's carbon budget for the fifth carbon budget period. These figures are based on a precautionary assessment which does not take into account or rely upon the further decarbonisation of the UK electricity system or the ongoing move to lower carbon fuels for vehicles.
- 14.9.19 The method to calculate the UK carbon budgets varies to that used for the calculation of lifecycle emissions from a road scheme and therefore some caution must be taken when making a direct comparison. However, for the purposes of identifying to what extent the Scheme may impact the ability of the UK meeting its carbon budgets, it is necessary to make this comparison to put the Scheme into context.
- 14.9.20 The NPSNN states that it is very unlikely that the impacts of a road project would, in isolation, affect the ability of the government to meet its carbon reduction plans. Indeed, emissions arising as a result of the Scheme represent less than 0.01% of total emissions in any five-year carbon budget during which they arise.
- 14.9.21 In this context, it is concluded that the GHG impact of the Scheme would not have a material impact on carbon reduction targets as set by the UK government.

#### **Climate change resilience assessment**

- 14.9.22 The potential climate resilience impacts on the Scheme during the construction phase, as identified in Section 14.7, are not expected to be significant due to the duration and nature of the construction activities. Climate change impacts during the operational phase have been assessed in accordance with the methodology set out in Section 14.3.
- 14.9.23 Based on the embedded and essential mitigation measures outlined in the, OEMP [TR010054/APP/6.11], assumed management practices, UKCP18 climate change projections, and information from other environmental disciplines, it is considered that none of the potential impacts identified in Section 14.7 would be significant (and are therefore classed as non-significant).
- 14.9.24 These non-significant climate resilience impacts, identified using the criteria set out in the assessment methodology, are presented in Appendix 14.2 [TR010054/APP/6.3] and include:
- health and safety risks to road users, and disrupted or inaccessible network due to snow, ice, standing water and other weather events;
  - damage to roads, cuttings and drainage systems due to flooding;
  - 'summer ice' which occurs after a prolonged period of no rain when dirt and oil residue builds up on the road. When the first rain event occurs, this material becomes very slippery and dangerous (similar to ice on the road);

- material and asset deterioration due to high temperatures including traffic related rutting and migration of materials and thermal expansion and movement of bridge joints and paved surfaces;
- increased slope instability leading to subsidence and landslides;
- damage and disruption to power supply and other linked infrastructure;
- increased pollution from road runoff;
- increased sediment transport;
- longer vegetation growing seasons leading to reduced soil moisture or increased tree leaf coverage combined with an increased magnitude and frequency of storm events may result in tree fall and increased maintenance and management requirements;
- reduced pavement friction coefficient; and
- reduced pavement deterioration from less exposure to freezing, snow and ice.

#### **In-combination climate change impact assessment**

14.9.25 The ICCI assessment has not identified the potential for significant combined impacts of future climate change and the Scheme on identified receptors in the surrounding environment. Potential non-significant effects are reported in Appendix 14.2 [TR010054/APP/6.3] and include:

- negligible impact upon controlled waters;
- negligible impact upon soil quality; and
- negligible and minor adverse impacts upon human health.

### **14.10 Monitoring**

14.10.1 As no significant effects have been identified for the climate assessment, no monitoring of significant effects is proposed.

#### **Construction**

14.10.2 The OEMP [TR010054/APP/6.11] sets out details of the monitoring to be undertaken during the Scheme construction stage to determine whether the mitigation measures embedded in the Scheme design are being appropriately implemented. Highways England is committed to reducing carbon emissions and working closely with suppliers to reduce emissions from network related activity. As a requirement of the OEMP [TR010054/APP/6.11], energy consumption and materials use would be recorded and reported on an ongoing basis during the Scheme construction phase using the Highways England Carbon Reporting Tool.

#### **Operation**

14.10.3 It is not considered practical to monitor GHG emissions from road users during the Scheme operational phase.

## 14.11 References

- Ref 14.1 Highways Agency (2011) Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, Air Quality
- Ref 14.2 Institute of Environmental Management and Assessment (2017) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance
- Ref 14.3 Institute of Environmental Management and Assessment (2015) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation
- Ref 14.4 H.M Government (2008) UK Climate Change Act 2008
- Ref 14.5 Department for Business, Energy and Industrial Strategy (2016) Carbon Budgets
- Ref 14.6 H.M Government (2019), UK Climate Change Act 2008 (2050 Target Amendment) Order 2019
- Ref 14.7 Committee on Climate Change (2019) Reducing UK emissions: 2019 Progress Report to Parliament
- Ref 14.8 Department for Transport (2014) National Policy Statement for National Networks
- Ref 14.9 H.M Government (2018) National Planning Policy Framework (NPPF)
- Ref 14.10 West Midlands Combined Authority (WMCA) (2016) The West Midlands Strategic Transport Plan
- Ref 14.11 Staffordshire County Council (2011) Staffordshire Local Transport Plan 2011-2026
- Ref 14.12 South Staffordshire Council (2012) A Local Plan for South Staffordshire
- Ref 14.13 Directive 2014/52/EU amending the EIA Directive 2011/92/EU
- Ref 14.14 Highways England. Carbon Reporting Tool, v1.03.
- Ref 14.15 World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) (2015) Greenhouse Gas Protocol Corporate Accounting and Reporting Standard
- Ref 14.16 European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment
- Ref 14.17 British Standards Institution (2011) PAS 2080:2016 Carbon Management in Infrastructure
- Ref 14.18 UK Climate Impacts Programme (UKCIP) (2018) UK Climate Projections 2018
- Ref 14.19 Department for Environment, Food and Rural Affairs (2017) UK Climate Change Risk Assessment 2017 Evidence Report
- Ref 14.20 The Met Office historic climate data. Weblink: [www.metoffice.gov.uk/public/weather/climate/gcqfp5e8g](http://www.metoffice.gov.uk/public/weather/climate/gcqfp5e8g) (Accessed 11/06/19)
- Ref 14.21 Department for Environment, Food and Rural Affairs and the Department of Business, Energy and Industrial Strategy (2019) UK Government GHG Conversion Factors for Company Reporting

- Ref 14.22 Sustainable Energy Research Team, Department of Mechanical Engineering, University of Bath, UK (2019) Inventory of Carbon and Energy Database (Version 3).
- Ref 14.23 Highways England (2018) M54-M6/M6 Toll Link Road Environmental Impact Assessment Scoping Report
- Ref 14.24 Highways England (2019) M54 to M6 Link Road Preliminary Environmental Information Report. Available online at:  
<https://highwaysengland.co.uk/projects/m54-to-m6m6-toll-link-road/>
- Ref 14.25 HM Government (2018) Road to Zero Strategy: Next steps towards cleaner road transport and delivering our Industrial Strategy
- Ref 14.26 Department for Business, Energy and Industrial Strategy (2019) Updated energy and emissions projections 2018
- Ref 14.27 Highways England (2019) LA 114 Climate