

High Speed Two Phase 2a: West Midlands to Crewe

 Working Draft Environmental Impact Assessment Report

Volume 3: Route-wide effects

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Department for Transport

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A report prepared for High Speed Two (HS2) Limited:

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Structure of the working draft Environmental Impact Assessment Report

This document is part of the working draft Environmental Impact Assessment (EIA) Report for Phase 2a of the proposed High Speed Two (HS2) rail network between the West Midlands and Crewe (the Proposed Scheme). The working draft EIA Report sets out the current design of the Proposed Scheme, the likely environmental impacts (and, where possible, the likely significant environmental effects) of the construction and operation of the Proposed Scheme and any proposed mitigation measures. The assessment will be updated for the formal EIA Report to reflect further work on the design, assessment and mitigation between now and when the hybrid Bill is deposited.

The working draft EIA Report comprises the following documents:

Non-technical summary

This provides a summary in non-technical language of:

- the Proposed Scheme and reasonable alternatives considered;
- the impacts of the Proposed Scheme (and, where possible, the likely significant environmental effects), both beneficial and adverse; and
- the proposed means of avoiding, reducing or managing the likely significant adverse effects.

Volume 1: Introduction and methodology

This provides:

- a description of HS2, the EIA process and the approach to consultation and engagement;
- details of the permanent features of the Proposed Scheme and generic construction techniques, based on the current level of design;
- a summary of the scope and methodology for the environmental topics; and
- a summary of the strategic, route-wide and route corridor alternatives to the scheme and local alternatives considered prior to November 2015.

Volume 1 also comprises a glossary of terms and list of abbreviations and two appendices which are listed below.

Volume 2: Community area reports and map books

These cover the following community areas: 1 Fradley to Colton; 2 Colwich to Yarlet; 3 Stone and Swynnerton; 4 Whitmore Heath to Madeley; and 5 South Cheshire. The reports provide the following for each area:

- an overview of the area;
- a description of the construction and operation of the Proposed Scheme within the area, based on the current level of design;

- a summary of the local alternatives considered since November 2015;
- a description of the environmental baseline;
- a description of the environmental impacts of the Proposed Scheme (and, where possible, the likely significant environmental effects), both beneficial and adverse; and
- the proposed means of avoiding, reducing or managing the likely significant adverse effects.

The maps relevant to the five community areas are provided in separate corresponding documents entitled Volume 2, CA Map Books, which should be read in conjunction with the reports. These maps include the location of the key environmental features (Map Series CT-10), key construction features (Map Series CT-05) and operation features (Map Series CT-06) of the Proposed Scheme. There are also specific maps showing proposed viewpoint and photomontage locations (Map Series LV-11, to be read in conjunction with Section 11, Landscape and visual), noise contour maps (Map Series SV, to be read in conjunction with Section 13, Sound, noise and vibration) and maps showing key water features (Map Series WR, to be read in conjunction with Section 15, Water resources and flood risk).

Volume 3: Route-wide effects

This describes the impacts and effects that are likely to occur at a geographical scale greater than the community areas described in Volume 2.

Glossary of terms and list of abbreviations

This contains terms and abbreviations, including units of measurement used throughout the working draft EIA Report.

Appendix: Alternatives report

This describes the evolution of the Proposed Scheme and the reasonable alternatives considered.

Appendix: Draft Code of Construction Practice (CoCP)

This sets out measures and standards to provide effective planning, management and control of potential impacts on individuals, communities and the environment during construction.

1 Introduction

1.1 Purpose of this report

- 1.1.1 The purpose of the working draft Environmental Impact Assessment (EIA) Report¹ is to provide the public and other stakeholders with an opportunity to comment on preliminary environmental information for Phase 2a of HS2. Whilst there is no statutory requirement to provide a working draft EIA Report, comments received at this stage will be considered during the ongoing process of assessment and design of the Proposed Scheme, and will be reflected in the formal EIA Report that will accompany the hybrid Bill for Phase 2a. The hybrid Bill is due to be deposited in Parliament by the end of 2017. Public consultation will also be undertaken on the formal EIA Report during the passage of the hybrid Bill through Parliament.
- 1.1.2 This report presents the impacts and where possible the likely significant environmental effects of the construction and operation of the current stage of design of Phase 2a of HS2 (referred to in this working draft EIA Report as the Proposed Scheme) that have been identified on a route-wide basis.
- 1.1.3 This report should be read in conjunction with community area reports 1-5 of Volume 2 and their corresponding map books. The community area reports present the elements of the Proposed Scheme and alternatives considered within each area of the Phase 2a route. They also identify, where possible, the likely significant environmental effects of the construction and operation of the Proposed Scheme at the current stage of design, as well as mitigation measures for those significant effects that are adverse, as appropriate to the respective area of study.

1.2 Introduction to HS2

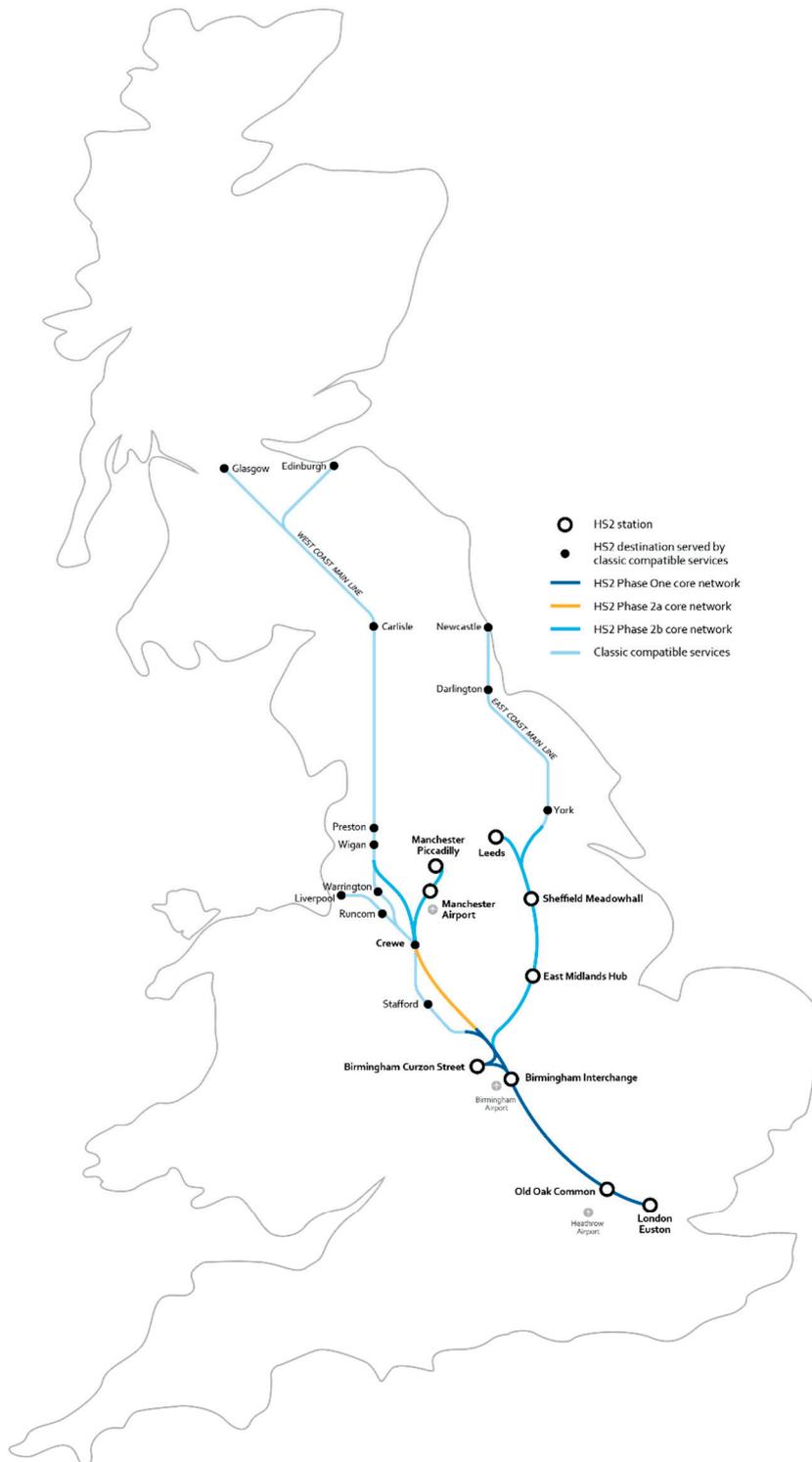
- 1.2.1 HS2 is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester, East Midlands and South Yorkshire will be served by high speed trains running at speeds of up to 360kph (225mph).
- 1.2.2 HS2 will be built in phases. Phase One comprises the first section of the HS2 network of approximately 230km (143 miles) between London, Birmingham and the West Midlands. It was the subject of an Environmental Statement (ES) deposited with the High Speed Two (London – West Midlands) Bill in 2013 and ES deposited with Additional Provisions to that Bill in 2014 and 2015. The Bill is currently proceeding through Parliament with the aim of achieving Royal Assent by the end of 2016 and commencing construction in 2017. Construction of Phase One is expected to begin in 2017 and the line will become operational by 2026; with a connection to the West Coast Main Line (WCML) near Lichfield.
- 1.2.3 Phase Two of HS2 would extend the line to the north-west and north-east, to Manchester with connections to the West Coast Main Line (WCML) at Crewe and

¹ Note that Parliament's Standing Order 27A makes reference to production of an environmental statement. Under the EIA Directive 2014/52/EU, the output of the environmental assessment is an Environmental Impact Assessment (EIA) Report. This report uses the term EIA Report where referring to the output of the EIA. The term formal EIA Report is used to refer to the EIA Report that will accompany the Phase 2a hybrid Bill. This working draft EIA Report provides an initial environmental assessment of the current stage of the design.

Golborne, and to Leeds with a connection to the East Coast Main Line approaching York, completing what is known as the 'Y network'.

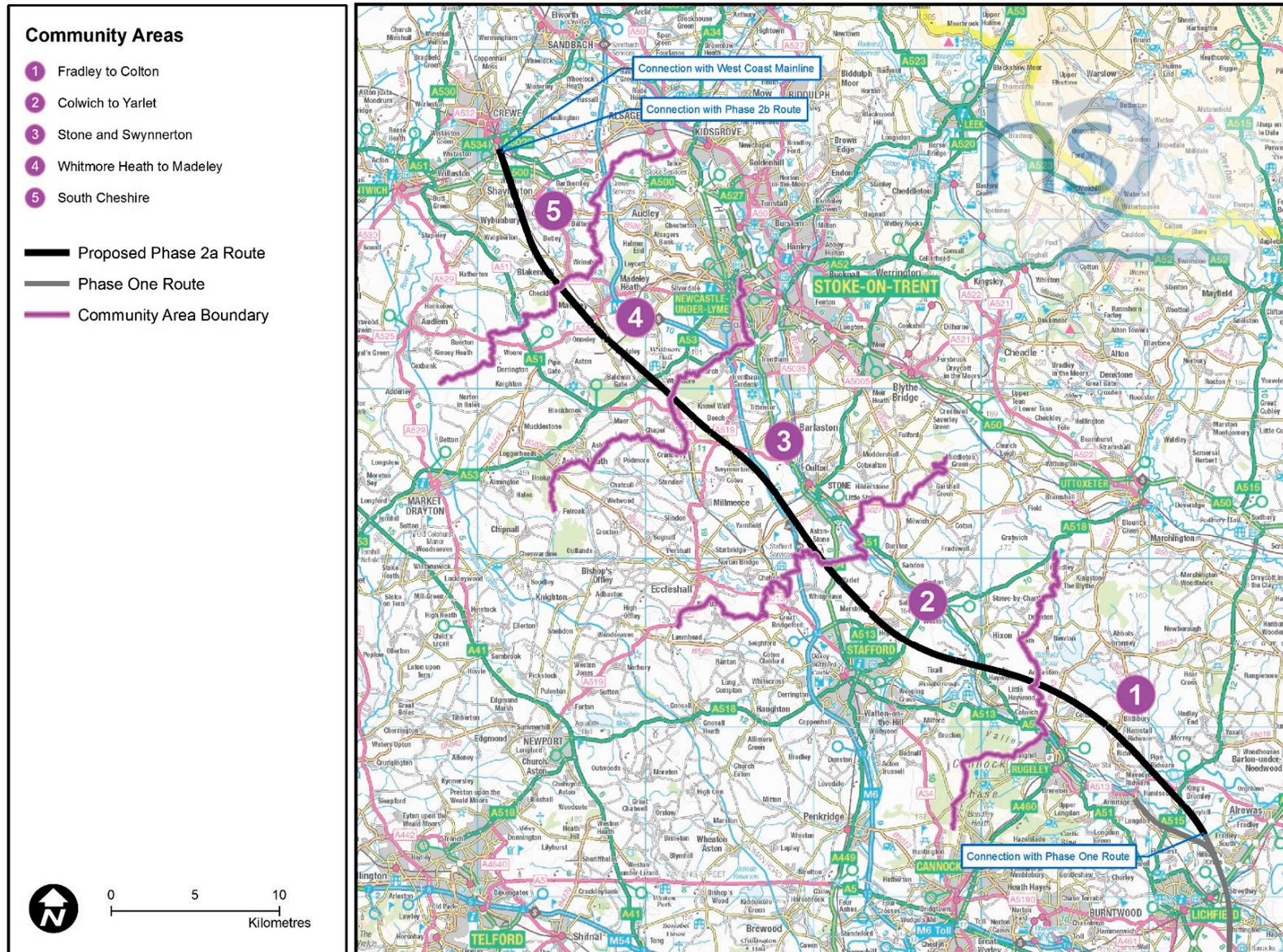
- 1.2.4 Phase 2a, the subject of this working draft EIA Report, comprises the first section of the western leg of Phase Two from the West Midlands to Crewe (approximately 60km (37 miles) in length). It would connect with Phase One near Fradley, to the north-east of Lichfield, and connect to the WCML south of Crewe, to provide onward services beyond the HS2 network, to the north-west of England and to Scotland. Construction of the Proposed Scheme would commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027 one year after the opening of Phase One. The proposed HS2 route highlighting the route to Crewe is shown in Figure 1.
- 1.2.5 An announcement on the Phase Two route from Crewe to Manchester and from the West Midlands to Leeds, referred to as Phase 2b, is expected in Autumn 2016. Construction of Phase 2b would commence in approximately 2023, with operation planned to start around 2033.
- 1.2.6 Phase One and Phase 2b are not the subject of this working draft EIA Report. However, any cumulative effects from the construction or operation of Phase One, Phase 2a and 2b will be considered in the formal EIA Report, based on the level of information available at the time of the assessment.
- 1.2.7 Section 4 of Volume 1 describes the interfaces with Phase One and the rest of Phase Two; the proposals for the new 'Crewe Hub' railway station (although this does not form part of the Proposed Scheme); and the anticipated services and operational characteristics of the Proposed Scheme.
- 1.2.8 For community engagement and environmental assessment purposes, the Proposed Scheme has been divided into five geographic community areas, as shown in Figure 2.

Figure 1: The HS2 Core Network²



² On 7 July 2016 Sir David Higgins' report Sheffield and South Yorkshire Report 2016 was published and indicated that a different route through South and West Yorkshire should be considered, which would remove the previously proposed Meadowhall station. This is currently being considered by the Secretary of State.

Figure 2: The HS2 Phase 2a route and community areas



1.3 Scope of this report

1.3.1 The effects reported in this volume are those considered to be appropriately assessed at a geographical scale greater than that presented within the Volume 2 community area reports. These include:

- overall effects on the agricultural, forestry and soil resource;
- effects relating to climate change;
- effects on ecological resources of at least national importance and on protected species;
- effects on health;
- effects resulting from major accidents and natural disasters;
- socio-economic effects;
- traffic and transport effects;
- effects associated with the generation of solid waste during construction and operation; and
- effects on water resources and on flood risk.

1.3.2 Of these topics, effects on health and effects resulting from major accidents and natural disasters are new topics in the EIA relative to those assessed for Phase One. They have been included for assessment due to the requirements of the 2014 EIA Directive, as described in Volume 1.

1.3.3 For some topics, the effects are predominantly localised in extent and no additional significant route-wide effects have been identified. These topics include air quality, community, cultural heritage, land quality, landscape and visual and sound, noise³ and vibration.

1.3.4 Given that each environmental topic assesses effects in a different way appropriate to that topic, the approach to route-wide effects varies between topics. The extent and basis of the route-wide assessment presented in this report is, therefore, explained in each of the topic sections. The scope of each topic and the general approach to assessment for this working draft EIA Report is described in Volume 1, which in turn refers to the draft Scope and Methodology Report (SMR)⁴ for Phase 2a (unless otherwise stated). The draft SMR was subject to consultation from 8 March 2016 to 13 May 2016. It was amended in response to that consultation, and the revised SMR, and a consultation summary report, is published alongside the working draft EIA Report. The assessment reported in the formal EIA Report will be based on the revised SMR.

³ A route wide assessment of operational noise impacts will be included in the Health section of the formal EIA Report.

⁴ HS2 Phase Two: West Midlands to Crewe. EIA Scope and Methodology Report - Draft for consultation. A report to HS2 Ltd by Arup / ERM. March 2016. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/506111/HS2_Phase_2a_EIA_Scope_and_Methodology_Report_Final_for_Comms_08-03-2016_WEB_1400.pdf

1.4 Structure of this report

1.4.1 This report presents the route-wide effects for each topic in the same order as reported in the community area reports, while including three additional sections describing the effects relating to climate change; major accidents and natural disasters; and waste and material resources. Where there are not considered to be significant route-wide effects (i.e. air quality, community, cultural heritage, land quality, and sound, noise and vibration), the topic is introduced and reasons for this conclusion are presented.

1.4.2 This report is structured as follows:

- introduction (Section 1);
- agriculture, forestry and soils (Section 2);
- air quality (Section 3);
- climate change (Section 4);
- community (Section 5);
- cultural heritage (Section 6);
- ecology and biodiversity (Section 7);
- health (Section 8);
- land quality (Section 9);
- landscape and visual (Section 10);
- major accidents and natural disasters (Section 11);
- socio-economics (Section 12);
- sound, noise and vibration (Section 13);
- traffic and transport (Section 14);
- waste and material resources (Section 15);
- water resources and flood risk (Section 16); and
- Phase One and Phase 2a combined impacts (Section 17).

2 Agriculture, forestry and soils

2.1 Introduction

- 2.1.1 This section provides an assessment of the route-wide impacts and likely significant effects on agriculture, forestry⁵ and soils arising from the construction of the Proposed Scheme, based on the current level of design. The temporary and permanent route-wide effects on forestry land and on the soil resource to be stripped from within the construction area (particularly the reuse of any surplus soil) will be reported in the formal EIA Report.
- 2.1.2 At the national level, paragraph 109 of the National Planning Policy Framework (NPPF) states that the planning system should contribute to and enhance the natural and local environment by protecting and enhancing soils, valued landscapes and geological conservation interests. It goes on to state that new and existing development should not contribute to unacceptable levels of soil pollution or other pollution.
- 2.1.3 Paragraph 112 of the NPPF indicates that the economic and other benefits of the best and most versatile (BMV) agricultural land (Grades 1, 2 and 3a in the Agricultural Land Classification (ALC) system) should be taken into account in development decisions. Where significant development of agricultural land is demonstrated to be necessary, poorer quality land should be used in preference to higher quality land.
- 2.1.4 As reported in the Phase Two Sustainability Report (West Midlands to Crewe)⁶, efforts have been made during the route development and Appraisal of Sustainability (AoS) process to select a route alignment that avoids the highest quality agricultural land. However, this has not always been possible given the need to satisfy or balance a number of other important environmental and engineering considerations.

2.2 Assessment of effects during and following construction

- 2.2.1 Current information indicates that the agricultural land likely to be required during the construction of the Proposed Scheme would amount to approximately 1,730ha, of which approximately 1,030ha (60%) would be BMV agricultural land. In addition, there is approximately 78ha of woodland within the construction boundary, of which about one-quarter is managed commercially.
- 2.2.2 Adopting the methodology set out in the draft SMR for assessing the significance of effect of the loss of agricultural land within the community areas would place BMV land as a resource of medium sensitivity (with 42% of farmland in England estimated to be of this quality). With respect to the Proposed Scheme, this resource would be subject to an impact of high magnitude (with 60% of the agricultural land required for construction being BMV), giving rise to a major/moderate adverse effect, which would be significant.

⁵ The assessment of forestry in this section relates to land being used for commercial forestry.

⁶ Temple/RSK, 2015, High Speed Rail: Preferred Route to Crewe, Sustainability Report Phase Two Post-Consultation Update: West Midlands to Crewe. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/480667/Sustainability_Report_Phase_Two_Post-Consultation_Update_West_Midlands_Crewe.pdf

- 2.2.3 The estimated proportion of Grade 1 land required during the construction of the Proposed Scheme is lower than the proportion of this grade in England (0.3% compared to a national figure of 2.7%). The proportion of Grade 2 land required is slightly higher than that for England (19.2% compared to 18.8%), whilst the proportion of Subgrade 3a land required is substantially higher than the national figure (40.3% compared to 20.7%). It is apparent, therefore, that within the BMV land category, the majority of agricultural land required during the construction of the Proposed Scheme would be of Subgrade 3a.
- 2.2.4 Whilst the total requirement for about 1,030ha of BMV agricultural land during the construction phase would be significant, it represents only a very small percentage (about 0.03%) of the BMV agricultural land in England and approximately 1% of the estimated BMV land in Staffordshire County and the former Crewe and Nantwich Borough Council area.
- 2.2.5 As part of the construction phase, the agricultural land required temporarily would be returned to agricultural use by following good practice guidance on the sustainable use of soils, as set out in the draft Code of Construction Practice (CoCP). It is estimated that there would not be any significant surplus of displaced agricultural soils arising from the Proposed Scheme.
- 2.2.6 The extent of land required permanently for the Proposed Scheme by ALC grade, following construction and restoration to the agreed end use, will be reported in the formal EIA Report.

2.3 Assessment of effects during operation

- 2.3.1 It is considered that during operation there would be no effects that become significant through accumulation across the whole route of the Proposed Scheme. Any significant effects assessed as arising at a local level during operation are reported in the Volume 2 community area reports 1-5.

3 Air quality

3.1 Introduction

- 3.1.1 This section provides an assessment of the route-wide impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme.

3.2 Assessment of effects during construction

- 3.2.1 Air quality impacts from construction activities could arise from two sources: directly from the construction sites; and indirectly from changes in the volume, composition and location of traffic on the highway network.
- 3.2.2 The main air pollutant emitted from construction sites is dust, since emissions from the engines of construction equipment are anticipated to have a negligible effect off-site. Construction dust potentially can be carried a few hundred metres from construction sites. However, dust generation from the Proposed Scheme will be strictly controlled by application of best practice measures set out in the draft CoCP (Volume 1 appendix). The result will be that significant effects from dust should not occur at properties and other receptors outside the construction sites.
- 3.2.3 The emissions from fixed sources and vehicle movements within the construction sites will be relatively small in comparison to existing local emissions from fixed sources and highway traffic, and are unlikely to cause a significant impact. Implementation of measures set out in the draft CoCP will enable these activities to be controlled such that the effects on air quality from the engines of construction equipment are anticipated to have a negligible effect off-site.
- 3.2.4 Construction traffic and changes in the volume and location of traffic on the highway network could result in impacts further from the construction sites.. The geographic extent of these impacts will be assessed within Volume 2 community area reports 1-5 and where necessary the Volume 4 off-route assessment within the formal EIA Report. It is estimated that there will be no significant air quality effects on a route-wide basis associated with construction of the Proposed Scheme.

3.3 Assessment of effects during operation

- 3.3.1 There would be no route-wide air quality impacts arising directly from the operation of the trains on the completed high speed railway. There would be minor emissions from buildings arising from heating plant and other activities, but these will have only local effects which are not expected to be significant.
- 3.3.2 The operation of the Proposed Scheme would result in local changes in road traffic location and volume, which may have an impact on air quality at some locations along the route as recorded within the relevant Volume 2 community area reports 1-5. It is estimated that there will be no significant air quality effects on a route-wide basis associated with the operation of the Proposed Scheme.
- 3.3.3 The Department for Transport (DfT) has provided estimates of grams of NO_x emissions per passenger kilometre (pkm) in 2030 as shown in Table 1: . HS2 trains are

predicted to have significantly lower emission rates than each of the other travel sectors, the emissions being from the power stations supplying the electricity grid.

Table 1: DfT estimates of grams of NOx emissions per passenger kilometre per travel sector⁷

Sector	NOx emissions per passenger km
Intercity rail	0.180
All domestic flights	0.749
Domestic flights/to from London	0.605
Inter-urban car journeys	0.140
HS2	0.031

⁷ Aviation emissions of NOx, from aircraft operating at altitude, are dispersed over a wider area than ground level emissions, so have less of an impact on local concentrations of air pollutants than road emissions which mainly affect concentrations at the road side.

4 Climate change

4.1 Introduction

- 4.1.1 This section of the report presents the three route-wide assessments undertaken within the climate change topic:
- the greenhouse gases (GHG) assessment;
 - the in-combination climate change impacts assessment; and
 - the climate change resilience assessment.
- 4.1.2 It should be noted that, at this stage, the above assessments continue to be developed. Results and conclusions will be reported in the formal EIA Report.
- 4.1.3 The GHG assessment will quantify and report the GHG emissions associated with the construction and operation of the Proposed Scheme in the form of the 'carbon footprint'. The carbon footprint will be presented as a range and will be reported in tonnes of carbon dioxide equivalent (tCO₂e). The Proposed Scheme's carbon footprint will be compared to UK national and transport sector GHG emissions in order to provide context for the scale of the carbon footprint.
- 4.1.4 The in-combination climate change impacts assessment will consider the combined effect of the Proposed Scheme and potential climate change impacts on the receiving environment during construction and operation⁸.
- 4.1.5 The climate change resilience assessment will consider potential climate change impacts on the design and operation of the Proposed Scheme's infrastructure and assets over their lifetime.
- 4.1.6 As stated in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Synthesis Report⁹, mitigation (i.e. reducing GHG emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing risks of climate change impacts over different timescales. Mitigation, in the short-term and medium-term, can substantially reduce climate change impacts in the latter decades of the 21st century. Benefits from adaptation can be realised now to address current risks, and can be realised in the future to address emerging risks. Innovation and investments in environmentally sound infrastructure and technologies can both reduce GHG emissions and enhance resilience to climate change.
- 4.1.7 There is some overlap between references within the legal and policy framework section and the environmental baseline sections as some documents and/or data are relevant to aspects of the GHG assessment, the in-combination climate change impacts assessment and the climate change resilience assessment. Where possible

⁸ The term in-combination climate change impacts refers to the combined effect of the impacts of the Proposed Scheme and potential climate change impacts on the receiving environment. It is not to be confused with the EIA terms 'combined effects' or 'cumulative effects'. The term 'potential climate change impacts' is not to be confused with the EIA term 'future predicted baseline'.

⁹ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Available online at: http://ar5-syr.ipcc.ch/topic_summary.php

duplication of content has been avoided. However, where documents and/or data are considered specific to each assessment they are mentioned in the relevant sections.

4.2 Legal and policy framework

International level

Greenhouse gases

- 4.2.1 The IPCC AR5¹⁰ published in September 2013 strengthened its statement on human influence being the dominant cause of the observed global average temperature increases from very likely (>90% certain) in the last assessment report (Fourth Assessment Report¹¹) to extremely likely (95-100% certain) in AR5.
- 4.2.2 The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)¹², adopted in 1997, provided legally binding limits on GHG emissions for 37 Annex 1 countries (of which the UK is one). The Protocol's first commitment period started in 2008 and ended in 2012; the 37 Annex 1 countries committed to reduce GHG emissions to an average of 5% below 1990 levels. The second commitment period began in 2013 and will end in 2020; parties have committed to reduce GHG emissions by at least 18% below 1990 levels¹³.
- 4.2.3 Negotiations in December 2015 on the future of international cooperation on climate change at the 21st Conference of the Parties of the UNFCCC (CoP21) in Paris¹⁴ resulted in a legally binding treaty on climate action containing voluntary emission reduction commitments from 195 countries starting in 2020. A central aim of the agreement is to strengthen the global response to climate change by limiting the global temperature increase this century to below 2 degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

In-combination climate change impacts

- 4.2.4 No relevant overarching international legislation or policy framework exists for the in-combination climate change impacts assessment within the EIA process. The most relevant publications for this assessment are:
- Food and Agriculture Organisation of the United Nations guidance report on climate change impacts on agriculture¹⁵, soils¹⁶ and forests¹⁷; and

¹⁰ IPCC, (2013), Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Available online at: <https://www.ipcc.ch/report/ar5/wg1/>; Accessed: 14 July 2016

¹¹ IPCC, (2007), Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Available online at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html; Accessed: 14 July 2016

¹² UNFCCC, (1998), Kyoto Protocol to the United Nations Framework Convention on Climate Change; <http://unfccc.int/resource/docs/convkp/kpeng.pdf>; Accessed: 5 August 2016.

¹³ UNFCCC, The Kyoto Protocol. Available online at: http://unfccc.int/kyoto_protocol/items/2830.php; Accessed: 5 August 2016.

¹⁴ UNFCCC, (2015), Conference of the Parties, Adoption of the Paris Agreement. Available online at: <http://unfccc.int/resource/docs/2015/cop21/eng/lo9r01.pdf>; Accessed: 20 April 2016

¹⁵ The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts for agriculture. Available online at: <http://www.fao.org/docrep/018/i3325e/i3325e.pdf>; Accessed 9 June 2016

¹⁶ The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts on soils. Available online at: <http://www.fao.org/docrep/w5183e/w5183e05.htm>; Accessed 9 June 2016

¹⁷ The Food and Agriculture Organisation of the United Nations guidance report on climate change impacts on forests. Available online at: <http://www.fao.org/3/i3383e.pdf>; Accessed 9 June 2016

- World Health Organisation fact sheet on climate change and health¹⁸.

Climate change resilience

- 4.2.5 There is no relevant overarching international legislation or policy framework for the climate change resilience assessments within the EIA process. The most relevant publication for this assessment is the UN report on Climate change impacts and adaptation for international transport networks¹⁹.

European level

Greenhouse gases

- 4.2.6 Under the Kyoto Protocol's second commitment period of 2013-2020, the collective EU target is to reduce GHG emissions by 20% relative to 1990 levels²⁰.
- 4.2.7 In 2014 the EU agreed to collectively reduce GHG emissions by at least 40% by 2030 compared to 1990 levels²¹, this commitment was reaffirmed in the EU's Intended Nationally Determined Contribution (INDC)²² submitted as part of the Paris Agreement.
- 4.2.8 The EU emissions trading system (EU ETS)²³ is a cornerstone of the EU's policy to meet its GHG emissions reduction targets and is a key tool for reducing GHG emissions cost-effectively. The EU ETS is a cap-and-trade mechanism whereby a total amount of allowable annual GHG emissions for electricity generation, large energy-intensive industries (such as steel and aluminium production) and commercial flights to and from the EU and the three European Economic Area European Free Trade Association states (Norway, Lichtenstein and Iceland) has been agreed at the EU level. Those installations covered by the cap are allowed to trade emission allowances²⁴ with one another.
- 4.2.9 The emissions cap for 2013 from all fixed installations (power stations and other activities excluding aviation) was set at 2,084,301,856 allowances (tCO₂e). During the third phase of EU ETS (2013-2020) the total number of allowances issued will decrease by 1.74% annually, equivalent to 38,264,246 per annum²⁵. This will result in there being 21% less emissions (within the cap) in 2020 than in 2005. In October 2014 the

¹⁸ The World Health Organisation fact sheet on climate change and health. Available online at:

<http://www.who.int/mediacentre/factsheets/fs266/en/> <http://www.who.int/mediacentre/factsheets/fs266/en/>

¹⁹ United Nations Economic Commission for Europe (2013) Climate Change Impacts and Adaptation for International Transport Networks. Available online at: http://www.unece.org/fileadmin/DAM/trans/main/wp5/publications/climate_change_2014.pdf; Accessed 20 June 2016.

²⁰ European Commission, (2013), Ratification of the second commitment period of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder. Available online at:

http://ec.europa.eu/clima/policies/international/negotiations/docs/com_2013_768_en.pdf; Accessed: 10 August 2016.

²¹ European Commission, (2014), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A policy framework for climate and energy in the period from 2020 to 2030. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>; Accessed: 5 August 2016.

²² Latvian Presidency for the Council of the European Union, (2015), Submission by Latvia and the European Commission on behalf of the European Union and its Member States. Available online at: <http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Latvia/1/LV-03-06-EU%20INDC.pdf>; Accessed: 5 August 2016.

²³ The EU referendum result will have no immediate impact on the UK's participation in EU ETS. The UK remains a member of the EU and giving effect to the referendum result is expected to include a long negotiation process, during which compliance with EU ETS will continue as normal.

²⁴ One allowance equals one tonne of CO₂e allowances can either be allocated freely or auctioned by governments. Available online at: <https://www.gov.uk/guidance/eu-ets-carbon-markets>; Accessed: 22 October 2013.

²⁵ European Commission, *Emissions cap and allowances*. Available online at: http://ec.europa.eu/clima/policies/ets/cap/index_en.htm; Accessed: 14 July 2016.

European Council endorsed²⁶ that industrial and power sectors covered by the EU ETS should reduce emissions by 43% by 2030 compared to 2005²⁷.

- 4.2.10 There has been a surplus in emission allowances since 2009, partially due to slow economic growth in the EU, resulting in low carbon prices and a weaker incentive to reduce emissions. The European Commission (EC) has tried to address this by postponing (or 'back-loading') of the auction of 900,000,000 allowances. This was followed by an agreement to establish a market stability reserve where unallocated allowances would be transferred to in 2019-2020²⁸. The EC hopes these measures will help address the market imbalance of allowances. Efforts to address the market imbalance would also be helped by a faster reduction of the annual emissions cap. This is part of the EC proposal for the revision of the EU ETS²⁹.
- 4.2.11 For the sectors of the economy not regulated under the EU ETS³⁰ the EC presented, in July 2016, proposals for binding annual GHG emissions reduction targets for Member States for the period 2021-2030³¹. The legislative proposal states that non-ETS sectors across Member States should reduce GHG emissions by 30% by 2030 compared to 2005³².
- 4.2.12 The 2011 government White Paper Roadmap to a Single European Transport Area³³ sets out a number of initiatives to build a transport sector which contributes to EU GHG emissions reduction targets. It states that transport policy must be resource and energy efficient. Its goal is *"to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently"*. It also states that curbing mobility is not an option. For high speed rail, the objective by 2050 is to *"complete a European high-speed rail network, triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail"*.

In-combination climate change impacts

- 4.2.13 The relevant publications for the in-combination climate change impacts assessment at the European level are:

²⁶ European Council. Brussels, 24 October 2014. EUCO 169/14. CO EUR 13. CONCL 5. From: General Secretariat of the Council. T: Delegations. Subject: European Council (23 and 24 October 2014) - Conclusions. [Relating to] I. 2030 Climate and Energy Policy Framework. <http://data.consilium.europa.eu/doc/document/ST-169-2014-INIT/en/pdf>

²⁷ European Commission, (2014), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A policy framework for climate and energy in the period from 2020 to 2030. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>; Accessed: 5 August 2016.

²⁸ European Commission, *Structural reform of the EU ETS*. Available online at: http://ec.europa.eu/clima/policies/ets/reform/index_en.htm; Accessed: 14 July 2016.

²⁹ http://ec.europa.eu/clima/policies/ets/revision/index_en.htm

³⁰ These sectors include buildings, agriculture, waste management and transport.

³¹ European Commission, (2014), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A policy framework for climate and energy in the period from 2020 to 2030. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015&from=EN>; Accessed: 5 August 2016.

³² The UK national target is to achieve a 37% reduction in non-ETS GHG emissions.

³³ European Commission, (2011), White Paper Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system. Available online at: [http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_com\(2011\)_144_en.pdf](http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_com(2011)_144_en.pdf); Accessed: 20 April 2016.

- the EIA Directive 2011/92/EU³⁴ and the amended EIA Directive 2014/52/EU³⁵;
- the EC guidance on Integrating Climate Change and Biodiversity into EIAs³⁶; and
- EC publications addressing climate change impacts for agriculture³⁷, ecology and landscape³⁸, health³⁹ and water⁴⁰.

Climate change resilience

4.2.14 The relevant publications for the climate change resilience assessment at a European level are:

- the EIA Directive 2011/92/EU and the amended EIA Directive 2014/52/EU;
- the EC guidance on Integrating Climate Change and Biodiversity into EIAs; and
- EC sector specific guidance⁴¹ on the interface between climate change and infrastructure.

4.2.15 In addition to the publications listed above, the International Union of Railways has published a report on the Adaptation of Railway Infrastructure to Climate Change⁴². The report includes a review of the current status of adaptation of railway infrastructure in Europe and also lists a set of recommendations to enhance the resilience of railway infrastructure.

National

Greenhouse gases

4.2.16 The Climate Change Act 2008⁴³ established a framework for the UK to achieve its long-term goals of reducing GHG emissions by at least 80% from 1990 levels by 2050. The Climate Change Act 2008 includes an interim target of at least a 34% reduction from 1990 levels by 2020. To ensure that regular progress is made towards the target, the Climate Change Act 2008 also established a system of carbon budgets. The first four carbon budgets, leading to 2027, have been set in law. Meeting the fourth carbon budget (2023-27) will require that GHG emissions are reduced by 50% on 1990 levels in 2025. In November 2015, the Committee on Climate Change (CCC) published its

³⁴ Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment. Strasbourg, European Parliament and European Council.

³⁵ Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052>; Accessed 10 June 2016

³⁶ European Commission, (2013), Integrating Climate Change and Biodiversity into Environmental Impact Assessment. Available online at: <http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf>; Accessed: 20 April 2016

³⁷ http://ec.europa.eu/agriculture/climate-change/factsheet_en.pdf; Accessed 10 June 2016

³⁸ <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2008.01569.x/pdf>; Accessed 10 June 2016

³⁹ http://ec.europa.eu/health/climate_change/policy/index_en.htm; Accessed 10 June 2016

⁴⁰ http://ec.europa.eu/environment/water/adaptation/index_en.htm; Accessed 10 June 2016

⁴¹ European Commission, (2013), Adapting Infrastructure to Climate Change- Communication from the commission to the European Parliament, the council, the European economic and social committee and the committee of the regions: An EU Strategy on Adaptation to Climate Change. Available online at: http://ec.europa.eu/clima/policies/adaptation/what/docs/swd_2013_137_en.pdf; Accessed 10 June 2016

⁴² International Union of Railways, (2011), Adaptation of Railway Infrastructure to Climate Change

⁴³ Her Majesty's Stationery Office, (2008), Climate Change Act 2008, London. Available online at: <http://www.legislation.gov.uk/ukpga/2008/27/contents>; Accessed: 20 April 2016.

recommendations for the fifth carbon budget⁴⁴. The CCC recommended that the fifth carbon budget is set at 1,765 MtCO₂e⁴⁵, over the period 2028-2032. This would limit annual GHG emissions to an average 57% below 1990 levels.

- 4.2.17 Following the COP21 Paris agreement in December 2015 the CCC repeated their recommendation that the fifth carbon budget be legislated at 1,765 MtCO₂e and stated that the Paris agreement, combined with the requirements of the Climate Change Act 2008, make it clear that this is the minimum level of UK ambition necessary⁴⁶. Since then, the CCC has published its annual progress report to Parliament⁴⁷, which reviews recent progress, but also sets out areas where policy should be developed and strengthened if it is to succeed in meeting the fourth and fifth carbon budgets. The CCC identified a need for development and strengthening of “national and local policies to reduce demand for car travel, sufficient to deliver car-km reductions of around 5% below the baseline trajectory, including through shifts to public transport, cycling and walking”.
- 4.2.18 The Government announced in June 2016 that it will adopt the CCC recommendation and is expected to propose draft legislation for the fifth carbon budget and publish a plan setting out how it expects to meet the fourth and fifth carbon budgets by the end of 2016.
- 4.2.19 The Carbon Plan (2011)⁴⁸ sets out the government's plans for achieving the GHG emissions reductions committed to in the Climate Change Act. Low carbon transport is an essential part of the Carbon Plan. The Carbon Plan states that rail travel will become substantially decarbonised through increasing electrification and the use of more efficient trains and lower carbon fuels. The Carbon Plan mentions that the proposed high speed rail network, now being developed by HS2 Ltd, “will transform rail capacity and connectivity to promote longterm and sustainable economic growth”. Furthermore, the Carbon Plan notes that further electrification of the rail network will support low carbon modal shift in the future.

In-combination climate change impacts

- 4.2.20 The relevant publications for the in-combination climate change impact assessment at the national level are:
- the Institute of Environmental Management and Assessment (IEMA) guidance on climate change resilience and adaptation⁴⁹;
 - the UK Climate Change Risk Assessment summary reports for agriculture;

⁴⁴ Committee on Climate Change, (2015), The Fifth Carbon Budget - The next step towards a low-carbon economy. Available online at: <https://documents.theccc.org.uk/wp-content/uploads/2015/11/Committee-on-Climate-Change-Fifth-Carbon-Budget-Report.pdf>; Accessed: 20 April 2016.

⁴⁵ The budget includes emissions from domestic aviation and shipping, and, for the first time, international shipping. However, emissions from international aviation are not accounted for.

⁴⁶ <https://www.theccc.org.uk/wp-content/uploads/2016/01/Paris-Agreement-and-fifth-carbon-budget-CCC-letter-to-Rt-Hon-Amber-Rudd.pdf>

⁴⁷ <https://www.theccc.org.uk/wp-content/uploads/2016/06/2016-CCC-Progress-Report.pdf>

⁴⁸ HM Government, (2011), The Carbon Plan: Delivering our Low Carbon Future. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf; Accessed: 20 April 2016.

⁴⁹ Institute of Environmental Management and Assessment (IEMA); IEMA guide to climate change resilience and adaptation, 2015. Available online at: https://www.iema.net/.../climate20change20adaptation20and20eia_o.pdf; Accessed 9 June 2016

biodiversity and ecosystem services; forestry; health; and water⁵⁰;

- the reports submitted under the UK Adaptation Reporting Power (ARP) in the first and second rounds of reporting⁵¹, which include the identification and examination of risks and impacts relevant to water, agriculture and forestry, health and wellbeing, and the natural environment;
- the Environment Agency guidance on climate change allowances to be used in flood risk assessments as set out in the NPPF⁵²; and
- CCC⁵³ and NPPF Planning Practice Guidance (PPG) on climate change⁵⁴, which consider addressing climate change impacts in the planning and decision making process for major transport infrastructure projects to be a core priority.

4.2.21 In addition to the publications listed above, the Adaptation Sub-Committee (ASC) reports to Parliament on the Government's progress in preparing the UK for the impacts of climate change, by delivering the National Adaptation Programme. The first ASC report to Parliament⁵⁵ highlights that flooding remains one of the most serious current and future risks to the UK and that there is a need to consider the impacts on health from current and future high temperatures.

Climate change resilience

4.2.22 The relevant publications for the climate change resilience assessment at the national level include:

- reports from Government Departments including Defra⁵⁶, the DfT⁵⁷ and the Cabinet Office⁵⁸;
- UK Adaptation Reporting Power reports submitted by bodies such as Transport for London and Network Rail⁵⁹; and
- the UK Climate Change Risk Assessment summary report for the transport sector⁶⁰ and the infrastructure chapter in the UK Climate Change Risk

⁵⁰ <http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=15747>; Accessed 9 June 2016

⁵¹ <https://www.gov.uk/government/collections/climate-change-adaptation-reporting-second-round-reports>; Accessed 9 June 2016

⁵² <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>; Accessed 9 June 2016

⁵³ Committee on Climate Change; Adapting to climate change. Available online at: <https://www.theccc.org.uk/tackling-climate-change/>. Accessed January 2016

⁵⁴ Department for Communities & Local Government; Planning Practice Guidance – Guidance climate change. Available online at: <http://planningguidance.communities.gov.uk/blog/guidance/climate-change/why-is-it-important-for-planning-to-consider-climate-change/>. Accessed February 2016.

⁵⁵ https://documents.theccc.org.uk/wp-content/uploads/2015/06/6.736_CCC_ASC_Adaptation-Progress-Report_2015_FINAL_WEB_070715_RFS.pdf; Accessed 9 June 2016

⁵⁶ Department for Environment, Food and Rural Affairs, (2011), Climate Resilient Infrastructure: Preparing for a Changing Climate. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69269/climate-resilient-infrastructure-full.pdf. Accessed 20 June 2016

⁵⁷ Department for Transport, (2010), Climate Change Adaptation Plan for Transport 2010-2012 – Enhancing Resilience to Climate Change. Available online at: <http://www.ukaccs.info/adaptationplan0310.pdf>. Accessed 20 June 2016

⁵⁸ Cabinet Office; Keeping the country running: natural hazards and infrastructure, 2011. Available online at: <https://www.gov.uk/government/publications/keeping-the-country-running-natural-hazards-and-infrastructure>

⁵⁹ Transport for London, (2015), Providing Transport Services Resilient to Extreme Weather and Climate Change: 2015 Update Report following last report to Government in 2011.

⁶⁰ <http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=15747>; Accessed 9 June 2016

Assessment 2017 Evidence Report⁶¹.

- 4.2.23 All of these reports have identified resilience to climate change as a major transport infrastructure challenge that needs to be addressed.
- 4.2.24 Government has also identified a need for "an infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate"⁶². This is reflected in the HS2 Sustainability Policy and is reinforced within the National Adaptation Programme⁶³.
- 4.2.25 The Rail Safety Standards Board⁶⁴ has examined current and projected impacts of climate change and extreme weather across the entire rail system of Great Britain within the Tomorrow's Railway and Climate Change Adaptation (TRaCCA) research project. It should be noted that HS2 was not specifically discussed in the TRaCCA project as it focused primarily on the classic rail network. Key recommendations for increasing awareness of impacts and risks, and developing strategies for adaptation and resilience have been published⁶⁵. Similarly, Network Rail⁶⁶ has reported on climate change risks and proposed adaptation measures for its infrastructure and assets.

4.3 Greenhouse gases assessment

Scope, assumptions and limitations

- 4.3.1 For further detail on the scope of the GHG assessment refer to Section 8 of the SMR. Assumptions and limitations will be presented in the formal EIA Report.

Greenhouse gases assessment methodology

- 4.3.2 This assessment follows the methodology set out in Section 8 of the SMR.

Greenhouse gases baseline

- 4.3.3 An environmental baseline provides a reference point against which the impact of a new project can be compared. The environmental baseline for the Proposed Scheme is based on a 'without the Proposed Scheme' scenario (i.e. the Proposed Scheme is not built).

Greenhouse gases assessment results and conclusions

- 4.3.4 It should be noted that, at this stage, the availability of data is limited and therefore the GHG modelling of the Proposed Scheme is continuing to be developed. Results and conclusions from the GHG assessment will be presented in the formal EIA Report.

⁶¹ UK Climate Change Risk Assessment 2017 Evidence Report; Chapter 4: Infrastructure. Available online at: <https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ccra-chapters/infrastructure/>; Accessed 5 August 2016.

⁶² Department for Environment, Food and Rural Affairs, (2011), Climate Resilient Infrastructure: Preparing for a Changing Climate.

⁶³ Department for Environment, Food and Rural Affairs, (2013), National Adaptation Programme – Making the Country Resilient to a Changing Climate.

⁶⁴ Rail Safety and Standards Board (2015) Tomorrow's Railway and Climate Change Adaptation: Work Package 1 Summary Report

⁶⁵ Rail Safety Standards Board Tomorrow's Railway and Climate Change Adaptation: Final Report. Available online at: <http://www.rspb.co.uk/Library/research-development-and-innovation/2016-05-T1009-final-report.pdf>. Accessed 5 July 2016

⁶⁶ Network Rail (2015) Climate Change Adaptation Report 2015

4.4 In-combination climate change impacts assessment

Scope, assumptions and limitations

- 4.4.1 For further detail on the scope and limitations of the in-combination climate change impacts assessment refer to Section 8 of the SMR. Assumptions will be presented in the formal EIA Report.

In-combination climate change impacts assessment methodology

- 4.4.2 This assessment follows the methodology set out in Section 8 of the SMR.

In-combination climate change impacts baseline

- 4.4.3 This baseline section presents an overview of current and future climate conditions, including extreme weather events relevant for the in-combination climate change impacts assessment. It is also relevant to the climate change resilience assessment and so is cross referenced in Section 4.5.

Current climate in Fradley and Crewe

- 4.4.4 This section provides an overview of current climate and extreme weather experienced in and around Fradley and Crewe. These locations are considered generally representative of the climate conditions in which the Proposed Scheme would be located. The gridded observational data⁶⁷ used to assess the current baseline climate has been obtained at a spatial resolution of 5km. The time period 1961–1990 has been considered for comparison with the baseline period used in UKCP09 and the period 1961–2011 used to assess and identify possible trends in historical data. Four grid points centred on either end of the route have been selected to obtain this data.
- 4.4.5 Overall the local climate in the region of the Proposed Scheme does not vary significantly, and similar values for the main climate characteristics are observed for Fradley and Crewe. The main differences are higher temperatures, lower annual and summer precipitation, a higher number of days with heavy rainfall and a higher number of dry spells in Fradley. The maximum difference between Fradley and Crewe is approximately 2°C in mean daily summer maximum temperature.
- 4.4.6 The current climate and extreme weather events in the region based upon the average of the data obtained for Fradley and Crewe can be summarised as follows:
- winter mean temperature is approximately 3.9°C and ranges from an average minimum and maximum temperature of 1°C to 6.2°C. Summer mean temperature is 15°C and ranges from 10°C to 19°C;
 - precipitation levels are similar in winter and summer at 1.9mm/day;
 - there are almost no days per year when mean temperature is above 25°C and there are approximately six frost days per year; and
 - there is an average of one day a year with 'heavy rain' (defined as precipitation

⁶⁷ Met Office, Climate monitoring, UKCP09: Available datasets. Available online at: <http://www.metoffice.gov.uk/climatechange/science/monitoring/ukcp09/available/index.html>. Accessed 9 June 2016

greater than 25mm per day) and three dry spells (defined as 10 or more consecutive days with no precipitation, which are days with precipitation less than or equal to 0.2mm).

- 4.4.7 The results from the trend analysis show that there is not a significant trend for any of the precipitation indicators assessed (mean precipitation, greatest single day precipitation and maximum number of consecutive dry days). However, there is a significant trend in all the temperature indicators (mean, maximum and minimum daily temperature). Overall the difference in mean, maximum, and minimum temperature between the period 1961-1986 and 1987-2011 is approximately 0.9°C.
- 4.4.8 Local Climate Impacts Profiles (LCLIPs) have been produced by Birmingham City Council (2008)⁶⁸ and Cheshire East Council (2010)⁶⁹ to gain an understanding of the nature of extreme weather events and the impact they have on the community, environment and economy. These two LCLIPs are the nearest representative locations to Fradley and Crewe and provide a list of the past extreme weather events that have had an impact in the region. For example, heavy rain and flash floods have in the past caused flooded drains, collapsed culverts and contamination, among other impacts. The types of weather impacts described in these LCLIPs, whilst localised, could occur anywhere across the route.
- 4.4.9 The region has been subject to a number of extreme weather events since the production of the LCLIPs described above. The most recent of these was a 1-day duration heatwave, which occurred on 1 July 2015 affecting the whole of the UK⁷⁰. There is no official definition of heatwave in the UK, the Met Office tend to use the World Meteorological Organization definition which is "*when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5°C, the normal period being 1961-1990*"⁷¹. However, shorter periods of hot weather relative to the expected conditions such as 1 July 2015 are in some cases also categorised as a heatwave by the Met Office.
- 4.4.10 Strategic and Preliminary Flood Risk Assessments for Staffordshire⁷² identified notable flood events that occurred in October 2010 and in 2012 between June and November which resulted in numerous local flooding issues across Staffordshire. Most recent anomalous temperature recordings include spring 2011, the warmest spring on record in the UK in the last 100 years, and in November and December in 2010 when the UK experienced two spells of severe winter weather with very low temperatures and significant snowfalls. Between 2010 and 2012, England experienced one of the 10 most significant droughts of one to two years duration in the last 100 years.

Climate change projections for Fradley and Crewe

- 4.4.11 As for the current climate conditions, climate change projections for Crewe are similar to those for Fradley. Climate change projections have been obtained for main climate variable characteristics for the medium and high emissions scenarios and the 10%,

⁶⁸ www.birmingham.org.uk/uploads/LCLIP.pdf

⁶⁹ <https://www.whatdotheyknow.com/request/197245/response/490315/attach/3/Cheshire%20East%20LCLIP.pdf>

⁷⁰ <http://www.metoffice.gov.uk/climate/uk/interesting/july2015>

⁷¹ <http://www.metoffice.gov.uk/learning/learn-about-the-weather/weather-phenomena/heatwave>

⁷² Staffordshire County Council (2011) Staffordshire Preliminary Flood Risk Assessment. Available online at:

<http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/flho1211bvro-e-e.pdf>

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50% and 90% probability levels. Table 2 summarises the overall climate change trends obtained. The trends shown in Table 2 represent the average of the projected changes for Fradley and Crewe. Data for the low emissions scenario has not been considered as, given historical GHG emissions, it is not regarded a realistic scenario. More detailed information on climate change projections for mean climate conditions and extreme weather events will be set out in supporting appendices to be included in the formal EIA Report.

Table 2: Summary of main climate change trends for Fradley and Crewe

Climate variable characteristic	Overall trend	Comments
Winter mean temperature	↑	The largest increase in temperature is estimated to be in the mean daily maximum temperature in summer, which is projected to increase from approximately 19°C to 24°C by the 2080s (medium emissions scenario and 50% level). For the high emissions scenario and 50% level daily maximum temperature in summer is projected to be 25.5°C by 2080
Summer mean temperature	↑	
Winter mean precipitation	↕	Winter precipitation is projected to remain similar to current mean precipitation for the 2020s and increase slightly by the 2080s for both the medium and high emission scenarios.
Summer mean precipitation	↓	Summer precipitation is projected to decrease for the 2020s and 2080s.
Annual number of days with high temperature (mean temperature higher than 25°C)	↑	Up to 3.2 days per year in 2080 for the high emissions scenario and 1.5 days for the medium emissions scenario.
Annual number of frost days	↓	The annual number of frost days is projected to decrease for the 2020s and 2080s.
Annual number of days with 'heavy rain' (precipitation higher than 25mm/day)	↑	Increase in the variability of rainfall patterns in the region for both the medium and high emission scenarios.
Annual number of dry spells (10 or more consecutive days without precipitation)	↑	
Summer highest daily maximum temperature	↑	Projected increase of 5°C and 6°C by the 2080s for the medium and high emissions scenarios respectively.
Winter number of frost days	↓	The projections point to a decrease of 9 days, from 12 in the current climate to 3 days by the 2080s and for the medium emissions scenario. A decrease of 10 days is projected for the high emissions scenario.
Winter greatest single days precipitation amount	↑	5mm/day and 6mm/day by the 2080s for the medium and high emissions scenarios respectively.
Summer greatest single days precipitation amount	↑	2mm/day and 2.5mm/day by the 2080s for the medium and high emissions scenarios respectively.

Climate variable characteristic	Overall trend	Comments
Summer consecutive dry days	↑	The projections point to an increase of 6 days, from 13 in the current climate to 19 days by the 2080s for the medium emissions scenario. The increase projected for the high emission scenarios is of almost 9 days.

In-combination climate change impacts assessment results and conclusions

- 4.4.12 An initial route-wide assessment of potential climate change impacts will be undertaken for all environmental topics. The results of this initial assessment will be summarised in tables for each topic to provide an understanding of the requirement for a more detailed assessment for specific topics or community areas.
- 4.4.13 The results of the assessment will be presented under the following general headings in the formal EIA Report:
- resources/receptors potentially impacted by the Proposed Scheme;
 - effects of Proposed Scheme on receptors/resources identified by topic;
 - existing mitigation measures identified by topic;
 - potential climate change impacts on resources/receptors;
 - likelihood and significance of in-combination climate change impacts and effects given existing mitigation measures;
 - mitigation measures to address adverse effects on the ability of resources and receptors to adapt to climate change; and
 - allowances for future measures and monitoring.
- 4.4.14 The results and conclusions of the in-combination climate change impacts assessment will be reported in the formal EIA Report.

4.5 Climate change resilience assessment

Scope, assumptions and limitations

- 4.5.1 For further detail on the scope and limitations of the climate change resilience assessment refer to Section 8 of the SMR. Assumptions will be presented in the formal EIA Report.

Climate change resilience assessment methodology

- 4.5.2 This assessment follows the methodology set out in Section 8 of the SMR.

Climate change resilience baseline

- 4.5.3 The baseline section in Section 4.4 of the in-combination climate change impacts assessment also applies to the climate change resilience assessment.

Climate change resilience assessment results and conclusions

- 4.5.4 A high level climate change risk and resilience assessment will be undertaken to identify the potential risks of climate change for all infrastructure and assets associated with the Proposed Scheme and to assess the Proposed Scheme's resilience and capacity to cope with these potential risks.
- 4.5.5 The assessment results will be presented under the following general headings in the formal EIA Report:
- climate hazard;
 - trend and/or likelihood of climate hazard;
 - infrastructure and/or asset/s associated with the Proposed Scheme which may be affected by hazard;
 - potential climate change impact on Proposed Scheme;
 - potential climate change risk to Proposed Scheme;
 - likelihood and consequence of risk (with embedded mitigation); and
 - likelihood and consequence of risk (with additional mitigation, if required).
- 4.5.6 The results and conclusions of the climate change resilience assessment will be reported in the formal EIA Report.

5 Community

- 5.1.1 Community impacts arising from both the construction and operation of the Proposed Scheme are considered to be of predominantly local significance and have accordingly been assessed in the community area reports. Impacts on the public rights of way that run through multiple community areas are considered to be localised, and therefore, are also appropriately reported in the individual Volume 2 community area reports 1-5.
- 5.1.2 Construction worker impacts on community resources will be considered at a route-wide level in the formal EIA Report. The assessment will take into account the number of workers, the type and location of accommodation, working hours, facilities provided on construction compounds, experience from other large projects (such as HS1) and the measures contained in the draft CoCP.
- 5.1.3 Following completion of associated studies (e.g. sound, noise and vibration and traffic and transport), localised in-combination effects will be reported at community area level for both construction and operation in the formal EIA Report.

6 Cultural heritage

- 6.1.1 Heritage assets can be affected through physical removal or through changes to their setting due to development. The loss of individual heritage assets and effects on setting are considered to be most appropriately assessed on a case by case basis and are, therefore, reported within Volume 2, community area reports 1-5.
- 6.1.2 The Proposed Scheme will not have a direct physical effect on any World Heritage site, scheduled monument, registered park and garden or registered battlefield and will not require the demolition of any Grade I or Grade II* listed building. Effects on ancient woodland are considered in Section 7, Ecology and biodiversity.
- 6.1.3 Across the entire route of the Proposed Scheme, a number of designated heritage assets will be significantly affected through direct physical impact. At this stage of the design process this comprises one Grade II listed milepost and two conservation areas (Ingestre and Swynnerton).
- 6.1.4 Heritage assets physically affected by the Proposed Scheme will be subject to a programme of historic environment investigation, recording, analysis, reporting and archiving. Although such a programme contributes to advancing our understanding, it will not fully mitigate the loss of the heritage assets and consequently each effect is considered on an individual basis within Volume 2, community area reports 1-5.

7 Ecology and biodiversity

7.1 Introduction

- 7.1.1 This section of the report discusses anticipated significant effects on ecological resources / receptors at the regional or route-wide scale. In line with Government policy, HS2 Ltd has the objective of seeking to achieve no net loss in biodiversity.
- 7.1.2 Ecology survey and assessment work is ongoing, and the findings from these surveys will be reported in the formal EIA Report. In the absence of field surveys and fully developed mitigation, it is not currently possible to identify fully the effects that are likely to be significant at regional or route-wide levels.
- 7.1.3 The assessment made for this working draft EIA Report is provisional and has been undertaken on a precautionary basis. A fuller assessment of significant effects will be included in the formal EIA Report.

7.2 Designated sites

- 7.2.1 No sites of international importance for nature conservation would be affected by construction or operation of the Proposed Scheme.
- 7.2.2 The potential for effects on Pasturefields Salt Marsh Special Area of Conservation (SAC), and the Midlands Meres and Mosses Phase 1 Ramsar site have been considered within Habitats Regulations Assessment (HRA) screening reports. Pasturefields Salt Marsh SAC is 650m from the Proposed Scheme and the Betley Mere element of the Midland Meres and Mosses Ramsar Site is over 200m from the Proposed Scheme. The HRA screening report for Pasturefields Salt Marsh SAC concluded that there were no likely significant effects. The HRA for the Midland Meres and Mosses Ramsar Site scoped out Betley Mere from further consideration due to lack of potential effects. The conclusions of the two HRAs were agreed with Natural England. These sites are also designated as sites of special scientific interest (SSSI). There are no additional SSSI within 500m of the Proposed Scheme.
- 7.2.3 Ten non-statutory local wildlife sites (LWS) are considered to be potentially subject to significant effects. LWS are of county/metropolitan value.
- 7.2.4 Two woodlands listed on the Ancient Woodland Inventory Sites (AWIS) (Whitmore Wood and Barhill Wood) are considered to be potentially subject to significant effects, and are relevant to the assessment. Ancient woodland is irreplaceable. A further 10 woodlands, not currently listed on the AWI, but with potential to be ancient woodlands based on a review of historical mapping, lie within the land required for construction of the Proposed Scheme, or may be affected by the Proposed Scheme.
- 7.2.5 On the basis of existing information, the land required for the construction of the Proposed Scheme would include the permanent loss of approximately 6.5ha of irreplaceable ancient woodland (AWIS), approximately 114km of hedgerows (some of which may be Important hedgerows⁷³) and 158 ponds. In view of the provisional identification of the further 10 areas that may be ancient woodland, the total area of

⁷³ As identified under the Hedgerows Regulations, 1997

ancient woodland that will be lost may be higher. The design of the Proposed Scheme includes viaducts across the main watercourses, which would reduce effects, and other mitigation included at this stage would help to reduce the effects on other habitats (excluding ancient woodland) to a level that would be not significant.

- 7.2.6 As well as direct losses to habitats, the formal EIA Report will identify any significant indirect effects to habitats (e.g. from dust, air emissions from construction traffic), and effects on connectivity of habitats.
- 7.2.7 The Volume 2, community area reports 1-5 identify some provisional mitigation areas. The formal EIA Report will include further mitigation as required.

7.3 Species

- 7.3.1 Adverse effects on protected and notable species could occur throughout the Proposed Scheme.
- 7.3.2 Based on existing records and the potential for suitable habitat, the impacts during construction which could result in significant route-wide effects may include:
- loss of bat roosts and foraging habitat severance of commuting routes used by bats;
 - loss of nesting and foraging habitat for barn owl and other Schedule 1⁷⁴ bird species;
 - loss of ponds and surrounding terrestrial habitat used by populations of great crested newt;
 - fragmentation of habitats used by other species such as great crested newt and badger;
 - loss of habitat used by polecat, water vole and reptiles; and
 - disturbance to sensitive species resulting from noise and lighting.
- 7.3.3 During operation there is the potential for significant route-wide effects on individuals of some bat species and birds, such as barn owl, due to the risk of mortality by passing trains during operation. This will be considered further and the findings reported in the formal EIA Report.
- 7.3.4 The Volume 2, community area reports 1-5 identify features (e.g. viaducts) and measures (e.g. new habitat creation) which have been included as part of the design, that reduce impacts on habitats and/or species, or contribute towards offsetting the effects of any impacts. The formal EIA Report will include assessments on habitats and species at a route-wide level, together with proposals for further measures to mitigate significant effects.

⁷⁴ The Wildlife and Countryside Act 1981 (1981 Chapter 69) – Schedule 1 – Birds which are Protected by Special Penalties, HMSO London (<http://www.legislation.gov.uk/ukpga/1981/69>)

8 Health

8.1 Introduction

8.1.1 This section assesses the potential health and wellbeing effects of the Proposed Scheme that would occur across the route as a whole, and also at the wider regional level. The health assessment considers the potential for impacts on a range of environmental and socio-economic 'health determinants', which would result in adverse or beneficial effects on the health of people within communities. Potential health effects that can be assessed at a local level are reported in the community area assessment sections in the Volume 2 community area reports.

8.2 Scope, assumptions and limitations

8.2.1 The scope, assumptions and limitations for the health assessment are set out in Volume 1 and the draft SMR.

8.2.2 A socio-economic model of health is adopted for this assessment in which the health status of a population, or changes to the health status, is attributed to a series of health determinants. An individual's health may be determined by genetics and lifestyle factors, but for a large enough population many other factors are known to be important and these factors may be affected by the Proposed Scheme. The scope of this route-wide assessment for the formal EIA includes the following health determinants:

- effects during construction:
 - education, employment and income;
 - residential relocations;
 - transport (traveller stress and road safety);
 - air quality; and
- effects during operation:
 - sound, noise and vibration (train noise).

8.2.3 The health assessment is based on a review of evidence linking changes in health determinants to potential health outcomes. This information will be presented in a literature review, which will be included in the formal EIA Report. The certainty that can be attached to any conclusion regarding effects on health will depend on the strength of the evidence for a given determinant and also the confidence attached to the prediction of an impact on a determinant. There will be greater certainty for the existence of an impact than a consequent effect on health.

8.2.4 Potential health effects have been identified based on information that is available at this stage of the assessment. A full assessment of health effects will be provided in the formal EIA Report.

8.3 Environmental baseline

- 8.3.1 The Proposed Scheme would run through mainly rural areas, which are sparsely populated. At its northern end, the route would run through more densely populated areas on the approach to Crewe. Data provided by the Office of National Statistics⁷⁵ and the Association of Public Health Observatories (APHO)⁷⁶ show that the rural areas that would be crossed by the Proposed Scheme are, by comparison with national averages, in good health and experience low levels of deprivation. The rural population as a whole is considered to be more resilient than the national average, with regard to changes in the relevant health determinants, and with relatively few vulnerabilities. One such vulnerability is a slightly higher than average proportion of older people across the majority of the route. Another is that the population is more deprived than the national average with regard to the indicator of 'barriers to affordable housing and social services'. In part, this reflects the rural nature of the area and the distance people have to travel to access such services.
- 8.3.2 The communities in Crewe East and Crewe South, within community area 5, have a number of vulnerabilities that are specific to this part of the route. Levels of employment deprivation and education and skills deprivation are higher than the national average and the proportion of children living in low income families is also above average. Parts of this area also have above national average levels of health and disability deprivation.
- 8.3.3 The available data permits a profile to be made of the whole population along the route of the Proposed Scheme and provides detail down to ward level⁷⁷. The description of the whole population and the populations within wards does not exclude the possibility that there will be some individuals or small groups of people who do not conform to the overall profile. Stakeholder engagement will be undertaken and this will provide further information of relevance to the community profile.

8.4 Avoidance and mitigation measures

- 8.4.1 Consideration of potential health issues is an integral part of the planning and design of the Proposed Scheme, alongside other environmental, community and economic issues. Adverse effects on health determinants have been reduced as far as reasonably practicable through embedded mitigation measures to reduce adverse effects on people. Examples of the mitigation measures incorporated into the design across the Proposed Scheme as a whole include the following:
- the Proposed Scheme has been designed to reduce the loss of property and community assets as far as reasonably practicable;
 - the vertical alignment has been designed to reduce visual intrusion and noise as far as reasonably practicable; and
 - landscape design and screening have been incorporated into the design.

⁷⁵ The Office of National Statistics (ONS) provides spatial data on levels of deprivation, using indicators of: 'multiple deprivation', 'employment', 'education', 'barriers to housing and social services', 'crime' and 'living environment'. These data are based on the 2011 census and available by Lower Super Output area.

⁷⁶ <http://www.apho.org.uk/> <http://www.apho.org.uk/> <http://www.apho.org.uk/> <http://www.apho.org.uk/>

⁷⁷ Electoral wards the spatial units used to elect local government councillors. National Census data are published at ward level.

- 8.4.2 In addition, the locations of construction compounds and haul routes have been selected to reduce exposure to construction impacts as far as reasonably practicable.
- 8.4.3 HS2 Ltd will require its contractors to comply with the environmental management regime for the Proposed Scheme, which will include the following core documents:
- the CoCP, which provides a generic basis for route-wide construction environmental management; and
 - Local Environmental Management Plans (LEMPs), which apply the management strategies at a local level.
- 8.4.4 The CoCP will be the means of controlling the construction works associated with the Proposed Scheme to ensure that the effects of the works upon people and the natural environment are reduced or avoided so far as reasonably practicable.
- 8.4.5 HS2 Ltd's strategic aims for skills, employment and education include facilitating access to training and employment opportunities along the line of the Proposed Scheme by local residents and includes apprenticeships and education initiatives. This includes working with local organisations to engage with unemployed people from local communities. HS2 Ltd's procurement strategy also includes measures to encourage local businesses to tender for work contracts.
- 8.4.6 Businesses required to relocate due to the construction of the Proposed Scheme may be eligible for compensation in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses being able to relocate to alternative premises and therefore, provides additional support over and above statutory requirements to facilitate this process and to reduce and/or offset the effects of the Proposed Scheme.
- 8.4.7 As described in Volume 1, it is assumed HS2 trains would be quieter than the relevant current European Union specifications. Noise barriers in the form of landscape earthworks and noise fence barriers will avoid or reduce significant airborne noise effects. Significant ground-borne noise and vibration effects will be avoided or reduced through the design and maintenance of the track and track bed.

8.5 Effects arising during construction

Education, employment and income

- 8.5.1 The Proposed Scheme has the potential to increase opportunities for employment and training during the construction phase. The socio-economic assessment (Section 12) estimates that the construction sites located along the route would generate 14,000 person years of construction jobs (the equivalent of 1,400 permanent full-time construction jobs), ranging from unskilled and low skilled jobs to technical and managerial roles. A further estimated 10,100 person years of employment (the equivalent of 1,010 full-time jobs) could be created as a result of demand for goods and services through the business supply chain and expenditure effects of workers. Communities along the route and in the wider Staffordshire and Cheshire East area would benefit from these job opportunities.
- 8.5.2 There is strong evidence of links between employment and income and physical and mental health status. The benefits of work are linked to increased opportunities for participation in society and increased access to healthier lifestyle choices, which are

associated with improved mental and physical health. Employment also has direct health benefits such as social and psychological wellbeing, with work being an important aspect of individual identity and social status.

- 8.5.3 Uptake of direct construction jobs from within local communities would be predominantly in lower skilled roles, as contractors generally appoint the majority of skilled and managerial staff from their existing workforce or recruit nationally. The jobs created would be located within the study area for the duration of the works, after which the training, skills and experience gained may improve future employment prospects in the construction sector.
- 8.5.4 The extent of beneficial health effects within the local communities along the route from direct construction employment would depend on the number of people who are able to, and choose to, take up opportunities for construction employment and training. For those who do, this has the potential to result in improved income, employment status and self-esteem, and associated health benefits. Health benefits are likely to be greatest in the more urban areas around Crewe, as this area contains a higher proportion of people of working age, more people with existing skills in the construction sector, and higher existing levels of unemployment and deprivation.
- 8.5.5 As well as generating construction employment opportunities, the Proposed Scheme would result in the displacement of some existing businesses through land required for its construction. The socio-economic assessment (Section 12) estimates that this would result in the relocation of 40 jobs. The majority of businesses affected in this way would be able to relocate, given the availability of alternative premises and the payment of compensation, and thereby continue to operate. However, some businesses may not relocate and taking this into account the socio-economic assessment estimates that 10 jobs might be lost across the route as a whole. This includes direct job losses within displaced businesses that do not continue to operate, and knock-on effects through the business supply chain.
- 8.5.6 This level of job losses is not considered to affect overall employment levels and associated levels of health and wellbeing across the community as a whole. However, some individuals may be adversely affected, particularly among the more vulnerable members of the community. Some businesses may be unable to find suitable alternative premises close to their existing site and may have to relocate further afield. In these instances, although the total number of jobs might remain the same, local workers might find themselves unable to commute to the new location, resulting in the loss of their job. This would be more likely to affect workers in lower paid positions for whom a longer commute might be not financially worthwhile or practical. Such impacts could result in long-term effects on employment status, leading to potential adverse health and wellbeing effects.

Residential relocations

- 8.5.7 The Proposed Scheme would result in the demolition of a total of 72 properties across the route as a whole, as follows:
- six properties in the Fradley to Colton area;
 - 13 properties in the Colwich to Yarlet area;

- six properties in the Stone and Swynnerton area;
- three properties in the Whitmore Heath to Madeley area; and
- 44 properties in the South Cheshire area⁷⁸.

- 8.5.8 People whose properties have to be acquired for the construction of the Proposed Scheme would be eligible for compensation in accordance with the Compensation Code. Similarly, compensation may also be available under the Compensation Code for people who find that their homes are physically affected (for example by noise from the railway) once the line is in operation. However, the majority of residents whose properties are required for the construction of the Proposed Scheme are likely to experience some degree of adverse effect resulting from the disruption and stress of moving.
- 8.5.9 There is moderate to strong evidence on the links between housing and health, relating to the quality and security of housing, and also to the effects of involuntary relocation. Relocation of people from their homes has been shown to influence health outcomes, as disturbance to people's living and social environment and routine may precipitate stress and related symptoms. Moving house involves disruption, uncertainty and changes to social networks and familiar environments and routines.
- 8.5.10 The degree of health effect associated with moving will depend on the vulnerability or resilience of the individuals affected. Age is a common factor in determining the ability of people to adapt to the effects of relocation. Older people are likely to find it more difficult to adapt to the effects of relocation, as are disabled people, or those with existing mental or physical health conditions. Parents and carers may need to move their children to different schools, or face longer journeys to school, particularly in rural areas. The total number of relocations has been reduced through the design of the Proposed Scheme. However, the majority of properties affected are in rural areas where there is a limited choice of alternative local properties. Those affected are therefore likely to experience a relatively high level of disruption and weakening of their social networks.
- 8.5.11 The degree to which the adverse effects associated with moving home and potentially relocating to a new neighbourhood are felt would depend on the individual vulnerability or resilience of the people affected. For example, older people, families with children, disabled people or those with long-term limiting illness are likely to be more dependent on support from within their local communities. Children may be particularly affected if the move results in a change of school. The onset of adverse effects would occur before the acquisition of properties, with uncertainty and concerns regarding timescales for the purchase and the impacts and logistics associated with the move.

⁷⁸ This includes 40 residential properties that are estimated to be either completed or under construction (as of Summer 2016) at the Basford West Development site. The assessment of residential relocation effects considers only those residential properties that are occupied. The working draft EIA Report is based on the existing baseline and therefore does not include impacts on residential properties currently under construction. Any effects relating to future occupied properties on this site will be reported in the formal EIA Report. An alternative location for a permanent maintenance facility is also being considered within the Stone and Swynnerton community area (CA3). If selected the Basford West development area would no longer be required and these demolitions would be avoided.

Transport effects

- 8.5.12 The Proposed Scheme will increase journey times on some roads affected by temporary and permanent stopping up and diversions. Changes to traffic flows and congestion around junctions during construction may also affect journey times. The potential health effects associated with access to social networks, services, health and social care are assessed at a local level in Volume 2. Journey time changes may also contribute to traveller stress; this is assessed at route-wide level since it will affect road users from across a wide area. Government guidance has identified traveller stress as comprising feelings of discomfort, annoyance, frustration or fear, culminating in physical and emotional tension that detracts from the quality and safety of a journey.
- 8.5.13 The extent to which the construction of the Proposed Scheme might lead to traveller stress depends on the duration and extent of increases in journey times. The transport assessment (Section 14 of Volume 2 reports) has identified routes that could be subject to increases in traffic flows, diversions or realignments. It is likely that some of these will cause journey time impacts with the potential to result in increased traveller stress. Predicted journey time impacts will be identified in the formal EIA Report, and the health effects in terms of traveller stress will be assessed. The construction of the Proposed Scheme would also increase the amount of HGV traffic on some roads which, if not properly managed, has the potential to adversely affect road safety. The HGV content of traffic can affect road safety, particularly for pedestrians, cyclists and equestrians. The rate of fatal or serious accidents involving HGVs is reducing significantly due to improved awareness and safety measures, with fatal or serious accidents involving HGVs falling by 45% between 2006 and 2015⁷⁹ HS2 Ltd would discuss with local authorities measures to ensure road safety during construction works. The nominated undertaker, in line with the CoCP, would produce traffic management plans including measures to address road safety and reduce the risks to non-motorised users from construction vehicles on the roads.
- 8.5.14 It is considered that, with appropriate management including restrictions on the timing of lorry movements, the construction of the Proposed Scheme would not result in direct adverse health effects associated with road safety. However, road safety is likely to be a key issue of concern to local communities, and this could contribute to adverse effects on wellbeing through increased levels of anxiety, as well as potential behavioural changes such as reduced uptake of walking and cycling on construction traffic routes.
- 8.5.15 The construction of the Proposed Scheme has the potential to result in increased exposure to air pollutants including NO₂, NO_x and small particulate matter (PM₁₀ and PM_{2.5}). Where a large population is exposed to an appreciable change in exposure it is possible to quantify these health effects. The likely extent of exposure across the route as a whole will be reviewed, based on the findings of the air quality assessment, and health effects will be assessed as appropriate in the formal EIA Report.

⁷⁹ Reported road casualties in Great Britain: main results 2015. DfT, 30 June 2016

8.6 Effects arising during operation

Sound, noise and vibration

- 8.6.1 During the operation of the Proposed Scheme people along the route will be exposed to noise and vibration from passing trains. The quantitative assessment of the potential health effects of noise will be undertaken at route-wide level, since a large exposed population is needed to yield reliable assessment results, and reported in the formal EIA Report. Other operational health effects will be assessed in the Volume 2 community area reports.

9 Land quality

9.1 Introduction

- 9.1.1 This section presents the route-wide assessment of the likely significant land quality effects arising from the Proposed Scheme. Land quality encompasses issues relating to existing land contamination, to mineral or mining resources and to geological conservation resources.
- 9.1.2 As most of the route would run through predominantly rural areas, potentially contaminative land uses will be found only in isolated locations, and remediation at the construction stage will give rise essentially to local effects. Controls to deal with the effects of encountering land contamination are set out in the draft CoCP, and may be enhanced by site-specific remediation measures.
- 9.1.3 Through more urban areas, where the incidence of potentially contaminative land uses will be more widespread, the effects will again be essentially local in nature due to the limited area over which contamination can spread. Although landfill gases, leachate and contaminated groundwater can migrate some distance from their source, such migration is unlikely to lead to any regional effects, for example, involving two or more community areas. Where either groundwater or ground gas migration is encountered, measures will be put in place to control contaminant mobilisation as necessary to avoid the occurrence of adverse effects.
- 9.1.4 One local geological conservation resource has been identified within the vicinity of the Proposed Scheme, but the effect of the Proposed Scheme crossing this feature is localised and does not constitute a regional or route-wide effect on geological conservation areas.

9.2 Assessment of the effects of construction

- 9.2.1 It is intended to deal with contamination by treating contaminated soils and reusing the suitably treated material wherever practicable and necessary. Off-site disposal of contaminated soils is normally considered to be the least sustainable method of dealing with contamination, and will be restricted to those soils which cannot be made suitable for reuse through treatment or reallocation to appropriate locations. The likely incidence of such materials is considered to be low, and therefore the route-wide disposal of contaminated soils is not considered to be a significant issue in the context of the off-site void space available (see Section 15, Waste and material resources). With the application of the measures set out in the draft CoCP and any site-specific remediation, it is anticipated that there will be no likely significant adverse route-wide effects during construction.
- 9.2.2 The incidence of mineral deposits affected by the Proposed Scheme is moderate, with Mineral Safeguarding Areas (MSA) for identified deposits of sand and gravel occurring regularly along the line of the route. Where appropriate, sand and gravel excavated for the purposes of construction will be re-used in the Proposed Scheme. There are some limited areas of salt deposits and some prospective hydrocarbon extraction areas occurring locally, in addition to widespread deposits of deep coal. Where construction does occur within a MSA, any pre-extraction of surface minerals, at least under landscaping areas adjacent to the route, would assist in reducing the

sterilisation impact to a local mineral supply. The pre-extraction of identified minerals would need to be discussed with the landowner, the Mineral Planning Authority and other relevant stakeholders to assist in achieving effective management of minerals. It should be noted that the salt deposits are no longer commercially exploited and the hydrocarbon deposits potentially could be exploited by lateral drilling for coalbed methane. With this mitigation available, it is considered that on a regional or route-wide basis, the effects on mineral resources during construction will not be significant.

9.3 Assessment of the effects of operation

- 9.3.1 Auto-transformer station sites are located at intervals along the Proposed Scheme. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leakage of coolant. However, the proposed auto-transformer stations, in common with other modern electrical substations, will use secondary containment appropriate to the level of risk.
- 9.3.2 There exists the potential for minor leakage of oils from HS2 trains. However, such leakage or spillage is expected to be very small and be mitigated through standard management measures during operation. Hence this is highly unlikely to lead to any significant contaminative effects on a route-wide basis.
- 9.3.3 On the basis of this evaluation, it is considered that there will be no significant route-wide effects for land quality during operation.

10 Landscape and visual

- 10.1.1 Within the Volume 2 community area reports 1-5, potential landscape effects are reported by landscape character areas (LCA) and potential visual effects are reported by reference to identified viewpoints. The LCAs have been defined with reference to available published documents and professional judgement. From a review of the potential effects on the landscape and visual receptors it is considered that there would be no significant route-wide landscape or visual effects arising from the construction or operation of the Proposed Scheme.
- 10.1.2 The landscape and visual impact assessment study area includes the northernmost part of the Cannock Chase Area of Outstanding Natural Beauty (AONB), which is approximately 600m from the Proposed Scheme at its closest point. The AONB is recognised as one of the most sensitive landscape receptors in the study area. Potential landscape effects of the Proposed Scheme on its scenic qualities are reported within the LCA assessments for CA1 and CA2. However, by virtue of the distance of the AONB from the Proposed Scheme and the visual containment from vegetation and topography within the AONB it is considered that there would be no significant route-wide effects on the special qualities or integrity of the AONB. It has, therefore, been scoped out of further assessment of route-wide effects.

11 Major accidents and natural disasters

11.1 Introduction

- 11.1.1 This section presents the route-wide assessment of the likely significant environmental effects arising directly from the Proposed Scheme if it were to be affected by a major accident and/or natural disaster.
- 11.1.2 The assessment of the vulnerability of the Proposed Scheme to major accidents and natural disasters is included in this working draft EIA Report following changes to EU legislation. The revised EIA Directive 2014/52/EU (revised Directive) entered into force on 15 May 2014 and states the need to assess 'the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned'.
- 11.1.3 The underlying objective of the assessment is to ensure that appropriate precautionary actions are taken for those projects which, "because of their vulnerability to major accidents and/or natural disasters (such as flooding, sea level rise, or earthquakes), are likely to have significant adverse effects on the environment."
- 11.1.4 Based on the requirements of the revised Directive, this section answers the following questions:
- what major accidents and disasters could the Proposed Scheme be vulnerable to?;
 - could these accidents and disasters result in likely significant adverse environmental effect(s) and if so what?; and
 - what measures are in place, or need to be put in place, to prevent or mitigate the likely significant adverse effects of such events on the environment?

11.2 Legal and regulatory framework

EIA requirement

- 11.2.1 The revised Directive states that in order to ensure a higher level of protection of the environment, precautionary actions need to be taken for certain projects that have a high vulnerability to major accidents and/or natural disasters.
- 11.2.2 Article 3 of the revised Directive requires that the EIA shall identify, describe and assess in the appropriate manner, the direct and indirect significant effects on population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape deriving from (amongst other things) the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned.

Other relevant legislation

- 11.2.3 The design, management, operation and maintenance of the Proposed Scheme must comply with the following legal requirements:

- Health and Safety at Work etc. Act 1974 (HSWA);
- The Management of Health and Safety at Work Regulations (1999);
- Construction (Design and Management) (CDM) 2015 Regulations;
- The Workplace (Health, Safety and Welfare) Regulations 1992;
- EU Regulation 402/2013 on the Common Safety Method on Risk Evaluation and Assessment (CSM-RA) (as amended by Regulation EU 2015/1136);
- The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) (ROGS); and
- The Railways (Interoperability) Regulations 2011 (as amended) (RIR).

11.2.4 In broad terms, this legislation confers the requirement, duties, and in some cases establishes the mechanisms by which risks associated with major accidents and disasters are identified, assessed and mitigated during the design, construction, operation and maintenance of the Proposed Scheme. In accordance with Paragraph 15 of the revised EIA Directive (2014/52/EU)⁸⁰, safety assessments undertaken for the Proposed Scheme have been used to inform the identification and assessment of major accidents and natural disasters to which the Proposed Scheme may be vulnerable.

11.2.5 In addition to these regulations, the Proposed Scheme is also being designed and its implementation guided by other industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are considered acceptable.

11.3 HS2 Ltd safety and risk management framework

11.3.1 The Proposed Scheme will be designed, constructed, operated and maintained to reduce, so far as is reasonably practicable, the risk of harm (including major accidents) occurring. This section briefly describes HS2 Ltd's commitment to deliver an exemplary project in terms of health, safety and the environment, since this provides the framework within which the risk of major accidents and/or natural disasters impacting the environment will be managed. All measures to manage and reduce risk described in this section are defined as 'embedded' measures for the purposes of this assessment.

Development agreement

11.3.2 The HS2 development agreement⁸¹ between the Government and HS2 Ltd (published in December 2014) sets out HS2 Ltd's role in developing, building and operating the new railway. This includes HS2 Ltd's legal obligations with respect to health and

⁸⁰ Paragraph 15 of the Directive states in its second part: "In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council (4) and Council Directive 2009/71/Euratom (5), or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met." The referenced Directives relate to operating sites which contain large quantities of dangerous substances (for example oil refineries, oil storage depots and nuclear facilities) which are not relevant to the Proposed Scheme.

⁸¹ High Speed Two (HS2) Limited (2014) *HS2 Development Agreement*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389368/HS2_development_agreement_December_2014_.pdf

safety, risk and liability. The railway shall be designed, constructed and operated so that safety risks are “*as low as reasonably practicable*”. Furthermore the railway shall be designed and delivered to avoid, reduce and if possible, remedy adverse impacts on the environment, as far as reasonably practicable.

11.3.3 The Functional Response, presented in Annex 4 of the development agreement, identifies the key project objectives and strategies to deliver HS2 Ltd’s commitments, including those above. This includes a commitment that: “*HS2 Ltd will design, build and operate the Railway to meet or better the performance standard of HS1, to reduce safety risks as low as reasonably practicable and in line with best current international practice.*”

11.3.4 HS2 Ltd’s commitments in terms of both physical and cyber-security, are set out in Section 16 of the Functional Response. Key to the assessment presented in this report is that: “*...measures to prevent unauthorised access to the Railway (primarily consisting of the physical separation of the Railway from the external environment) will be developed.*”

Health and safety policy

11.3.5 The HS2 Ltd Health and Safety Policy⁸² presents HS2 Ltd’s high-level health and safety commitments, which will be delivered by HS2 Ltd’s health and safety management system. It underlines HS2 Ltd’s principles of health and safety, and sets out their areas of focus for eliminating, reducing and controlling risk.

Health and safety management system

11.3.6 HS2 Ltd’s health and safety management system is founded on the principles of the Health and Safety Executive’s guidance HSG65⁸³ and is certified to OHSAS 18001:2007⁸⁴. It defines the responsibilities at each level in the business, and establishes the organisational framework, the processes and tools to continually identify, prevent and manage health and safety risks, to comply with, or exceed legislative requirements and to monitor and review health and safety performance.

Risk management framework

11.3.7 Risk management is embedded as a fundamental tenet for the management of all aspects of HS2 and is undertaken in order to constrain threats and optimise opportunities within acceptable limits. HS2 Ltd’s approach to risk management is based on a number of guiding principles, including that:

- risk management applies to all aspects of HS2;
- clear accountability for risk will be ensured; and
- risk management will be based on continuous improvement.

⁸² High Speed Two (HS2) Limited (2016) *Health and Safety Policy*. Weblink to be updated when April 2016 Health and Safety Policy is uploaded to Government website.

⁸³ Health and Safety Executive (2013) *Managing for Health and Safety (HSG65)*.

⁸⁴ British Standards Institution (2016) *BS OHSAS 18001 Occupational Health and Safety Management*.

HS2 Ltd supply chain health and safety standards

11.3.8 Contractors and suppliers working on behalf of HS2 Ltd are expected to comply with HS2 Ltd's supply chain health and safety standards⁸⁵. These set out HS2 Ltd's expectations in terms of the health and safety commitments of its suppliers, HS2 Ltd's health and safety principles, and its strategic commitments. Contractors appointed by HS2 Ltd to design, assess and construct the railway (and undertake the enabling works) are required to further identify and mitigate risk during the detailed design stage and identify and mitigate construction risks. HS2 Ltd evaluates the competence of contractors to be able to do this as part of the procurement process. These strategic commitments cover:

- workforce safety;
- public and neighbour health and safety;
- occupational health and wellbeing;
- safe design;
- safe supply chain selection and management;
- safe operations; and
- assurance.

Draft Code of Construction Practice (CoCP)

11.3.9 A draft CoCP describing the control measures and standards to be implemented in order to protect communities and the environment during construction works is presented as an appendix to Volume 1 of this working draft EIA Report. It sets out the principles which form the basis of the environmental management system (EMS), and measures to be defined within LEMPs.

11.3.10 Particularly relevant to this topic assessment, the draft CoCP includes the requirement for construction contractors and suppliers to have or take:

- a comprehensive community emergency plan, where relevant;
- site specific assessments of security and trespass risk, and appropriate control measures;
- pollution incident control and emergency preparedness;
- appropriate plans and management controls to prevent fires; and
- due consideration to the impacts of extreme weather events and related conditions during construction.

⁸⁵ High Speed Two (HS2) Limited (2015) *Supply chain health and safety standard*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510415/Supply_Chain_Health_and_Safety_Standard.pdf

11.4 Scope, limitations and assumptions

11.4.1 The scope of this assessment topic follows that set out in Volume 1 and the draft SMR and addresses those unplanned events or situations, that have been determined as being *relevant* to the Proposed Scheme, are considered to be *major* in scale and have been identified as having the potential to result in likely significant environmental effects. Key terms used in this assessment topic are defined in Table 3.

Table 3: Key definitions relevant to this assessment topic

Term	Definition
Major accident and/or natural disaster events	<p>A major accident, in the context of the Proposed Scheme, is an event or situation which threatens immediate or delayed serious damage to human health, welfare and/or the environment <u>and</u> triggers the use of resources beyond those of the HS2 Ltd or its contractors.</p> <p>Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor which cannot be restored through minor clean-up and restoration efforts.</p> <p>A natural disaster, in the context of the Proposed Scheme, would include an extreme weather event (e.g. storm, flood, temperature) or ground-related hazard events (subsidence, landslide, earthquake) with the potential to cause an event or situation as described above.</p>
Vulnerability	In the context of the 2014 EU EIA Directive, the term refers to the 'exposure and resilience' of the Proposed Scheme to the risk of a major accident and/or natural disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.
Likely significant effect	This is the expected outcome or consequence of the impact to an environmental receptor, should the major accident or natural disaster occur.
Risk event	An identified, unplanned event which is considered relevant to the Proposed Scheme which has the potential to result in a significant adverse effect on an environmental receptor.
Environmental receptor	Features of the environment that are subject to assessment under Article 3 of the amended Directive, namely population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape.
Hazard	A situation or biological, chemical or physical agent that has the potential to harm or cause adverse impacts on an <i>environmental receptor</i> .
Risk	The likelihood of an impact occurring, combined with effect or consequence(s) of the impact on a receptor if it does occur.

11.4.2 Environmental effects associated with unplanned events that do not meet the definition of *major* accidents and/or natural disaster (e.g. leaks and spills that may be contained within construction sites and the operational railway infrastructure) are addressed in other sections of the working draft EIA Report (for example Section 9, Land quality).

11.4.3 Receptors addressed in the assessment are those relevant to the scope of the EIA and include:

- members of the public and local communities;
- infrastructure and the built environment;
- the natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape; and
- historic environment, including archaeology and built heritage.

Exclusions

11.4.4 Effects of the Proposed Scheme on employees of HS2 Ltd and/or its contractors and suppliers (e.g. construction and maintenance staff) and HS2 passengers are managed via other legislation (see paragraph 11.2.3) and are not addressed in the scope of this assessment. Effects on members of the public who wilfully trespass are also considered to be outside the scope of this assessment, recognising that HS2 Ltd will take appropriate measures to reduce the likelihood of trespass. Finally, risk events that only present risks to HS2 Ltd as an organisation (e.g. cost and programme) are outside the scope of this assessment.

Risk identification

11.4.5 Major accident and natural disaster 'risk events' to which the Proposed Scheme is considered vulnerable have been identified by referring to risk assessments undertaken for the Proposed Scheme as part of other processes (many of which are required by law) and determining whether there is potential for impact to an in-scope receptor. Further detail of the information sources used and approach adopted to identify relevant risk events will be provided in the formal EIA Report.

11.4.6 The identification of relevant risk events focuses on high-level major accident and/or natural disaster events that have the potential to cause significant harm. Many of the risk events to which the Proposed Scheme may be vulnerable have multiple causes; for example a train derailment may be caused by infrastructure condition, a natural disaster event, malicious intent, or human error, amongst others. Unless the risk event is identified as having the potential to result in a likely significant adverse effect, the underlying causes of the risk event are not the subject of assessment.

11.5 Assessment methodology

11.5.1 The assessment has been undertaken in accordance with the methodology described in the draft SMR and will be presented in the formal EIA.

11.5.2 The determination of likely significant effects takes into account mitigation measures that are known to be in place, for example as described in Section 11.3. These measures comprise both 'barriers' to reduce the likelihood of the risk event occurring, and 'controls' such that if the event does occur, its likely impacts are minimised so far as practicable.

11.6 Baseline

11.6.1 The baseline relevant to this topic comprises:

- features external to the Proposed Scheme that contribute a potential source of hazard to the Proposed Scheme;
- sensitive environmental receptors at risk of significant effect; and
- current (without the Proposed Scheme) accident and natural disaster risks.

Baseline features that contribute a hazard source

- 11.6.2 To the extent possible, the route of the Proposed Scheme avoids existing features that have the potential to cause a potential hazard (a so-called 'domino effect'). For example, there are no sites where hazardous materials and/or substances are stored, used or made in types or quantities to trigger registration under the Control of Major Accidents Hazards (COMAH) Regulations⁸⁶ in proximity to the Proposed Scheme (the closest COMAH registered site to the Proposed Scheme is approximately 1.5km away).
- 11.6.3 Features external to the Proposed Scheme that lie within the construction boundary and/or cross the route of the Proposed Scheme that present a potential source of hazard, either during construction or operation include:
- gas and electricity transmission lines;
 - potential presence of unexploded ordnance;
 - former landfill sites and the potential presence of landfill gas;
 - potential presence of coal-bed methane;
 - below ground hazards such as salt and coal mining;
 - existing operational railway lines; and
 - adjacent highways, both local roads and motorways.

Sensitive environmental receptors

- 11.6.4 Potentially sensitive environmental receptors that may be at risk in the event of a major accident and/or natural disaster include those in proximity to the construction operational boundary. Baseline characteristics relevant to this topic are described in respective chapters of this working draft EIA Report.

Baseline accident and natural disaster risks

- 11.6.5 Major accident and natural disaster risks relevant to the baseline in the absence of the Proposed Scheme include extreme weather events, associated flooding and road traffic accidents. Baseline 'without project' conditions are described in Section 4 (Climate change), Section 14 (Traffic and transport) and Section 16 (Water resources and flood risk) of this Volume 3 working draft EIA Report, and respective sections of the Volume 2 reports.

⁸⁶ Health and Safety Executive (2015) *Control of Major Accidents Hazards Regulations (COMAH)*.

11.7 Construction phase assessment

11.7.1 Major accidents and natural disasters to which the Proposed Scheme may be vulnerable during the construction phase and the outcomes of the assessment are summarised in Table 4. Further details of assessment and mitigation measures will be presented in the formal EIA Report.

Table 4: Assessment of major accident and/or natural disaster events during construction

Risk event	Likelihood of event occurring (at a scale which constitutes a major accident or disaster) ⁸⁷	Embedded mitigation	Assessment of likely significant environmental effects
Derailment and or collision involving trains on WCML due to construction work.	Very low	Captured in CDM risk assessment for working on or near operational railway and consequent controls to prevent accident occurring (e.g. speed restrictions, scheduling and planning of works, lifting plans etc.) (see also Section 11.3).	None expected
Major road traffic accident (involving construction traffic or because of road works).	Low	Captured in CDM risk assessment, draft CoCP and contractor traffic management plans (see also Section 11.3).	None expected
Fire and/or explosion during construction impacts on nearby receptors, with a secondary impact of fire water reaching adjacent receptors.	Low	Captured in CDM risk assessment and measures undertaken to minimise likelihood (e.g. inclusion of fire prevention and control measures in draft CoCP) (see also Section 11.3)	None expected
Extreme weather (flood, wind, rain, heat) during construction leads to contaminants reaching nearby receptors.	Low	Captured in CDM risk assessment and draft CoCP (see also Section 4 (Climate change))	None expected

11.8 Operational phase assessment

11.8.1 Risk events to which the Proposed Scheme may be vulnerable during the operational phase and the results of the assessment are summarised in Table 5.

⁸⁷ Note that this likelihood refers to the change in major accident risk compared to the baseline.

Table 5: Assessment of major accident and/or natural disaster events during operation

Risk event	Likelihood of event occurring (at a scale which constitutes a major accident or disaster) ⁸⁸	Embedded mitigation	Assessment of likely significant environmental effects
Train derailment or collision (multiple potential causes) resulting in damage outside the rail boundary	Very low	CSM-RA considers multiple causes and puts barriers in place to prevent occurrence as well as controls to mitigate impact should the event occur.	None expected
Major road traffic accident related to changed road alignments and junctions	Very low	Design will be in accordance with design standards for highways and in consultation with relevant highways authorities to reduce risk of accidents to an acceptable level. The design will also be subject to road safety audit.	None expected
Extreme weather (rain/flood) resulting in breach of embankment and/or collapse of structures	Very low	Rail infrastructure designed to remain operational in 1:1000 year flood. See further detail on resilience of the Proposed Scheme to extreme weather in Section 4 (Climate change).	None expected
Fire on train with resulting potential to affect neighbouring land and properties (directly from fire or from contaminated fire water runoff)	Very low	Risk to public around fixed infrastructure managed through design (e.g. application of design codes) Operational fire plans, including response equipment provided on trains and in depots and other locations. No significant quantities of fuel or hazardous materials stored or transported.	None expected
Alteration of flood patterns	Very low	Drainage is designed to accommodate flood risk, inclusive of climate change allowance. Refer to Section 4 (Climate change) and Section 16 (Water resources and flood risk) for further detail.	None expected

11.9 Conclusions on likely significant residual environmental effects

- 11.9.1 Given the processes that are in place, and the resulting measures that would be introduced to avoid and/or reduce the vulnerability of the Proposed Scheme to major accidents and/or natural disasters, no significant environmental effects are expected.
- 11.9.2 The risk events presented in this section either have a low or very low likelihood of occurring during the construction and operational periods of the Proposed Scheme.

⁸⁸ Note that this likelihood refers to the change in major accident risk compared to the baseline.

As such, under the principles of risk management it may not be essential to remove these risks entirely, but to manage them to be 'as low as reasonably practicable'.

The measures in place to avoid and/or reduce the vulnerability of the Proposed Scheme to major accident and natural disasters will be considered and subject to review under other legislative processes in addition to those put in place by the hybrid Bill.

12 Socio-economics

12.1 Introduction

12.1.1 Direct socio-economic effects of the Proposed Scheme are reported at route-wide and community area levels. The potential overall changes to employment levels (i.e. both the wider socio-economic benefits and those that arise from the construction and operation of the Proposed Scheme) are reported in this section at a route-wide level. Significant localised effects on employment are reported at a local level in the in Volume 2, community area reports 1-5.

12.2 National policy and guidance

12.2.1 The key points from national policy and guidance, which have informed the planning and development context for the socio-economic assessment are as follows.

- The UK Government's commitment to sustainable development presented in the Defra publication 'Mainstreaming sustainable development'⁸⁹. The document sets out an approach based on providing ministerial leadership and oversight, leading by example, embedding sustainable development into policy, and providing transparent and independent scrutiny;
- The NPPF⁹⁰, which identifies the role of the planning system in promoting sustainable development and suggests that economic, social and environmental gains should be sought jointly and simultaneously. As well as the NPPF, local planning policy helps to define the significance of impacts. This is because it is planning policy that typically identifies areas and issues of environmental sensitivity and economic opportunity;
- The National Infrastructure Plan, which provides a strategic framework for the identification and prioritisation of infrastructure development within the UK and establishes a series of objectives for infrastructure investment. The original 2011 plan⁹¹ identified HS2 as a priority project with the potential to deliver the essential capacity and connectivity, attract investment and secure long-term economic prosperity, and therefore, generate employment. An update was undertaken in 2012 in which the Government announced its decision to proceed with HS2, and a further update published in 2016⁹², which set out the progress made on priority infrastructure investments. Following the Sir David Higgins review 'Rebalancing Britain'⁹³, recommendations were made to accelerate the development of the route to Crewe, in order to bring forward the regeneration benefits such as growth and jobs associated with the Northern Powerhouse and the Midlands Engine initiatives. In November 2015⁹⁴, the Government confirmed its intention to accelerate the section of

⁸⁹ Department for Environment, Food and Rural Affairs (2011) Mainstreaming sustainable development – The Government's vision and what this means in practice, Department for Environment Food and Rural Affairs, February 2011

⁹⁰ Communities and Local Government (2012) National Planning Policy Framework, Department for Communities and Local Government, March 2012

⁹¹ Infrastructure UK (2011) National Infrastructure Plan 2011, HM Treasury, November, 2011

⁹² Infrastructure and Projects Authority (2016) National Infrastructure Delivery Plan 2016–2021, HM Treasury and Cabinet Office, March 2016

⁹³ HS2 Limited (2014) Rebalancing Britain – From HS2 towards a national transport strategy, Department for Transport

⁹⁴ Department for Transport (2015) High Speed Two: East and West – The next steps to Crewe and beyond, November 2015, Cm9157

the route from the West Midlands to Crewe so that it would open six years earlier than planned in 2027, which now forms the basis of the Proposed Scheme; and

- The January 2012 Command Paper, which articulates a national strategy for high speed rail placing the Proposed Scheme as part of a wider network supporting the continuing growth of rail services in the UK to support ongoing economic growth.

12.3 Key themes of the assessment

12.3.1 This section presents the three types of impacts considered in the route-wide socio-economic assessment, using the methodology described in the draft SMR.

Impacts on employment associated with construction

12.3.2 Two types of impact are defined:

- direct employment opportunities: the number of jobs that the Proposed Scheme is expected to directly generate throughout the construction phase; and
- indirect employment opportunities: the number of jobs that the Proposed Scheme is expected to indirectly generate throughout the construction phase through multiplier effects.

Existing businesses and organisations

12.3.3 Three types of impact are defined:

- businesses and organisations (socio-economic resources) that would be relocated due to land being acquired for the construction of the Proposed Scheme. Socio-economic resources are defined as a property used by one business or organisation, or by a group of businesses and/or organisations;
- socio-economic resources affected by a change in key environmental conditions as a result of construction and operation of the Proposed Scheme. A combination of factors such as: sound, noise and vibration; air quality; HGV traffic flows; and visual impacts could adversely affect the ability of a business unit to attract trade; and
- socio-economic resources affected by isolation from customers/users as a result of the construction and operation of the Proposed Scheme. This analysis considered the consequence of these isolation effects on business operations.

Impacts on employment associated with operation

12.3.4 Two types of impact are defined:

- direct employment opportunities: the number of jobs that the Proposed Scheme is expected to directly generate throughout the operational phase; and
- indirect employment opportunities: the number of jobs that the Proposed

Scheme is expected to indirectly generate throughout the operational phase through multiplier effects.

12.3.5 Socio-economic effects are presented as either gross or net employment effects. Gross effects refer to the total effect of the Proposed Scheme. This includes:

- direct effects (such as jobs required to lay the track in the construction phase or operatives employed at the Infrastructure Maintenance Depot (IMD) required in the operational phase); and
- indirect effects (or knock-on effects, such as supply chain and expenditure effects, which are collectively referred to as multiplier effects).

12.3.6 In calculating net effects, economic adjustments such as leakage, displacement and substitution⁹⁵ are applied to reflect the interrelated nature of the economy. These effects can be beneficial or adverse.

12.4 Wider socio-economic benefits

12.4.1 Wider socio-economic benefits would be generated by businesses, property developers, communities and local authorities responding to economic and regeneration opportunities brought about by the Proposed Scheme. Key benefits would include:

- wider economic benefits identified in the case for accelerating the West Midlands to Crewe section⁹⁶ comprising: better linkages between firms - resulting in improvements in productivity (agglomeration impacts); extending labour markets and allowing businesses to attract more skilled employees (labour market impacts); and the additional value to customers of goods and services (imperfect competition). These wider economic benefits total £14bn (present value, 2011 prices) for the full 'Y' network and £0.4bn for Phase 2a alone (present value, 2011 prices). These benefits would translate into increased employment and average household incomes on a scale substantially greater than the other immediate direct and indirect socio-economic impacts;
- generating additional economic activity around Crewe; and
- freeing up capacity on the classic rail network as a consequence of passengers transferring from the classic rail network to long distance services provided by the Proposed Scheme. This is expected to allow the provision of more local passenger services and freight services on the WCML.

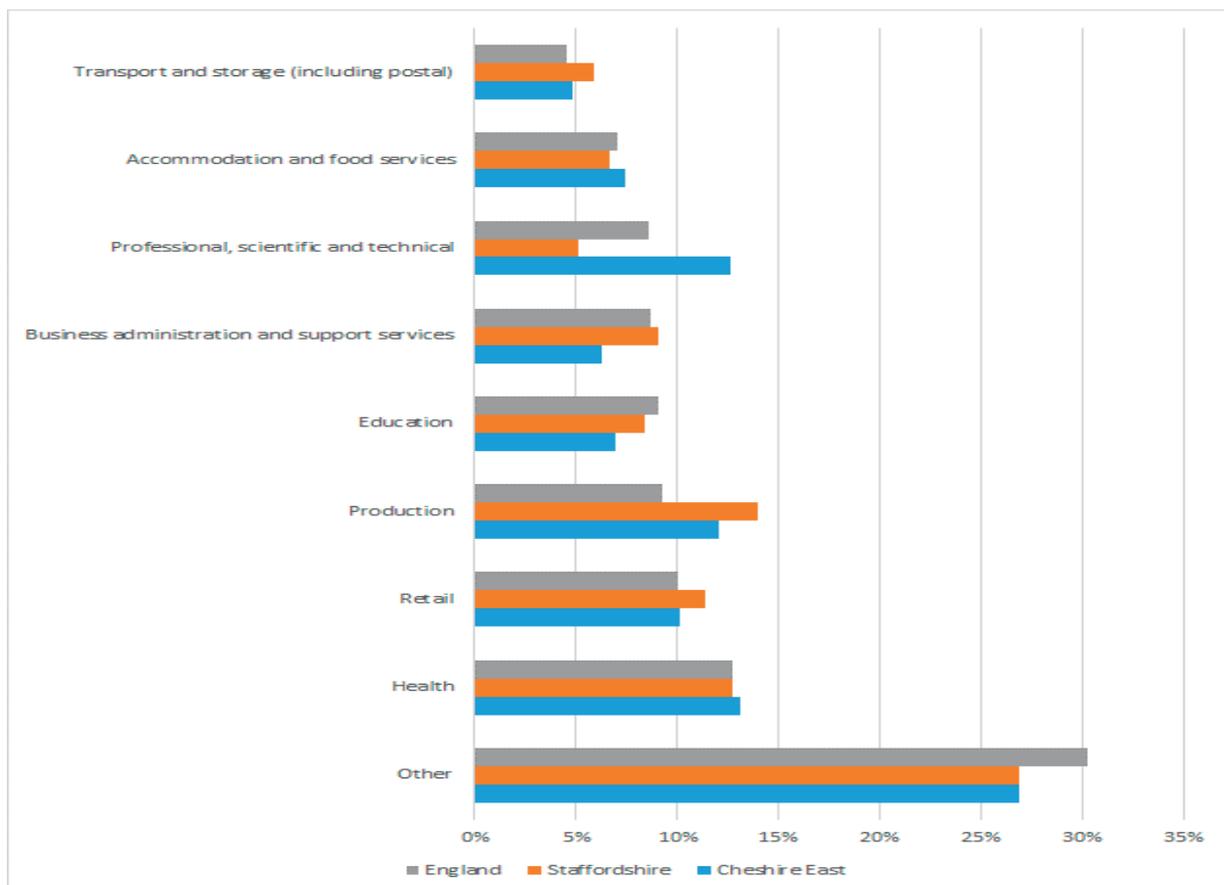
⁹⁵ The additional impacts of construction employment creation on the business supply chain and their expenditure effects can be calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in English Partnerships (2008), English Partnership Additionality Guide: A standard approach to assessing the impact of interventions (3rd Edition).

⁹⁶ Department for Transport (2015) High Speed Two: East and West – The next steps to Crewe and beyond, November 2015, Cm9157 (paragraph 4.33)

12.5 Socio-economic baseline

- 12.5.1 This section summarises key economic indicators for England and the two sub-regional economies of Cheshire East and Staffordshire, which the Proposed Scheme would serve.
- 12.5.2 Gross value added (GVA) measures the contribution to the economy of each individual producer, industry or sector. England generated a GVA of £1,377,900 million in 2015, of which Staffordshire contributed £15,300 million (1.1%) and Cheshire East Council (CEC) area £11,200 million (0.8%). GVA per person per year is higher in the CEC area (£30,000) than in Staffordshire (£17,800) and the England average (£25,400). The long term trend has been for both total GVA and GVA per person per year to grow.
- 12.5.3 In 2014, employment in England stood at 25.2 million, 0.18 million (0.7%) in CEC area and 0.34 million (1.3%) in Staffordshire. The majority of employment in England is in the service sector (85%). CEC area employment is marginally more heavily concentrated in services than Staffordshire (84% compared with 81%, respectively). A sector breakdown by industry in CEC area and Staffordshire, benchmarked against England, is shown in Figure 3.

Figure 3: Proportion of employment by industry in Cheshire East, Staffordshire and England ^{97, 98}



- 12.5.4 Figure 3 shows some clear similarities between the employment profile of the CEC area and Staffordshire compared to England, with health and retailing accounting for

⁹⁷ 'Other' includes Agriculture, forestry and fishing; construction; motor trades; wholesale; information and communication; finance and insurance; property; public administration and defence and arts, entertainment, recreation and other services.

⁹⁸ Office for National Statistic (2014), Business Register and Employment Survey 2014; Accessed: 11 January 2016.

a significant share of total jobs. The CEC area has a higher proportion of employment in professional, scientific and technical jobs compared to both the England and Staffordshire share.

12.6 Assessment of the effects of construction

12.6.1 There are broadly two types of impacts considered for the construction phase of the Proposed Scheme: employment associated with construction of the Proposed Scheme; and employment associated with businesses affected by construction of the Proposed Scheme.

Construction employment

12.6.2 The Proposed Scheme would support employment in the construction industry over the construction period. Overall, it is estimated that the construction phase would generate 26,900 person years of construction employment opportunities⁹⁹ (equivalent of 2,690 permanent full time construction jobs¹⁰⁰), which would be a major beneficial effect and is, therefore, considered to be significant.

12.6.3 Of these, an estimated 14,000 person years of construction employment opportunities (equivalent of 1,400 permanent full-time construction jobs)¹⁰¹ would be based at worksites along the Proposed Scheme, as described in the relevant Volume 2, Section 2 of the community area reports. Depending on skill levels required, and the skills of local people, these jobs will be accessible to local residents and to others living within the travel to work area or farther afield.

12.6.4 It is anticipated that direct construction jobs would potentially offer a range of occupations and skillsets, such as: skilled construction workers, labourers, tunnelling specialists, mechanical fitters, steel fixers, electricians, engineering professionals, and management and planning professionals.

12.6.5 The construction works would generate additional indirect demand for goods and services through the business supply chain and expenditure effects of workers, which could stimulate business growth and opportunities to generate further employment¹⁰². As a consequence, a further 10,100 person years of employment could be created (equivalent of 1,010 full-time jobs)¹⁰³, which would be a major beneficial effect and will therefore be significant

Businesses affected

12.6.6 The construction phase would result in the displacement of some existing businesses through land required for the construction of the Proposed Scheme. These effects have been assessed and reported within Section 12 of the relevant Volume 2,

⁹⁹ Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

¹⁰⁰ Based on the total construction person years generated by the Proposed Scheme and a ratio of 10 construction person years to one full time permanent job.

¹⁰¹ Based on average employment at civils and rail system compounds except at CA5 where peak employment has been used for rail systems.

¹⁰² The additional impacts of construction employment creation on the business supply chain and their expenditure effects can be calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in English Partnerships (2008), English Partnership Additionality Guide: A standard approach to assessing the impact of interventions (3rd Edition).

¹⁰³ Based on average employment at civils and rail system compounds except at CA5 where peak employment has been used for rail systems.

community area reports. In most cases, it is concluded that the majority of businesses affected in this way would be able to relocate¹⁰⁴, given the availability of alternative premises, the payment of compensation, and thereby continue to operate. It is also concluded that a large proportion of employees who may lose their jobs as a consequence of their employer closing or relocating and contracting, would be able to secure new employment relatively quickly given the size and strength of the relevant local labour markets.

- 12.6.7 Whilst it is not possible to predict accurately the numbers of jobs that are at risk of being lost route-wide (as a result of businesses failing to relocate and closing, or relocating and contracting, and employees being unable to find work in the short term), an assumption can be made by drawing on previous research. The London Development Agency (LDA) carried out research into the relocation of companies and jobs on account of the London 2012 Olympic Games. This research¹⁰⁵ indicated that the majority of businesses (88%) relocated while 12% of businesses did not continue to trade.
- 12.6.8 Therefore, for the purpose of this assessment, the indicative rate of successful relocation is judged to be 88% and employment at these businesses would not be lost¹⁰⁶. Based on this, there would be a total relocation of 40 jobs from businesses as a result of land required for construction of the Proposed Scheme.
- 12.6.9 Businesses displaced by the Proposed Scheme would be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to alternative premises and would, therefore, provide additional support over and above statutory requirements to facilitate this.
- 12.6.10 If an assumption is made that 12% of all jobs associated with directly affected businesses as a result of the Proposed Scheme could be lost route-wide, then approximately five jobs could be lost.
- 12.6.11 The direct loss of businesses and employment would have knock-on effects through the business supply chain and expenditure effects alongside other economic adjustment factors¹⁰⁷. As a consequence, it is estimated an additional five jobs could be lost through indirect effects, route-wide.
- 12.6.12 Therefore, in total, approximately 10 jobs could be lost route-wide from businesses affected during the construction phase, which would be a negligible adverse effect, and therefore, considered to be not significant. The impact would be mitigated over time as the UK and regional economies grow and new opportunities for employment for people that have lost their jobs, and have been unable to find work, come forward.

¹⁰⁴ A business decision to relocate is dependent on a number of factors, including market conditions at the time of relocation, business vulnerability, state of preparation and owner-specific drivers.

¹⁰⁵ In total, 208 businesses providing 4,946 jobs were relocated as part of the Compulsory Purchase Order (CPO) process. In total, 183 (88%) businesses relocated and continued to trade and 25 (12%) closed. See London Development Agency (LDA) (30th June 2008), Request for Information/Freedom of Information Act by Mr Julian Cheyne, FO1291.

¹⁰⁶ Of the businesses which closed (or may close), these businesses represent only 2% of total employment within businesses displaced by London 2012. Given the potential complexities associated with relocating some of the affected businesses, for the purposes of the route-wide assessment, it is assumed that a worst-case figure of 12% to represent total employment lost as a result of the Proposed Scheme.

¹⁰⁷ These knock-on effects are calculated using four economic adjustment factors: leakage, displacement, substitution and multiplier effects. These factors and their rates are explained in English Partnerships (2008), English Partnership Additionality Guide: A standard approach to assessing the impact of interventions (3rd Edition). Please refer to Volume 1 assumptions for further details on multipliers.

12.7 Assessment of the effects of operation

- 12.7.1 There are two types of impacts considered for the operational phase of the Proposed Scheme: employment associated with businesses affected by operation of the service; and employment associated with the operation of the service.

Direct operational employment

- 12.7.1 The Proposed Scheme would create direct operational employment at the IMD at Crewe. Route-wide there would be an estimated 300 direct operational jobs created at the IMD, which would be a moderate beneficial effect and would, therefore, be considered to be significant.
- 12.7.2 The Proposed Scheme would create indirect employment opportunities associated with the IMD. These indirect jobs would result from expenditure on supplies and services necessary for the operation of the Proposed Scheme. Indirect jobs would also result from expenditure by those directly employed at the depot and by workers employed by suppliers contracted to the Proposed Scheme. It is estimated that 115 jobs would be created route-wide through indirect effects as a result of the operational phase of the Proposed Scheme. Route-wide, the indirect employment impact would be a minor beneficial effect and would, therefore, be considered to be not significant.

Businesses directly affected

- 12.7.3 The socio-economic assessment has currently not identified any businesses that could be directly affected negatively by the operations of the Proposed Scheme beyond those already covered in the construction phase analysis.

Total operational employment

- 12.7.4 In total 415 direct and indirect permanent jobs are estimated to be created during the operational phase.

13 Sound, noise and vibration

13.1 Introduction

13.1.1 This section presents the route-wide assessment of the likely significant sound, noise or vibration effects arising from the Proposed Scheme. A summary of any route-wide health effects arising from the operation of the Proposed Scheme and how these compare to health effects arising from exposure to existing noise sources in the study area will be presented in the Health section of Volume 3 in the formal EIA Report.

13.2 Assessment of the effects of construction

13.2.1 Noise and vibration effects from construction activities will be confined to local areas around construction operations. Construction noise and vibration effects have been assessed on a local basis and are described for each area within the Volume 2 community area reports 1-5.

13.2.2 It is considered that there will be no significant noise or vibration effects on a route-wide basis associated with the construction of the Proposed Scheme.

13.3 Assessment of the effects of operation

13.3.1 Noise and vibration effects from passing trains and fixed operational noise sources will occur locally on people and other sensitive receptors (including schools, churches, hospitals and offices). Operational noise and vibration effects have been assessed on a local basis and are described for each area within the Volume 2, community area reports 1-5.

13.3.2 No potentially significant noise or vibration route-wide effects arising from changes to existing roads have been identified at this stage.

13.3.3 It is considered that there will be no significant noise or vibration effects on a route-wide basis associated with the operation of the Proposed Scheme.

14 Traffic and transport

14.1 Introduction

- 14.1.1 The geographical extent of the Proposed Scheme is such that for some traffic and transport significant effects, consideration at a regional, and where appropriate, route-wide scale is required.
- 14.1.2 The assessment of traffic and transport impacts and effects at regional and route-wide levels is primarily based upon the output from transport models, which themselves flow from the economic assessment and associated modelling. An initial overview of the assessment of impacts is provided here. The outcome of the route-wide and regional traffic and transport assessments will be reported in the formal EIA Report.
- 14.1.3 The traffic and transport effects set out in the working draft EIA Volume 2 Reports for each of the five community areas are structured to identify impacts by individual transport mode. The assessment of route-wide and regional effects adopts the same approach and criteria for identifying impacts and assessing their effects. This will be reported in the formal EIA Report.

14.2 Assessment of the effects of construction

- 14.2.1 During construction, traffic and transport effects could arise from the cumulative impact of all construction works on the wider strategic highway network and the impact on the wider rail network as a cumulative result of closures or possessions.
- 14.2.2 The potential impacts that have been identified include:
- impacts on rail passenger users and rail freight during rail possessions, although these are likely to be short term with largely local impacts, mitigated and in most cases not significant at a route-wide level; and
 - overall combined traffic impacts during construction.
- 14.2.3 As part of the construction of the Proposed Scheme every effort will be made to re-use any excavated material (where suitable and reasonably practicable). However there is likely to be a requirement to move bulk material that is either surplus to the needs of the Proposed Scheme or where there is a deficit, requiring import of materials to the Proposed Scheme. The impacts of these traffic movements will be assessed to the strategic highway network. The results of this assessment will be reported in the formal EIA Report.

14.3 Assessment of the effects of operation

- 14.3.1 The introduction of HS2 services will provide new and improved journey opportunities and will release capacity on the existing rail network. The released capacity will then be used to improve services further. Together with HS2 services, the use of this released capacity has the potential to result in route-wide effects. The operation of HS2 services, together with the timetable, service and infrastructure changes on the classic rail network will be assessed, including:
- potential journey time benefits that will be achieved by the introduction of the

Proposed Scheme;

- changes in passenger demand including the extent of changes in mode share;
- changes in vehicle and passenger km by mode and in typical journey times;
and
- any impact of released capacity on potential for additional passenger or rail freight movements.

14.3.2 The results of these assessments will be reported in the formal EIA Report.

15 Waste and material resources

15.1 Introduction

General

15.1.1 This section presents a route-wide assessment of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by the construction and operation of the Proposed Scheme. This assessment considers:

- the types and quantity of waste that would be generated;
- the quantity of waste that would require off-site disposal to landfill; and
- the availability of off-site landfill disposal capacity.

15.1.2 This assessment does not consider liquid waste, the direct and indirect effects of waste-related transport, or mineral resources located along the route of the Proposed Scheme.

15.1.3 Consideration of material resources in this assessment is limited to the beneficial reuse of excavated material arising from the construction of the Proposed Scheme. Only if excavated material is not required or is unsuitable for the construction of the Proposed Scheme would it be considered for use beyond the scheme or consigned as waste.

15.1.4 Details of the types and quantities of waste that would be generated within each community area will be presented within the formal EIA Report.

15.1.5 Other supporting information specific to this route-wide assessment will also be presented in the formal EIA Report. This information will include:

- the local policy framework applicable to this assessment;
- detailed environmental baseline; and
- a schedule of developments to be considered as part of the assessment of cumulative impacts.

Context

Need for route-wide assessment

15.1.6 The movement of waste from source to final destination is a complex process, as waste is often transferred across waste planning authority boundaries for treatment and disposal according to the type of waste and the nature of the waste management facility required.

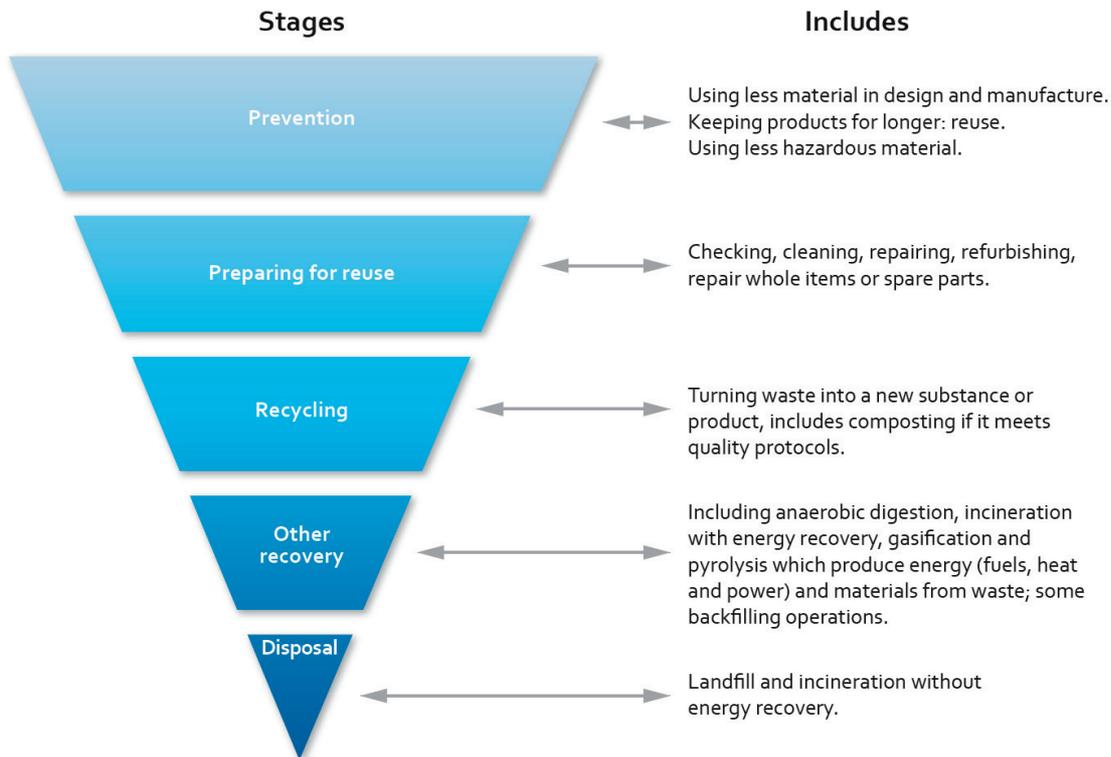
15.1.7 Waste planning authorities have a statutory duty to plan for an appropriate amount of waste infrastructure capacity to be available over a defined time period according to projected waste arisings, targets to divert waste from landfill, requirements with regard to the separate collection of waste types and the need to take account of waste that may need to be imported from other areas for treatment and disposal.

- 15.1.8 For this reason, waste planning has traditionally been undertaken on a county, and until early 2013, regional level basis that takes account of the need for the inter-regional movement of waste within England.
- 15.1.9 To reflect this broader county and regional-based approach to waste planning and management, an assessment of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by the Proposed Scheme, has been undertaken on a route-wide basis.
- 15.1.10 This route-wide approach takes into account waste arisings and waste infrastructure capacity data available at county and regional levels. Comprehensive waste data at district level is often limited and so has not been considered for use in this assessment.

Environmental effects of waste management

- 15.1.11 The waste hierarchy¹⁰⁸ (see Figure 4) sets out the preferred approach to the management of waste from waste prevention, to reuse, recycling, energy recovery and landfill as a last resort.

Figure 4: Waste hierarchy



- 15.1.12 The waste hierarchy supports the need to achieve efficient use of material resources, minimise the amount of waste produced (or otherwise increase its value as a resource) and reduce, as far as possible, the amount of waste that is disposed to landfill.
- 15.1.13 The waste hierarchy advocates the use of landfill disposal only as a last resort due to a range of potential adverse effects associated with its use. This includes natural resource depletion, methane production and nuisance effects (e.g. dust and odour). There is also a need to conserve existing landfill capacity for wastes for which there is

¹⁰⁸ Adapted from Defra (2011), Government Review of Waste Policy in England 2011; London, HMSO.

currently no alternative treatment option that can be used to recover material resources and/or energy.

- 15.1.14 In England and Wales, waste producers have a legal duty to apply the waste hierarchy to decisions concerning the generation and management of waste¹⁰⁹. The availability of waste management infrastructure capacity is also important in light of national policy that supports implementation of the proximity principle to manage waste as close as possible to the point of production without reliance on other communities to do so¹¹⁰.
- 15.1.15 For this reason, the assessment sets out the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by construction and operation of the Proposed Scheme.

Design approach and mitigation

- 15.1.16 An integrated design approach has been developed that seeks to reuse excavated material to satisfy the necessary engineering and environmental mitigation earthworks requirements for the Proposed Scheme, to minimise the quantity of surplus excavated material generated and minimise off-site disposal to landfill. This includes reuse of all topsoil and agricultural subsoil as close to the point of excavation as practicable.
- 15.1.17 A Materials Management Plan will be drafted in accordance with the Contaminated Land: Applications in Real Environments (CL:AIRE) Code of Practice¹¹¹ in anticipation of implementing the integrated design approach. This will enable suitable excavated material to be used as a resource within the construction of the Proposed Scheme with the additional benefit of reducing the quantity of imported fill required.
- 15.1.18 For the excavated material that cannot be beneficially reused for the earthworks of the Proposed Scheme, which would potentially be surplus, the nominated undertaker would, where regulation allows, seek to provide this excavated material for:
- use in other local construction projects where opportunities arise at the time of construction; and/or
 - use for restoration of mineral sites.
- 15.1.19 This only applies to cases where the transportation of that material does not result in significant environmental effects.

15.2 Policy framework

General

- 15.2.1 The assessment and mitigation of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste that would be generated by the construction and operation of the Proposed Scheme has been considered with

¹⁰⁹ The Waste (England and Wales) Regulations 2011 (SI 2011 No. 988) (as amended); London, HMSO.

¹¹⁰ Department for Communities and Local Government (October 2014), *National Planning Policy for Waste*.

¹¹¹ Contaminated Land: Applications in Real Environments (2011), The Definition of Waste: Development Industry Code of Practice - Version 2; http://www.claire.co.uk/index.php?option=com_phocadownload&view=file&id=212&Itemid=230; Accessed 22 April 2016.

respect to relevant waste planning and management policies. Those of relevance to this assessment are summarised within this section.

National policy framework

- 15.2.2 The NPPF does not contain any specific policies on waste planning. The National Planning Policy for Waste¹¹², published in October 2014, sets out detailed waste planning policies, which all local planning authorities must follow when discharging their responsibilities associated with waste management. The policy aims to:
- deliver sustainable development through the provision of modern infrastructure, which aims to drive waste management up the waste hierarchy;
 - consider other spatial planning concerns while recognising the positive contribution that waste management can make to the development of sustainable communities;
 - provide a framework for communities to take more responsibility of their waste;
 - secure the reuse, recovery or disposal of waste without endangering human health or the environment; and
 - ensure that the design and layout of new development supports sustainable waste management.
- 15.2.3 The Waste Management Plan for England¹¹³ provides an analysis of the waste management situation in England, as at the end of 2013, and a framework to support a more sustainable and efficient approach to resource use and management. Its purpose is to consolidate a number of existing policies within the context of a single national waste management plan.
- 15.2.4 The Government's Review of Waste Policy in England¹¹⁴ published in 2011 contains the main policies of relevance to the Waste Management Plan for England. It sets out the Government's overarching approach to work towards a zero waste economy, to value waste as a resource (both financially and environmentally) and to work towards zero waste to landfill.
- 15.2.5 The Government's Waste Prevention Programme for England¹¹⁵ was published in December 2013 as a requirement of the revised EU Waste Framework Directive¹¹⁶. The

112 Department for Communities and Local Government (2014), National Planning Policy for Waste; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/364759/141015_National_Planning_Policy_for_Waste.pdf; Accessed 22 April 2016.

113 Defra (December 2013), Waste Management Plan for England. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf; Accessed 22 April 2016.

114 Defra (2011), Government Review of Waste Policy in England 2011. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69401/pb13540-waste-policy-review110614.pdf; Accessed 22 April 2016.

115 HM Government (2013), Prevention is Better Than Cure: The Role of Waste Prevention in Moving to a More Resource Efficient Economy.

116 The revised EU Waste Framework Directive was adopted on 20 October 2008, signed on behalf of the European Parliament and the Council on 19 November 2008, and published in the Official Journal of the European Union on 22 November (L312/3) as Directive 2008/98/EC. The revised EU Waste Framework Directive entered into force on 12 December 2008. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN>; Accessed 3 June 2015.

programme establishes the Government's framework on measures to minimise the quantity of waste generated. It also develops the key roles and actions that need to be carried out during the transition towards a more resource efficient economy.

- 15.2.6 The Strategy for Sustainable Construction¹¹⁷ is a joint Government and industry initiative that aims to promote the concept of sustainability within the construction industry by specifying actions to be taken by both parties. It recognises that outputs from the construction industry have a major effect on both the economy and the environment. There are a number of mitigation measures included in the document with a view to halve construction, demolition and excavation waste (CDEW) to landfill.
- 15.2.7 Government policy on hazardous waste is contained within the National Policy Statement for Hazardous Waste: A Framework Document for Planning Decisions on Nationally Significant Hazardous Waste Infrastructure¹¹⁸. This document sets out the need for large-scale hazardous waste infrastructure, and the framework for decision making on relevant development consent applications within England.

Regional policy framework

- 15.2.8 Regional spatial strategies applicable to areas along the route of the Proposed Scheme were revoked late in 2012 and early in 2013¹¹⁹. They have not been replaced by other equivalent policy measures.

Local policy framework

- 15.2.9 Following abolition of the regional assemblies and revocation of regional spatial strategies, waste planning is now provided for at the county planning level along the route of the Proposed Scheme. Local development frameworks for minerals and waste planning provide the local policy framework of relevance to this assessment. Often in the form of core strategies, local plans or development plans, these frameworks set out the strategic vision and overall spatial strategy applicable to waste and material resources. This is in relation to the development of waste infrastructure and waste generation and management associated with non-waste development.

Staffordshire and Stoke-on-Trent

- 15.2.10 The Staffordshire and Stoke-on-Trent Joint Waste Local Plan 2010-2026¹²⁰ sets out the vision, objectives and spatial strategy for waste management, and the development of waste management facilities up to 2026.
- 15.2.11 Strategic Objective 1 supports new waste development that reduces the effects of GHG emissions and climate change impacts, helps to maximise waste as a resource, increases diversion from landfill and supports renewable energy supplies where recycling is not viable.

¹¹⁷ HM Government (2008), Strategy for Sustainable Construction.

¹¹⁸ Defra (2013), *National Policy Statement for Hazardous Waste: A Framework Document for Planning Decisions on Nationally Significant Hazardous Waste Infrastructure*.

¹¹⁹ Applicable to the West Midlands (revoked 20 May 2013) and North West (revoked 31 March 2012).

¹²⁰ Staffordshire County Council & City of Stoke-on-Trent. 2013 (Adopted). Available online at: [http://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-\(2010-to-2026\)-\(adopted-March-2013\).pdf](http://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-(2010-to-2026)-(adopted-March-2013).pdf); Accessed 17 May 2016.

- 15.2.12 Policy 1.2 (Waste as a Resource: Make Better Use of Waste Associated with Non-Waste Development) places an emphasis on developers to incorporate sustainable design techniques and demonstrate resource efficiency to minimise waste and use of raw materials. Building design should take into account end-of-life management to facilitate ease of reuse and recycling and include provision for appropriate waste segregation and storage when in use. CDEW recovery should also be maximised and be supported by a site waste management plan.
- 15.2.13 Policy 1.3 (Construction, Demolition and Excavation Waste) supports CDEW recycling and favours the use of inert waste for restoration purposes over landfill and land raising proposals.
- 15.2.14 Where inert waste is to be used for landscaping, screening and engineering purposes and/or for the improvement of agricultural or forestry land, proposals must comply with criteria set out within Policy 1.4 (Use of Waste for Landscaping, Screening, Engineering Purposes or for the Improvement of Agricultural or Forestry Land).
- 15.2.15 Landfill diversion targets are set out for both CDEW and C&I waste in Policy 2.1 (Landfill Diversion Targets). These targets include:
- 70% landfill diversion of CDEW by 2020/21; and
 - 95% landfill diversion of C&I waste by 2015/16 rising to 100% by 2020/21.

Cheshire East

- 15.2.16 The CEC Municipal Strategy of 2030¹²¹ sets out the strategic policy framework adopted by the council in 2014 and its provisions for future waste collection, treatment and disposal strategies up to 2030. The council recognises the need to review the strategy at least every five years; a requirement that was also included in the Cheshire Joint Municipal Strategy of 2007-2020¹²² (which should currently be used only as a historical reference).
- 15.2.17 The Municipal Strategy of 2030 does not contain any specific policies on waste and material resources, instead defining high level strategic objectives. One of the objectives ('Working together'), emphasises the need for a reinforcement of partnerships with the commercial and charitable sectors, as well as the development of waste education and awareness schemes, in order to promote waste reduction, reuse and recycling.

15.3 Scope, assumptions and limitations

- 15.3.1 The scope of this assessment is set out in further detail within Volume 1 and Section 20 of the draft SMR.
- 15.3.2 Assumptions and limitations relevant to this assessment are set out in Volume 1.

¹²¹ Cheshire East Council (2014) Municipal Waste Management Strategy 2030. Available online at: http://www.cheshireeast.gov.uk/PDF/FINAL_REPORT_WEBpdf.pdf (Accessed: 13 June 2016).

¹²² Cheshire Waste Partnership (2007) Cheshire Consolidated Joint Municipal Waste Management Strategy. Available online at: <http://consult.cheshirewestandchester.gov.uk/file/2923198> (Accessed: 13 June 2016).

15.4 Assessment methodology

15.4.1 This assessment follows the methodology set out in Section 20 of the draft SMR.

15.5 Environmental baseline

General

15.5.1 The baseline comprises environmental conditions with respect to the types, quantities and management routes of waste generated in England, and within each of the counties and former regional planning areas through which the Proposed Scheme would pass.

15.5.2 The types of waste described in this context are:

- CDEW that would be generated during the overall construction phase of the Proposed Scheme (2020 to 2026);
- C&I waste that would be generated from worker accommodation sites during the overall construction phase of the Proposed Scheme (2020 to 2026); and
- C&I waste that would be generated during the first year of operation of the Proposed Scheme (2027).

15.5.3 The baseline also comprises the availability (types and capacity) of waste infrastructure within each of the county and former regional planning areas through which the Proposed Scheme would pass.

15.5.4 Baseline conditions are presented as existing environmental conditions (based on latest available published data) and then as future baseline conditions for the period 2020 to 2026 (construction period) and 2027 (first full year of operation).

15.5.5 The spatial scope and study area for this assessment is defined as the two regions shown in Table 6. These regions comprise the former regional planning areas through which the Proposed Scheme would pass. The two regions also represent the administrative areas for which waste arisings and waste infrastructure data is available¹²³ and within which the various waste streams are likely to be managed.

15.5.6 Reference is also made in this assessment to specific local areas (shown in Table 6) within the two regions. Local areas comprise local authority administration areas through which the Proposed Scheme would pass.

¹²³ Comprehensive data for waste arisings and waste infrastructure capacity is not available on a community area basis.

Table 6: Study area for assessment

Regional area	Local area
West Midlands	Staffordshire and Stoke-on-Trent
North West	Cheshire East

15.5.7 Baseline and future baseline information is presented by both local and regional area, as there is often a need to manage waste outside of the immediate administrative area in which it is generated. This is dependent upon the type of waste infrastructure required and the available capacity of such facilities to receive and manage the type(s) of waste generated.

Waste arisings and management

Construction, demolition and excavation waste

National construction, demolition and excavation waste

- 15.5.8 In 2012, Defra ceased publication of national estimates for the recycling and recovery of CDEW. However, latest available data shows that a total of 85,240,459 tonnes of CDEW¹²⁴ was generated in England in 2012¹²⁵. Of this amount, 44,785,511 tonnes comprised of non-hazardous waste, of which 38,938,102 tonnes (approximately 87%) were recovered.
- 15.5.9 Based on the estimated proportion of CDEW sent to landfill in 2010¹²⁶, the last year for which data is available, it has been forecast that of the 85,240,459 tonnes of CDEW generated in England in 2012, 21,855,137 tonnes (approximately 26%) was sent to landfill.
- 15.5.10 Comprehensive information on the likely future growth of CDEW arisings across England is limited. The Staffordshire and Stoke-on-Trent Joint Waste Local Plan 2010-2026¹²⁷ suggests that the quantity of CDEW generated in the Staffordshire and Stoke-on-Trent areas will fall by 2% between 2015/16 and 2025/26. In contrast, the CEC Waste Management Needs Assessment¹²⁸ predicts a 23% increase in CDEW generated in the Cheshire East area between 2015 and 2030.
- 15.5.11 Slow and stable growth is also expected based on trend data (2004 to 2012) for the UK, published by Eurostat¹²⁹ (shown in Table 7).

¹²⁴ Defined as NACE Code F. Available online at: http://ec.europa.eu/competition/mergers/cases/index/nace_all.html.

¹²⁵ Defra (2015), UK Statistics on Waste. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487919/UK_Statistics_on_Waste_dataset_15_12_2015_update_f2 ods; Accessed 21 April 2016.

¹²⁶ Defra (2012), Construction, Demolition and Excavation Waste Generation Estimate: England, 2008 to 2010. Available online at: <https://www.gov.uk/government/publications/construction-and-demolition-waste>; Accessed 8 June 2016.

¹²⁷ Staffordshire County Council (2013), Staffordshire and Stoke-on-Trent Joint Waste Local Plan 2010-2026 - Appendix 6: Waste Data Tables, Adopted March 2013.

¹²⁸ LRS Consultancy Limited (2014), Cheshire East Borough Council - Waste Management Needs Assessment.

¹²⁹ Eurostat (2016), Generation of waste. Accessed online at: <http://appsso.eurostat.ec.europa.eu/>; Accessed 21 April 2016.

Table 7: UK CDEW generation trend data

Area	2004	2006	2008	2010	2012
United Kingdom	99,234,124	109,545,987	100,999,493	102,231,321	100,230,495

Regional construction, demolition and excavation waste

15.5.12 Regional CDEW arisings and management data have not been published by Defra in the UK since 2007. The latest available data is shown in Table 8¹³⁰, and is based on the latest available comprehensive dataset for regional CDEW arisings in England.

Table 8: Baseline CDEW arisings by region, 2005

Regional area	Total arisings (tonnes)	Recycled aggregate and soil (tonnes)	Used on exempt sites (tonnes)	Landfill (tonnes)
West Midlands	9,839,688	4,917,624	2,910,592	2,011,472
North West	11,345,222	6,720,814	1,958,148	2,666,260
Total	21,184,911	11,638,438	4,868,740	4,677,732

Local construction, demolition and excavation waste

15.5.13 Forecast CDEW arisings and waste management methods for the local authority areas of Staffordshire and Stoke-on-Trent, and Cheshire East (the study area) are shown in Table 9 for the year 2016 (baseline).

15.5.14 The baseline local CDEW arisings have been extrapolated from annual forecasts using latest available information published by the relevant waste planning authorities.

Table 9: Baseline CDEW arisings and management methods by local authority area, 2016

Area	Total arisings (tonnes)	Overall diversion from landfill		Disposal to landfill	
		(tonnes)	(proportion) ¹³¹	(tonnes)	(proportion)
Staffordshire and Stoke-on-Trent	1,342,750	940,350	70%	402,400	30%
Cheshire East	117,000	35,600	30%	81,400	70%

15.5.15 Further details regarding the sources of information used will be presented in the formal EIA Report.

¹³⁰ Defra (2007), Estimated reuse, recycling and disposal of hard construction & demolition and excavation waste by region in 2005. Accessed online at: <http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/evidence/statistics/environment/waste/download/xls/wrtb08.xls>; Accessed 21 April 2016.

¹³¹ 'Proportion data' presented in table in percentage was calculated from tonnage projections, and rounded to two significant figures.

*Commercial and industrial waste***National commercial and industrial waste**

- 15.5.16 A 2011 survey by Defra¹³² represents the most recently published set of detailed national data regarding the national treatment and disposal routes for C&I waste; however, latest available information¹³³ reports that, in 2012, a total of 38,976,000 tonnes of C&I waste were produced in England according to returns made under the EU Waste Statistics Regulation.
- 15.5.17 The Economics of Waste and Waste Policy provides C&I waste growth forecasts for England¹³⁴. Using extrapolation of regional data, which Defra considers to provide a more accurate forecast, C&I waste arisings in England are projected to remain at around 50 million tonnes from 2015 to 2031.

Regional commercial and industrial waste

- 15.5.18 Regional C&I waste arisings and management data has not been published by Defra in the UK since 2011. The latest available regional C&I waste arisings data and management methods are shown in Table 10 and are based on latest available data from 2009.

Table 10: Baseline C&I waste arisings by region, 2009

Regional area	Total arisings (tonnes)	Reuse, recycling or composting (tonnes)	Energy recovery (tonnes)	Other treatment, recovery and transfer (tonnes)	Landfill (tonnes)	Unknown (tonnes)
West Midlands	5,248,000	2,739,000	100,000	737,000	1,202,000	470,000
North West	7,529,000	4,527,000	54,000	931,000	1,584,000	433,000
Total	12,777,000	7,266,000	154,000	1,668,000	2,786,000	903,000
Proportion	100%	57%	1%	13%	22%	7%

- 15.5.19 Table 10 indicates that approximately 57% of all C&I waste generated regionally is reused, recycled or composted, a further 14% is diverted from landfill via various treatment and recovery methods, and 22% is sent to landfill. The fate of 7% of C&I waste generated is reported as unknown.

¹³² Defra (2011), Survey of Commercial and Industrial Waste Arisings 2010 - Revised Final Results. Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400595/ci-statistics-release.pdf; Accessed 21 April 2016.

¹³³ Defra (2016), Digest of Waste and Resource Statistics – 2016 Edition (revised). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/508787/Digest_of_Waste_and_Resource_Statistics_rev.pdf; Accessed 21 April 2016.

¹³⁴ Defra (2011), The Economics of Waste and Waste Policy. Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69500/pb13548-economic-principles-wr110613.pdf; Accessed 21 April 2016.

- 15.5.20 In line with the outlook for national C&I waste arisings, reasonably stable growth is expected based on forecasts for England published by Defra¹³⁵.

Local commercial and industrial waste

- 15.5.21 Forecast C&I waste arisings and waste management methods for the local study areas are shown in Table 11 for the year 2016 (baseline).
- 15.5.22 The baseline local C&I waste arisings have been extrapolated from annual forecasts using latest available information published by the waste planning. Further details regarding the sources of information used will be presented in the formal EIA Report.

Table 11: Baseline C&I waste arisings and management methods by local authority area, 2016

Local area	Total arising (tonnes)	Overall diversion from landfill		Disposal to landfill	
		(tonnes)	(proportion) ¹³⁶	(tonnes)	(proportion)
Staffordshire and Stoke-on-Trent	1,828,501	1,750,973	96%	77,528	4%
Cheshire East	525,725	315,435	60%	210,290	40%

Waste infrastructure

General

- 15.5.23 Latest available information published by the Environment Agency has been used to inform the baseline and future baseline with respect to waste infrastructure capacity within each of the county and former regional planning areas through which the Proposed Scheme would pass. Waste infrastructure capacity is not provided on a national basis since it is not required for use in this assessment.
- 15.5.24 Whilst information on waste infrastructure is also available from waste planning authorities, this information may not always be presented in a way that is directly and easily comparable. Environment Agency data provides both a credible and reliable source of information that is consistent and comparable across all counties and regions. Permitted landfill capacity data from the Environment Agency has also been used to inform the significance criteria used in this assessment¹³⁷.

Baseline

- 15.5.25 Table 12 provides baseline waste infrastructure capacity data for the two regions through which the Proposed Scheme would pass¹³⁸.
- 15.5.26 The baseline information presented is based on permitted capacity for all types of waste treatment and disposal facilities for the year 2014, published by the Environment Agency. Waste infrastructure capacity for all types of treatment and

¹³⁵ Defra (2011), The Economics of Waste and Waste Policy. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69500/pb13548-economic-principles-wr110613.pdf; Accessed 21 April 2016.

¹³⁶ 'Proportion data' presented in table in percentage was calculated from tonnage projections, and rounded to two significant figures.

¹³⁷ See the Significance criteria section of the Waste and material resources chapter of the draft SMR

¹³⁸ Environment Agency (2015), Waste Management Information 2014. Available online at: <https://www.gov.uk/government/statistics/waste-management-for-england-2014>; Accessed 21 April 2016.

disposal facility (including incineration, transfer and treatment) is reported in the baseline to provide context for this assessment.

15.5.27 Baseline waste infrastructure capacity data for the relevant counties within each of the regions will be shown in the formal EIA Report.

Table 12: Baseline waste infrastructure capacity by region, 2014

Facility type	West Midlands	North West	Total
	Capacity (tonnes)	Capacity (tonnes)	Capacity (tonnes)
Inert waste landfill	26,368,349	12,414,038	38,782,387
Non-hazardous waste landfill	37,801,773	35,143,757	72,945,530
Hazardous waste landfill	997,572	7,358,669	8,356,241
<i>Sub-total landfill</i>	<i>65,167,694</i>	<i>54,916,464</i>	<i>120,084,158</i>
Municipal solid waste, C&I waste incineration	1,440,000	127,100	1,567,100
Other incineration	425,960	495,998	921,958
<i>Sub-total incineration</i>	<i>1,865,960</i>	<i>623,098</i>	<i>2,489,058</i>
Waste transfer	4,384,471	6,107,330	10,491,801
Waste treatment	4,837,276	9,377,911	14,215,187
Metal recycling	1,781,158	2,385,604	4,166,762
<i>Sub-total treatment and waste transfer</i>	<i>11,002,905</i>	<i>17,870,845</i>	<i>28,873,750</i>
Total	78,036,559	73,410,407	151,446,966

15.5.28 In relation to the information presented in Table 12, landfill capacity information is published by the Environment Agency in cubic metres but has been converted to tonnes using the following landfill density conversion factors¹³⁹:

- 1.5 tonnes per cubic metre for inert waste landfill;
- 0.83 tonnes per cubic metre for non-hazardous waste landfill; and
- 1.5 tonnes per cubic metre for hazardous waste landfill.

15.5.29 The capacity of waste transfer, waste treatment and metal recycling facilities presented in Table 12 is based on the annual input rates provided by the Environment

¹³⁹ Department of the Environment (1995), Waste Management Paper 26B, Landfill Design, Construction and Operational Practice.

Agency, as separate capacity information is not published (i.e. capacity assumed to be at least equivalent to the input rates specified by the Environment Agency).

Future baseline

- 15.5.30 It is expected that various types of waste infrastructure capacity will continue to be available during the period 2020 to 2026 (for construction) and in 2027 (for operation).
- 15.5.31 Landfill will experience some draw-down of available capacity as void space is used up. Government policy measures to divert waste from landfill will also result in less waste being sent to landfill overall. Taking into account the purpose and scope of this assessment, the future baseline for waste infrastructure capacity is limited to information on landfill disposal capacity only.
- 15.5.32 Permitted capacity data published by the Environment Agency has been used to provide an indication of projected landfill capacity for the future baseline. This method provides an indication of projected landfill disposal capacity for each class of landfill as defined by Council Directive 1999/31/EC¹⁴⁰ (the Landfill Directive). This relates to the capacity of inert, non-hazardous and hazardous waste landfill that will be available during the period 2020 to 2026 (for construction) and 2027 (for operation) within each of the regional areas through which the Proposed Scheme would pass. Projected landfill capacity data for the relevant counties within each of the regions will be shown in the formal EIA Report.
- 15.5.33 Projected landfill capacity is based on the average percentage change in permitted landfill capacity for the years 2000 to 2014 (for inert and non-hazardous waste landfills) and for the years 2006 to 2014 (for hazardous waste landfill) as reported by the Environment Agency. The average percentage change has then been applied to the reported 2014 permitted landfill capacity and projected forward to 2027.
- 15.5.34 This method assumes that the average percentage change in permitted capacity for each class of landfill remains constant. Use of an average value taken from historical data also provides a reasonable allowance for potential future increases in permitted capacity for each class of landfill.
- 15.5.35 Waste planning authorities have a responsibility to make provision for sufficient waste infrastructure capacity based on projected waste arisings (over a defined time period), targets to divert waste from landfill and the need to take account of waste that may need to be imported from other areas for treatment and disposal. Subject to receipt of planning permission and other criteria stipulated by waste planning authorities, new, permitted landfill capacity is likely to be provided to meet any future gaps in inert, non-hazardous and hazardous waste landfill capacity.
- 15.5.36 The information presented is, therefore, considered to be a reasonable scenario with respect to future landfill capacity within the two regions that form the scope of the study area. This approach takes account of future draw-down and increases in permitted capacity, as well as government policy measures to divert waste from

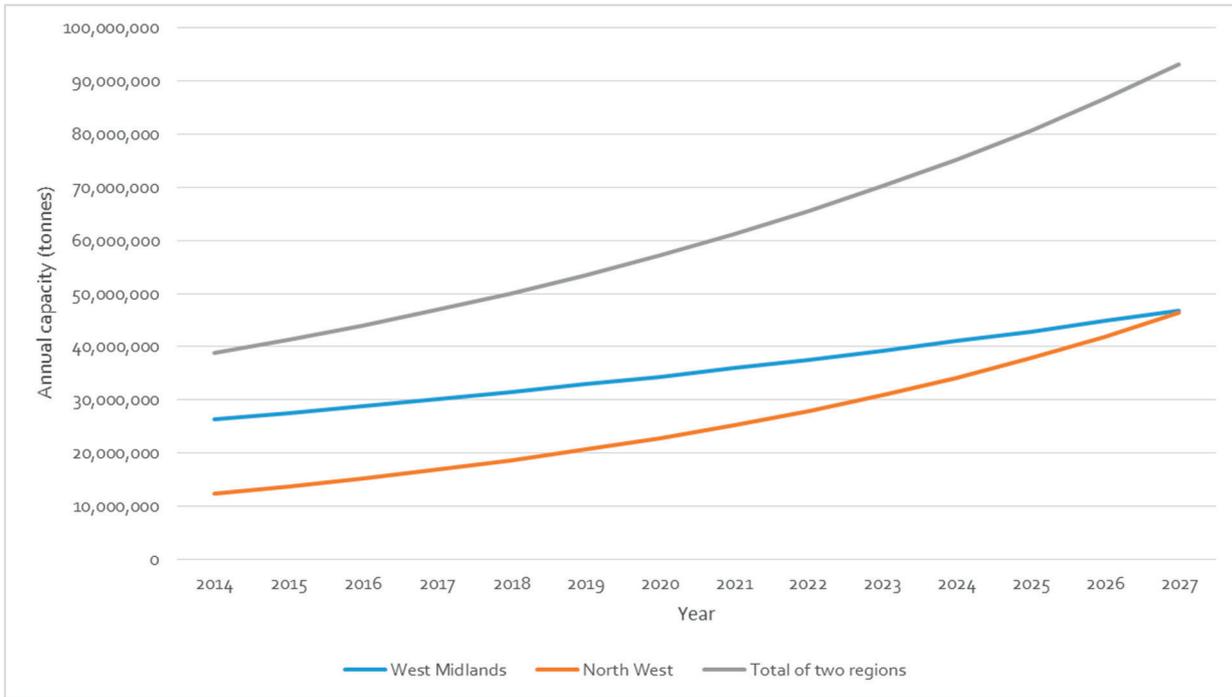
¹⁴⁰ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>; Accessed 21 April 2016.

landfill and the requirement for waste planning authorities to provide for future landfill capacity needs.

Inert waste landfill capacity

15.5.37 Using the latest available published data for the year 2014 as a starting point, Figure 5 shows projected inert waste landfill capacity for the future baseline period 2020 to 2026 (for construction) and the year 2027 (operation). Detailed source data, and local level projections, will be presented in the formal EIA Report.

Figure 5: Projected (future baseline) inert waste landfill capacity by region

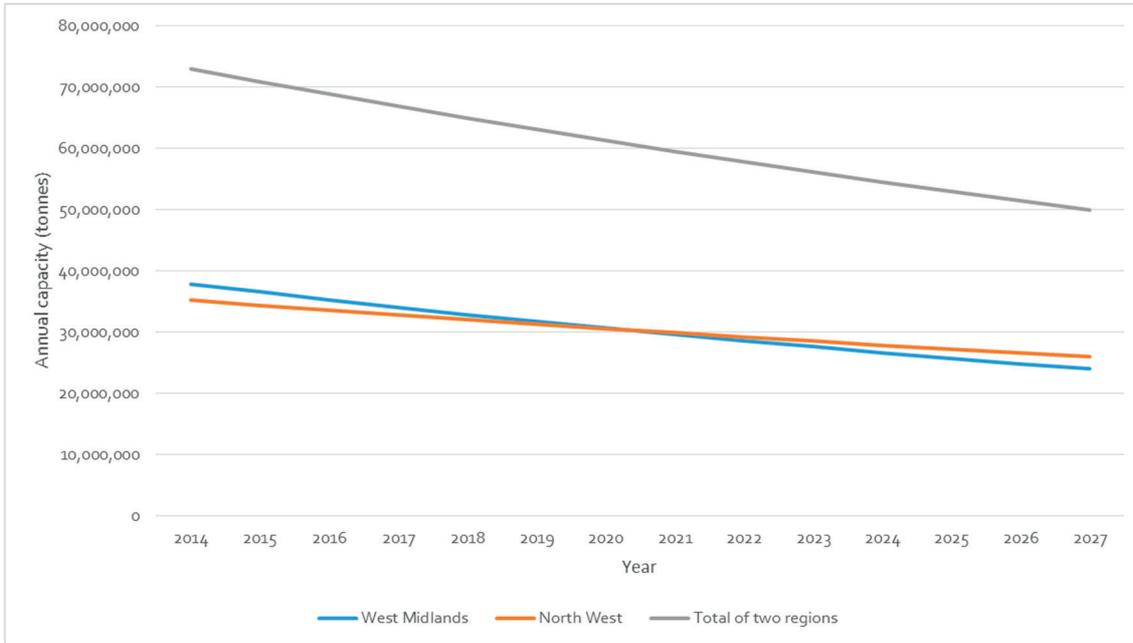


15.5.38 Figure 5 shows that, by 2027, there will be approximately 93 million tonnes of inert waste landfill capacity remaining in the two regions through which the Proposed Scheme would pass. This is a projected increase from approximately 39 million tonnes of inert waste landfill capacity in 2014, which reflects a gradual increase in inert waste landfill capacity in both regions during the period, which the trend was forecast from.

Non-hazardous waste landfill capacity

15.5.39 Using latest available published data for the year 2014 as a starting point, Figure 6 shows projected non-hazardous waste landfill capacity for the future baseline period 2020 to 2026 (for construction) and the year 2027 (operation). Detailed source data, and local level projections, will be presented in the formal EIA Report.

Figure 6: Projected (future baseline) non-hazardous waste landfill capacity by region

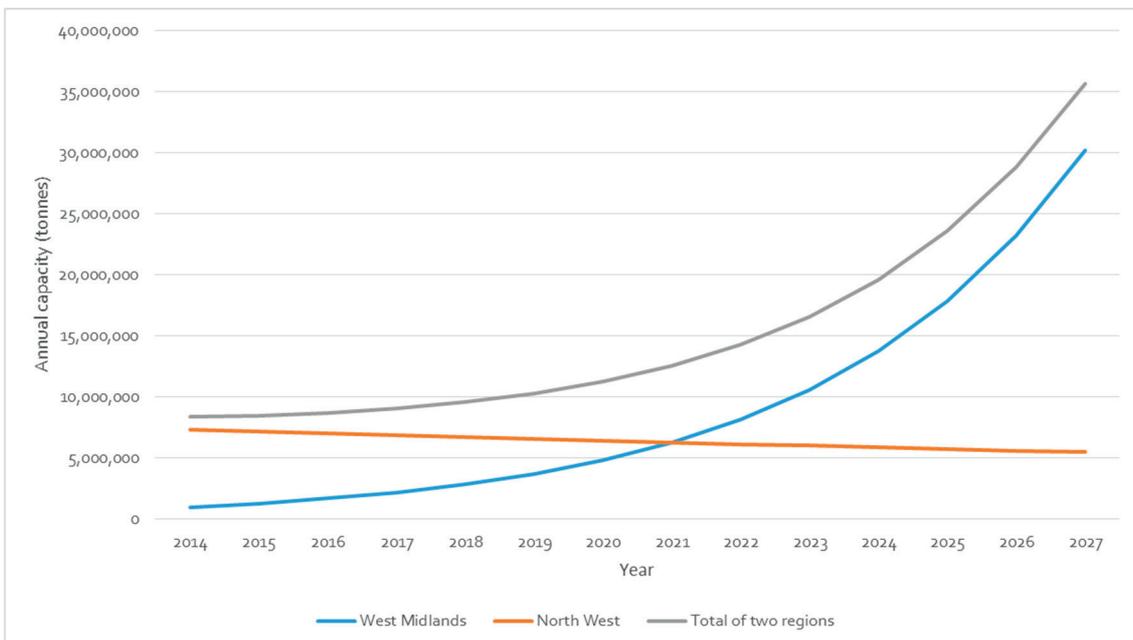


15.5.40 Figure 6 shows that, by 2027, there will be approximately 50 million tonnes of non-hazardous waste landfill capacity remaining in the two regions through which the Proposed Scheme would pass. This is a reduction from approximately 73 million tonnes of non-hazardous waste landfill capacity in 2014, which reflects a gradual decline in non-hazardous waste landfill capacity in both regions.

Hazardous waste landfill capacity

15.5.41 Using the latest available published data for the year 2014 as a starting point, Figure 7 shows projected hazardous waste landfill capacity for the future baseline period 2020 to 2026 (for construction) and the year 2027 (operation). Detailed source data, and local level projections, will be presented in the formal EIA Report.

Figure 7: Projected (future baseline) hazardous waste landfill capacity by region



- 15.5.42 Figure 7 shows that, by 2027, there will be approximately 36 million tonnes of hazardous waste landfill capacity remaining in the two regions through which the Proposed Scheme would pass. The majority (approximately 85%) of this available capacity will be in the West Midlands, equivalent to approximately 30 million tonnes.
- 15.5.43 Hazardous waste landfill capacity is projected to decline to less than approximately six million tonnes in the North West by 2027.

15.6 Assessment of the effects of construction

Excavated materials

- 15.6.1 It is estimated that 99% of the excavated material generated by the Proposed Scheme will be used to satisfy the necessary engineering and environmental mitigation earthworks quantities required on a route-wide basis.
- 15.6.2 The estimated quantity of surplus excavated material that would not be reused within the construction of the Proposed Scheme would be less than 1% of the overall excavated material that would be generated on a route-wide basis, based on the current level of design. This would comprise approximately 211,000 tonnes of chemically unacceptable U1B materials¹⁴¹, which would require off-site disposal to non-hazardous landfill.
- 15.6.3 It is expected that all of the excavated material generated by the Proposed Scheme that will be suitable for reuse, will be used within the Proposed Scheme as engineering fill material and for environmental mitigation earthworks. There is expected to be a net shortfall in excavated material.

Demolition material and waste

- 15.6.4 Demolition material quantities have been estimated using the Waste and Resources Action Programme 'Demolition bill of quantities estimator'¹⁴², which uses the basic dimensions and typology of buildings to be demolished. Using this methodology, the Proposed Scheme would generate approximately 156,000 tonnes of demolition material during the overall construction period of 2020 to 2026.
- 15.6.5 The quantity of demolition material that would be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 90%. This rate has been selected based on a review of industry good practice landfill diversion rates of other large-scale infrastructure projects in the UK (e.g. Crossrail, London 2012 Olympics and High Speed 1).
- 15.6.6 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment that the remaining 10% of demolition material that would be generated would be disposed of off-site to landfill. The quantity of demolition waste that would

¹⁴¹ Materials that are unsuitable for reuse by virtue of an excess concentration of contaminants that render the material 'contaminated' (as defined by statutory Regulation or HS2 project requirements) at the place and environmental setting of its final deposition.

¹⁴² Waste & Resources Action Programme (2016), Net Waste Tool; <http://nwtool.wrap.org.uk/>; Accessed 7 June 2016. <http://nwtool.wrap.org.uk/>; Accessed 7 June 2016. <http://nwtool.wrap.org.uk/>; Accessed 7 June 2016.

require off-site disposal to landfill during the overall construction period of 2020 to 2026 would be approximately 15,600 tonnes.

- 15.6.7 The Overview of Demolition Waste in the UK¹⁴³ uses waste data provided by the National Federation of Demolition Contractors, to determine that approximately 91% of demolition waste is reused and recycled. This can be accounted for in the most part, by the inert fraction of the waste. The report states that approximately 3% of demolition waste produced in the UK is hazardous and a further 6% of demolition waste is sent to non-hazardous waste landfill. For the purpose of this assessment, it has been assumed that 60% of the quantity of demolition waste requiring off-site disposal to landfill would be non-hazardous waste and 40% would be hazardous waste.
- 15.6.8 Based in this assumption, it has been forecast that the quantity of demolition waste for off-site disposal to non-hazardous waste landfill, would be approximately 10,000 tonnes, and the quantity of demolition waste for off-site disposal to hazardous waste landfill would be 6,000 tonnes.

Construction waste

- 15.6.9 Construction waste quantities have been estimated based on a waste generation rate derived from industry-wide benchmark performance data procured from the Building Research Establishment Ltd. Using this methodology, the Proposed Scheme would generate approximately 410,000 tonnes of construction waste during the construction period of 2020 to 2026.
- 15.6.10 The quantity of construction waste that would be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 90%. This rate has been selected based on a review of industry good practice landfill diversion rates of other large-scale infrastructure projects in the UK (e.g. Crossrail, London 2012 Olympics and High Speed 1).
- 15.6.11 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment that the remaining 10% of construction waste that would be generated would be disposed of off-site to landfill. The quantity of construction waste that would require off-site disposal to landfill during the overall construction period of 2020 to 2026 would be approximately 41,000 tonnes.
- 15.6.12 It has been assumed for the purpose of this assessment that all of the construction waste requiring off-site disposal to landfill would be sent to non-hazardous waste landfill. This is based on indicative construction waste composition information published by the Building Research Establishment¹⁴⁴, Strategic Forum for Construction¹⁴⁵ and Waste and Resources Action Programme¹⁴⁶. These sources

¹⁴³ Waste & Resources Action Programme (2009), Overview of Demolition Waste in the UK; <http://www.wrap.org.uk/sites/files/wrap/CRWP-Demolition-Report-2009.pdf>; Accessed 7 June 2016.

¹⁴⁴ Building Research Establishment (2001), SMARTWaste case studies: reducing construction waste: <http://www.smartwaste.co.uk/smartaudit/downloads/chiswick.pdf>; Accessed 7 June 2016. <http://www.smartwaste.co.uk/smartaudit/downloads/chiswick.pdf>; Accessed 7 June 2016.

¹⁴⁵ Strategic Forum for Construction (2011), Waste: An Action Plan for halving construction, demolition and excavation waste to landfill. Available online at: <http://www.greenconstructionboard.org/otherdocs/10WasteActionPlan.pdf>; Accessed 7 June 2016.

¹⁴⁶ Waste & Resources Action Programme (2005), Reference document on the status of wood waste arisings and management in the UK. Available online at: <http://www.bvsde.paho.org/bvsacd/cd43/wood.pdf>; Accessed 7 June 2016. <http://www.bvsde.paho.org/bvsacd/cd43/wood.pdf>; Accessed 7 June 2016. <http://www.bvsde.paho.org/bvsacd/cd43/wood.pdf>; Accessed 7 June 2016. <http://www.bvsde.paho.org/bvsacd/cd43/wood.pdf>; Accessed 7 June 2016.

suggest that minimal quantities of hazardous waste are generated and that construction waste to landfill is likely to comprise non-hazardous fractions such as component packaging, insulation materials and mixed construction wastes that are unsuitable for reuse and recycling.

Worker accommodation site waste

- 15.6.13 It is expected that two worker accommodation sites will be used during construction of the Proposed Scheme. The quantity of waste likely to be generated by these sites has not yet been forecast and will be presented in the formal EIA Report.

Impact of construction on future baseline waste arisings

- 15.6.14 Table 13 provides a summary of material and waste quantities that would be generated by excavation, demolition and construction works of the Proposed Scheme during the period 2020 to 2026.

Table 13: Summary of material and waste quantities that would be generated by excavation, demolition and construction works of the Proposed Scheme, 2020 to 2026

Source	Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Excavation	24,597,407	24,386,536	210,871
Demolition	155,968	140,372	15,596
Construction	410,097	369,087	41,010
Total	25,163,472	24,895,995	267,477
Proportion	100%	99%	1%

- 15.6.15 Table 13 shows that the Proposed Scheme would generate approximately 25 million tonnes of excavated material, demolition material and construction material during the period 2020 to 2026. Over 99% of this total quantity would be diverted from landfill via reuse, recycling and recovery, based on current level of design.
- 15.6.16 The impact of this material and waste generation and its off-site disposal to landfill is shown in Table 14 as the percentage difference between future baseline CDEW arisings with and without the Proposed Scheme.
- 15.6.17 Future baseline CDEW arisings are presented as the total quantity projected to be generated during the period 2020 to 2026. This is to provide a direct comparison with the total quantity of excavated material, demolition material and construction material and waste that would be generated during construction of the Proposed Scheme.

Table 14: Impact of material and waste quantities that would be generated by excavation, demolition and construction of the Proposed Scheme, 2020 to 2026

Future baseline scenario with and without the Proposed Scheme	National change		Regional change ¹⁴⁷	
	CDEW arisings (tonnes)	CDEW arisings to landfill (tonnes)	CDEW arisings (tonnes)	CDEW arisings to landfill (tonnes)
Future baseline waste arisings 2020 to 2026 without the Proposed Scheme	596,683,213 ¹⁴⁸	152,985,962 ¹⁴⁹	148,294,377 ¹⁵⁰	32,744,124 ¹⁵¹
Proposed Scheme material and waste arisings 2020 to 2026	25,163,472	267,477	25,163,472	267,477
Future baseline waste arisings 2020 to 2026 with the Proposed Scheme	621,846,685	153,253,439	173,457,849	33,011,601
Increase in future baseline waste arisings with the Proposed Scheme	+4%	+0.2%	+17%	+1%

15.6.18 Table 14 shows that the total quantity of excavated material, demolition material and construction material generated by the Proposed Scheme would be equivalent to approximately 4% of national and 17% of regional future baseline CDEW arisings during the period 2020 to 2026.

15.6.19 The total quantity of surplus excavated material, demolition waste and construction waste generated by the Proposed Scheme that would require off-site disposal to landfill would be equivalent to approximately 0.2% of national and 1% of regional future baseline CDEW arisings to landfill during that time.

Likely significant environmental effects

Inert waste landfill capacity

15.6.20 Current forecasts show that it is likely that no material generated by the construction of the Proposed Scheme would require off-site disposal to inert landfill.

15.6.21 On this basis, and in accordance with the significance criteria for inert waste landfill capacity the likely significant environmental effects associated with the off-site disposal to landfill of inert material generated by construction of the Proposed Scheme would be negligible.

¹⁴⁷ Based on future baseline CDEW arisings and CDEW to landfill for the aggregated two regions.

¹⁴⁸ Based on annual projection of 85,240,459 tonnes nationally as set out in Section 15.5. (national construction, demolition and excavation, waste arisings and management).

¹⁴⁹ Based on an annual projection of 21,855,137 tonnes nationally as set out in Section 15.5 (national construction, demolition and excavation waste arisings and management).

¹⁵⁰ Based on an annual projection of 21,184,911 tonnes for the aggregated two regions as set out in Table 8.

¹⁵¹ Based on an annual projection of 4,677,732 tonnes for the aggregated two regions as set out in Table 8.

Non-hazardous waste landfill capacity

- 15.6.22 Subject to waste acceptance criteria set out in the Landfill Directive¹⁵² and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁵³, the total quantity of non-hazardous waste that would require off-site disposal to landfill during the construction period 2020 to 2026 is approximately 260,000 tonnes (see Table 15). The majority (approximately 81%) would comprise of surplus excavated material of Unacceptable Class U1B material. Other quantities of non-hazardous waste would be generated by demolition and construction activities.

Table 15: Quantity of waste requiring off-site disposal to non-hazardous waste landfill, 2020 to 2026

Waste source	Total quantity (tonnes)	Proportion
Excavation	210,871 ¹⁵⁴	81%
Demolition	9,358	3%
Construction	41,010	16%
Total	261,239	100%

- 15.6.23 Off-site disposal of non-hazardous surplus excavated material, demolition and construction waste would result in an overall reduction of non-hazardous waste landfill void space of 260,000 tonnes throughout the seven-year construction period.
- 15.6.24 This would be equivalent to a 0.5% reduction in non-hazardous waste landfill capacity void space across the aggregated two regions according to the amount of capacity projected to be available at the end of construction in 2026 (approximately 51 million tonnes).
- 15.6.25 On this basis, it is considered that there would be sufficient non-hazardous waste landfill capacity available in the aggregated two regions to accept the forecast quantity of non-hazardous surplus excavated material, demolition and construction waste for off-site disposal to landfill.
- 15.6.26 Table 15 shows that non-hazardous waste would be generated by a range of construction activities that would occur throughout the seven year duration of construction of the Proposed Scheme.
- 15.6.27 Consequently, the draw-down of non-hazardous waste landfill void space as a result of the Proposed Scheme would occur over a period of several years and is unlikely to draw-down projected capacity to an extent where there is an immediate, significant need for additional non-hazardous waste landfill capacity to be made available in these areas.

¹⁵² Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT> ; Accessed 8 June 2016.

¹⁵³ Commission of the European Communities (2002), Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 and Annex II of Directive 1999/31/EC on the Landfill of Waste (COM/2002/0512 Final); <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT> ; Accessed 8 June 2016.

¹⁵⁴ Quantity of Unacceptable Class U1B material.

- 15.6.28 Assuming a constant rate of waste generation throughout the seven-year construction period, the total quantity of non-hazardous waste requiring off-site disposal to landfill would be approximately 37,000 tonnes per annum.
- 15.6.29 Significance criteria for non-hazardous waste landfill capacity state that a regional-scale reduction in non-hazardous waste landfill void space capacity of up to 50,000 tonnes per annum may be judged to be of low importance in the regional planning context.
- 15.6.30 According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely significant environmental effects associated with the off-site disposal to landfill of non-hazardous surplus excavated material, construction and demolition waste generated by the Proposed Scheme would be minor adverse.

Hazardous waste landfill capacity

- 15.6.31 Subject to waste acceptance criteria set out in the Landfill Directive¹⁵⁵ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁵⁶, the total quantity of hazardous waste requiring off-site disposal to landfill during the construction period 2020 to 2026 is approximately 6,000 tonnes (see Table 16). This quantity comprises solely of hazardous waste generated by demolition activities.

Table 16: Quantity of waste requiring off-site disposal to hazardous waste landfill, 2020 to 2026

Waste source	Total quantity (tonnes)	Proportion
Excavation	0 ¹⁵⁷	0%
Demolition	6,239	100%
Construction	0	0%
Total	6,239	100%

- 15.6.32 Off-site disposal of hazardous waste would result in an overall reduction of hazardous waste landfill void space of approximately 6,000 tonnes throughout the seven-year construction period.
- 15.6.33 This would be equivalent to a 0.02% reduction in hazardous waste landfill void space across the aggregated two regions according to the amount of capacity projected to be available at the end of construction in 2026 (approximately 29 million tonnes).

¹⁵⁵ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT> ; Accessed 8 June 2016.

¹⁵⁶ Commission of the European Communities (2002), Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 and Annex II of Directive 1999/31/EC on the Landfill of Waste (COM/2002/0512 Final). Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT> ; Accessed 8 June 2016.

¹⁵⁷ Quantity of Unacceptable Class U2 material, which comprises of hazardous or radioactive waste as defined in the 'Hazardous Waste (England and Wales) Regulations 2005' and the 'Radioactive Substances Act 1993'.

- 15.6.34 Significance criteria for hazardous waste landfill capacity state that a regional-scale reduction in hazardous waste landfill void space capacity of up to 20,000 tonnes per annum may be judged to be of low importance in the regional planning context.
- 15.6.35 According to the significance criteria applicable to hazardous waste landfill capacity, the likely significant environmental effects associated with the off-site disposal to landfill of hazardous surplus excavated material, construction and demolition waste generated by the Proposed Scheme would be minor adverse.

Other mitigation measures

- 15.6.36 Management of CDEW and worker accommodation site waste generated by the Proposed Scheme will be subject to the Environmental Minimum Requirements (EMR) discussed within Volume 1.
- 15.6.37 Further opportunities to minimise CDEW and worker accommodation site waste, and increase diversion from landfill, would be investigated during the detailed design phase of the Proposed Scheme.
- 15.6.38 Some of the non-hazardous waste generated by the construction of the Proposed Scheme would be suitable for energy recovery (i.e. incineration). This would reduce reliance on non-hazardous waste landfill capacity.
- 15.6.39 A reasonable worst-case approach has been taken in determining the quantity of hazardous waste for off-site disposal to landfill. However, detailed chemical sampling and laboratory analysis, as part of future ground investigation works, may allow the hazardous waste to be reclassified as non-hazardous waste. This would reduce reliance on hazardous waste landfill capacity.
- 15.6.40 It is likely that a large proportion of the hazardous demolition waste would comprise asbestos containing materials. This material could be disposed of at non-hazardous landfill sites within a separate cell for Stable Non-Reactive Hazardous Waste (SNRHW)¹⁵⁸ providing it meets SNRHW waste acceptance criteria in accordance with the Landfill Directive¹⁵⁹ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁶⁰. This would reduce reliance on hazardous waste landfill capacity.

Summary of likely residual significant environmental effects

- 15.6.41 On the basis of the other mitigation measures proposed, the likely residual significant environmental effects from construction would be:

¹⁵⁸ A non-hazardous waste landfill with a SNRHW cell allows for hazardous waste that has been stabilised and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes and in accordance with Council Decision 2003/33/EC (Council Decision of 19 December 2002 Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 of Annex II to Directive 1999/31/EC). For further details, see Environment Agency (2010), Waste Acceptance at Landfills: Guidance on Waste Acceptance Procedures and Criteria, November 2010. Available online at: <http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/geho1110btew-e-e.pdf>; Accessed 6 June 2016.

¹⁵⁹ Council of the European Union (1999), Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT>; Accessed 8 June 2016.

¹⁶⁰ Commission of the European Communities (2002), Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 and Annex II of Directive 1999/31/EC on the Landfill of Waste (COM/2002/0512 Final). Available online at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT>; Accessed 8 June 2016.

- negligible in relation to inert waste landfill capacity;
- minor adverse in relation to non-hazardous waste landfill capacity; and
- minor adverse in relation to hazardous waste landfill capacity.

15.7 Assessment of the effects of operation

Avoidance and mitigation measures

- 15.7.1 During operation waste from passenger trains and rolling stock maintenance will be managed by the train operating company (or its fleet maintenance contractor in the case of rolling stock maintenance waste). Waste generated by track maintenance and other ancillary infrastructure will be managed by Network Rail and/or the train operating company.
- 15.7.2 There are no railway stations or rolling stock maintenance depots along the route of the Proposed Scheme.

Assessment of impacts and effects

Waste forecast

Railway station and train waste

- 15.7.3 Railway station and train waste refers to waste that will arise at stations along the route. Waste will be generated on board the trains travelling along the line of route, however the waste will only be removed at terminal stations. There are no stations along the route of the Proposed Scheme and consequently none of this type of waste will arise on the route.
- 15.7.4 Waste generated by the passengers using the route is accounted for in the calculation of waste arising at Curzon Street, Old Oak Common and Euston to the south in Phase One and will also be accounted for in the calculation of waste arising at the next station to the north. To avoid double counting of the waste, no assessment of impact is therefore currently made.

Rolling stock maintenance waste

- 15.7.5 Rolling stock maintenance waste refers to waste that will be generated by the relevant train operating company at rolling stock maintenance depots. There is no such depot along the line of the Proposed Route and consequently none of this type of waste will arise.
- 15.7.6 Waste generated by the train operating company using the route is accounted for in the calculation of waste arising at Washwood Heath rolling stock maintenance depot and the people mover maintenance depot to the south in Phase One and will also be accounted for in the calculation of waste arising at the next rolling stock maintenance depot to the north. To avoid double counting of the waste, no assessment of impact is therefore currently made.

Track maintenance waste

- 15.7.7 Track maintenance waste will comprise of track ballast and other rail components (e.g. steel railway tracks, sleepers, switches and crossings) that will be replaced as part of routine maintenance activities.
- 15.7.8 Table 17 presents a route-wide summary of the forecast track maintenance waste quantities for the Proposed Scheme in 2027¹⁶¹. A detailed track maintenance waste quantity forecast will be provided in the formal EIA Report.
- 15.7.9 Track maintenance waste will be generated along the entire route of the Proposed Scheme. Quantities have been estimated based on a waste generation rate of 8.23 tonnes per kilometre of track per year¹⁶². Using this methodology, the Proposed Scheme will generate approximately 793 tonnes of track maintenance waste during the first year of operation in 2027.
- 15.7.10 In practice, the nature of the high speed track is such that very little track maintenance waste will be generated during the first few years after construction (including the operational assessment year of 2027). The largest quantity of track maintenance waste will occur as the track ballast reaches the end of its life and requires replacement. This is unlikely to occur until at least 25 years after construction, which is beyond this assessment horizon.
- 15.7.11 The methodology used to forecast track maintenance waste, therefore, provides a reasonable worst-case scenario in terms of waste generation for the purpose of this assessment.

Table 17: Forecast track maintenance waste quantities by region, 2027

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
West Midlands	645	548	97
North West	148	126	22
Total	793	674	119

- 15.7.12 The quantity of track maintenance waste that will be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 85%. This rate has been selected based on data provided by Network Rail across a range of material types for track maintenance waste¹⁶³.
- 15.7.13 It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment that, the remaining 15% of track maintenance waste would be disposed of off-site to landfill. The quantity of track maintenance waste that would require off-site disposal to landfill in 2027 will be approximately 119 tonnes.

¹⁶¹ It has been assumed that track maintenance waste will be largely managed within the region in which it will be generated.

¹⁶² Further details will be provided in the formal EIA Report.

¹⁶³ For further details, see Waste forecast and assessment methodology technical note, which can be found in the Phase One main ES SMR Addendum (Volume 5: Appendix CT-001-000/2) which will be updated for Phase 2a.

15.7.14 It has been assumed for the purpose of this assessment that all of the track maintenance waste requiring off-site disposal to landfill will be sent to non-hazardous waste landfill.

Ancillary infrastructure waste

15.7.15 Ancillary infrastructure waste refers to waste that will arise from operational support sites including depots (for example the infrastructure maintenance depot in South Cheshire community area 5), signalling locations, operations and maintenance sites (other than those involving track maintenance).

15.7.16 Table 18 presents a regional and route-wide summary of the forecast ancillary infrastructure waste quantities for the Proposed Scheme in 2027¹⁶⁴. A detailed ancillary infrastructure waste quantity forecast will be provided in the formal EIA Report.

15.7.17 Ancillary infrastructure waste will be generated along the entire route of the Proposed Scheme. Quantities have been estimated based on a waste generation rate of 0.692 tonnes per kilometre of track per year¹⁶⁵. Using this methodology, the Proposed Scheme will generate approximately 67 tonnes of ancillary infrastructure waste during the first year of operation in 2027.

Table 18: Forecast ancillary infrastructure waste quantities by region, 2027

Regional area	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
West Midlands	54	33	22
North West	13	7	5
Total	67	40	27

15.7.18 The quantity of ancillary infrastructure waste that will be diverted from landfill by reuse, recycling and recovery is based on a landfill diversion rate of 60%. This rate has been selected based on the Network Rail target to divert 60% of operational waste from landfill by 2014.

15.7.19 It has been assumed that, as a reasonable worst-case scenario for the purpose of this assessment, the remaining 40% of ancillary infrastructure waste will be disposed of off-site to landfill. The quantity of ancillary infrastructure waste that will require off-site disposal to landfill in 2026 will be approximately 27 tonnes.

15.7.20 It has been assumed for the purpose of this assessment that all of the ancillary infrastructure waste requiring off-site disposal to landfill will be sent to non-hazardous waste landfill.

¹⁶⁴ It has been assumed that ancillary infrastructure waste will be largely managed within the region in which it will be generated.

¹⁶⁵ For further details, see Waste forecast and assessment methodology technical note, which can be found in the Phase One main ES SMR Addendum (Volume 5: Appendix CT-001-000/2) which will be updated for Phase 2a.

Impact of operation on future baseline waste arisings

- 15.7.21 Table 19 provides a summary of operational waste arisings for the Proposed Scheme that will be generated in 2027. This represents the total quantity of operational waste that will be generated during the first year of operation of the Proposed Scheme, and which will be managed as C&I waste. For the Proposed Scheme, operational waste includes track maintenance waste and ancillary infrastructure waste. As set out above, there are no railway stations or rolling stock maintenance depots along the route of the Proposed Scheme, and therefore, this assessment does not include this type of waste.

Table 19: Summary operational waste forecast, 2027

Waste source	Total quantity (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Railway station and train	0	0	0
Rolling stock maintenance	0	0	0
Track maintenance	793	674	119
Ancillary infrastructure	67	40	27
Total	860	714	146
Proportion	100%	83%	17%

- 15.7.22 Table 19 shows that the Proposed Scheme will generate approximately 860 tonnes of operational waste in 2027. Approximately 83% of this quantity will be diverted from landfill via reuse, recycling and recovery.
- 15.7.23 The impact of operational waste generation and off-site disposal to landfill is shown in Table 20 as the percentage difference between future baseline C&I waste arisings with and without the Proposed Scheme.

Table 20: Impact of commercial and industrial waste arisings generated by the Proposed Scheme, 2027

	Regional change ¹⁶⁶	
	C&I waste arisings (tonnes)	C&I waste arisings to landfill (tonnes)
Future baseline waste arisings 2026 without the Proposed Scheme	12,777,000	2,786,000
Proposed Scheme waste arisings 2027	860	146
Future baseline waste arisings 2027 with the Proposed Scheme	12,777,860	2,786,146

¹⁶⁶ Based on future baseline C&I waste arisings and C&I waste to landfill for the aggregated two regions.

	Regional change ¹⁶⁶	
	C&I waste arisings (tonnes)	C&I waste arisings to landfill (tonnes)
Increase in future baseline waste arisings with the Proposed Scheme	+0.007%	+0.005%

15.7.24 Table 20 shows that the total quantity of operational waste generated by the Proposed Scheme in 2027 will be equivalent to less than 0.01% of regional future baseline C&I waste arisings.

15.7.25 The total quantity of operational waste generated by the Proposed Scheme that will require off-site disposal to landfill in 2026 will be equivalent to less than 0.01% of regional baseline C&I waste arisings to landfill during that year.

Likely significant environmental effects

15.7.26 The total quantity of non-hazardous operational waste requiring off-site disposal to landfill in 2027 will be 146 tonnes (see Table 19). This comprises non-hazardous waste that will be generated by track maintenance and ancillary infrastructure activities.

15.7.27 Subject to waste acceptance criteria set out in the Landfill Directive¹⁶⁷ and the Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills¹⁶⁸, operational waste generated by the Proposed Scheme will be mostly non-hazardous in nature.

15.7.28 Off-site disposal of non-hazardous operational waste to landfill will result in an overall reduction of non-hazardous waste landfill void space of 146 tonnes in 2027. This will be equivalent to a less than 0.01% reduction in non-hazardous waste landfill capacity across the aggregated two regions according to the capacity projected to be available in 2027 (approximately 50 million tonnes).

15.7.29 On this basis, it is considered that there will be sufficient non-hazardous waste landfill capacity available in the aggregated two regions to accept the forecast quantity of non-hazardous operational waste for off-site disposal to landfill.

15.7.30 Significance criteria¹⁶⁹ for non-hazardous waste landfill capacity state that there is unlikely to be any appreciable adverse effect where there is:

- an insignificant increase in waste arisings relative to the future baseline; or
- an insignificant reduction in landfill void space capacity for non-hazardous waste.

15.7.31 According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely significant environmental effects associated with the off-site

¹⁶⁷ Council of the European Union, Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste. Available online at: <http://eurlexeuropa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:NOT> ; Accessed 11 October 2013.

¹⁶⁸ Commission of the European Communities; Proposal for a Council Decision Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 and Annex II of Directive 1999/31/EC on the Landfill of Waste (COM/2002/0512 Final). Available online at: <http://eurlexeuropa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52002PC0512:EN:NOT> ; Accessed 27 September 2013.

¹⁶⁹ Rationale for landfill significance criteria technical note that is included as Annex J to the London-West Midlands Environmental Statement. Volume 5, Technical Appendices, Scope and methodology report addendum (CT-001-000/2).

disposal to landfill of non-hazardous operational waste generated by the Proposed Scheme will be negligible.

Other mitigation measures

- 15.7.32 Some of the non-hazardous waste generated during the operation of the Proposed Scheme will also be suitable for energy recovery (i.e. incineration). This will reduce reliance on non-hazardous waste landfill capacity.

Summary of likely residual significant effects

- 15.7.33 Based on the assessment above, the likely residual significant effects associated with operation of the Proposed Scheme will be negligible.

Cumulative effects

- 15.7.34 A qualitative assessment will be undertaken to establish the cumulative effects associated with the off-site disposal to landfill of solid waste that will be generated by the operation of the Proposed Scheme and other developments along its route.
- 15.7.35 The cumulative effects assessment will take into account developments that are assumed to become operational at the same time as the Proposed Scheme (i.e. in the year 2027), thus they will have a simultaneous requirement for landfill disposal capacity of any operational waste generated during that year.
- 15.7.36 Developments that are assumed to become operational either before or after 2027 will be screened out of the cumulative effects assessment on the basis that they do not fall within the assessment year for operation.
- 15.7.37 A list of developments that have been taken into account in the cumulative effects assessment will be provided in the formal EIA Report. These developments will be listed by regional area and will be identified by way of a screening exercise in line with the aforementioned rationale for screening of other developments. A list of developments that have been screened out will also be provided.
- 15.7.38 Cumulative effects will be considered on the basis of professional judgement according to the nature of the operational activities proposed.
- 15.7.39 Operation of these developments will produce C&I waste and municipal solid waste, a proportion of which will require disposal to landfill. In line with relevant policy, also applicable to the Proposed Scheme, it is anticipated that all of these developments will seek to minimise waste to landfill and manage waste in accordance with the waste hierarchy.
- 15.7.40 The Proposed Scheme, together with any cumulative developments identified will add further to the need for off-site disposal to landfill. The extent of this cannot be quantified accurately hence the need for a qualitative assessment. This is due to a lack of published information on forecast waste arisings and landfill disposal assumptions for these developments.
- 15.7.41 Considering the potential for waste generation, opportunities to divert waste from landfill and the amount of non-hazardous waste landfill capacity projected to be available in the aggregated two regions as of 2027 (approximately 50 million tonnes),

it is expected that the cumulative effects will be as identified for the main assessment, i.e. negligible for operation.

16 Water resources and flood risk

16.1 Introduction

16.1.1 This section considers route-wide effects on surface water and groundwater resources (quality and quantity) and flood risk. In general these effects, which relate to potential impacts on individual water bodies, springs and water supplies, are site-specific and localised in nature and have therefore been scoped out of the route-wide assessment on that basis.

16.1.2 The water resources and flood risk issues that are being considered on a route-wide basis relate to:

- the overall effects of the Proposed Scheme on surface water and groundwater bodies with specific reference to how the Proposed Scheme complies with the statutory requirements of the Water Framework Directive (WFD);
- the risk to water resources associated with accidents or spillages from trains using the Proposed Scheme during its operational phase; and
- route-wide effects on flood risk, with specific reference to application of the Sequential Test and Exception Test in the NPPF.

16.1.3 These route-wide assessments will be reported within Volume 3 of the formal EIA Report.

16.2 Water resources

WFD compliance assessment

16.2.1 The Proposed Scheme lies within the Staffordshire Trent Valley catchment of the Humber River Basin District (as far north as Baldwin's Gate/Whitmore) and the Upper Weaver catchment of the North West River Basin District (between Baldwin's Gate/Whitmore and Crewe). The statutory objectives of relevance to all surface water and groundwater bodies potentially affected by the Proposed Scheme are recorded within the Humber River Basin Management Plan (RBMP) and the North West RBMP. The current status and objectives for each element of each water body is also recorded within these documents.

16.2.2 A WFD compliance assessment for the Proposed Scheme, prepared on a route-wide basis, will be included in the formal EIA Report. Although no published methodology exists for WFD compliance assessment, the approach being adopted is based on guidance from the Environment Agency and has been discussed and agreed with Environment Agency specialists.

16.2.3 Pending the results of site surveys, all surface water and groundwater bodies, other than minor ponds and ditches, are assumed to be of high or very high value. This assumption will be revised where necessary once the results of any site surveys become available.

16.2.4 The assessment will take into account the mitigation built into the design of the Proposed Scheme. In addition, the mitigation identified in the formal EIA Report Volume 2 community area reports (Section 7, Ecology and biodiversity; Section 13,

Water resources and flood risk) will be taken into account in the WFD compliance assessment.

- 16.2.5 The risk of the Proposed Scheme resulting in long term deterioration in any element used to determine the WFD status of these water bodies will be reduced as far as is reasonably practicable.
- 16.2.6 In the unlikely event that the measures proposed do not fully mitigate the risks of deterioration occurring, then the assessment will include the evidence required to satisfy the requirements of Article 4.7 of the WFD legislation, namely that:
- all practicable steps have been taken to mitigate the adverse impact on the status of the water body;
 - the reasons for the modifications or alterations are specifically set out and explained in the RBMP;
 - the reasons for the modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the Article 4.1 objectives are outweighed by the benefits of the new modifications or alterations to (among other things) sustainable development; and
 - the beneficial objectives served by the modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.
- 16.2.7 Where an Article 4.7 exemption is identified as being required as part of the WFD assessment it will be reported as a significant effect within the formal EIA Report. The WFD compliance assessment will outline the measures that would be taken in these circumstances to ensure that the Proposed Scheme would still achieve compliance with WFD legislation.

Route-wide pollution risks

- 16.2.8 Localised impacts and effects related to pollution risk and water quality are assessed in the Volume 2 community area reports (Section 13, Water resources and flood risk). These assessments include:
- potential impacts on individual water bodies, springs and water supplies resulting from rail and highway runoff;
 - potential impacts of spillages during construction;
 - mobilisation of existing contaminants during excavation and dewatering operations; and
 - point-sources of pollution such as treated wastewater effluent and fuel storage areas.

Assessment of these issues has therefore been scoped-out of the route-wide assessment.

- 16.2.9 During operation there is potential for HS2 trains to generate minor leakages of oil, which could occur anywhere along the route during the Proposed Scheme's operational phase. As outlined in Section 11, Major accidents and natural disasters, the risk of accidents occurring is low or very low. Although such events are highly unlikely to occur, there is potential for a major accident to cause pollution to the water environment at any point along the route. These specific issues are therefore being assessed on a route-wide basis and will be reported in the formal EIA Report.

16.3 Flood risk

- 16.3.1 Sections of the Proposed Scheme are located in flood zones, including two crossings of the River Trent floodplain, numerous crossings of ordinary watercourses and areas at heightened risk of flooding from surface water sources.
- 16.3.2 The design of the Proposed Scheme has been developed to avoid flood hazards wherever this is reasonably practicable and to help ensure that the Proposed Scheme will not have a significant effect on flood risk. The Volume 2 assessments will include separate flood risk assessments for each community area providing details of how these design aims would be achieved. These assessments will consider all flooding sources, pathways and receptors and will be accompanied by technical modelling reports. This detailed flood risk assessment work has therefore been scoped out of the route-wide assessments.
- 16.3.3 The design has aimed to take account of the requirements of the Sequential Test and Exception Test in the NPPF and non-statutory guidance on sustainable drainage systems (SuDS). An overall assessment will be made of any potential route-wide effects on flood risk, with specific reference to demonstrating alignment with the NPPF tests and non-statutory SuDS guidance.
- 16.3.4 The potential for the Proposed Scheme to have an adverse impact on the severity of major natural disasters, including floods, is also assessed on a route-wide basis in Section 11, Major accidents and natural disasters.

16.4 Conclusions

- 16.4.1 A WFD compliance assessment will be included in the formal EIA Report in which the results of a route-wide assessment of the impacts of the Proposed Scheme on surface water and groundwater bodies in the Staffordshire Trent Valley and Upper Weaver catchments will be reported. It is anticipated that the Proposed Scheme would comply with WFD legislation on the basis of the approach proposed.
- 16.4.2 Spillage risks associated with accidental releases of contaminants from trains, and the pollution risk associated with accidents, are being assessed on a route-wide basis and will be reported in the formal EIA Report. These risks are likely to be similar to those reported on Phase One of HS2 and are unlikely to result in significant effects, once the relevant mitigation has been developed in full. A draft operation and maintenance plan for water resources and flood risk will be prepared and included in the formal EIA Report.
- 16.4.3 The route-wide assessment will outline how the Proposed Scheme aims to satisfy the Sequential Test and Exception Test as set out in the NPPF and the non-statutory requirements for SuDS. The design approach has aimed to avoid locating flood-

sensitive apparatus in zones that are at higher risk of flooding as far as is reasonably practicable and the drainage strategy incorporates SuDS principles. Consequently, it is likely that the Proposed Scheme would comply with national policy for development and flood risk and sustainable drainage.

17 Phase One and Phase 2a combined impacts

17.1.1 Table 21 presents a summary of the potential total impacts of both Phase One and Phase 2a, based on the current stage of design, on a range of environmental receptors.

Table 21: Combined Impacts of Phase One and Phase 2a

	Phase One ¹⁷⁰	Phase 2a West Midlands to Crewe ¹⁷¹	Total
Route characteristics (km)			
Total	216	60	276
At grade	0	3.4	3.4
Tunnel	49.5	2.3	51.8
Cutting	74.7	26	100.7
Viaduct	16.3	5.6	21.9
Embankment	62.5	22.7	85.2
Property and settlements			
Demolitions (residential)	326 dwellings (218 buildings)	72 dwellings ¹⁷²	398
Demolitions (community)	19 community facilities	0 community facilities	19
Demolitions (commercial/ retail)	372 units (309 buildings) ¹⁷³	40 units ¹⁷⁴	412
Demolitions (manufacturing/ industrial)			
Total demolitions (including residential)	546 buildings ¹⁷⁵	112 buildings ¹⁷⁵	658

¹⁷⁰ High Speed Rail (London-West Midlands). Supplementary Environmental Statement 4 and Additional Provision 5 Environmental Statement. Volume 3. Route-wide effects. December 2015. HS2 Ltd, London.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/481043/Volume_1_Introduction_and_methodology_Volume_2_Community_forum_area_reports_Volume_3_Route-wide_effects_Glossary_of_terms_and_list_of_abbreviations.pdf

¹⁷¹ Phase 2a figures relate to the construction and operation of Phase 2a only.

¹⁷² This figure includes 40 residential properties that are estimated to be either completed or under construction (as of Summer 2016) at the Basford West Development site. An alternative location for a permanent maintenance facility is also being considered within the Stone and Swynnerton community area (CA3). If selected, the Basford West development area would no longer be required and these demolitions would be avoided.

¹⁷³ This figure includes some properties which also provide community resources, e.g. public house, local services.

¹⁷⁴ Total includes outbuildings at farm holdings.

¹⁷⁵ This total includes the total number of residential, community, commercial/retail/manufacturing/industrial & miscellaneous buildings.

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	Phase One ¹⁷⁰	Phase 2a West Midlands to Crewe ¹⁷¹	Total
Employment and housing			
Permanent jobs created	2,200 ¹⁷⁶	300	2,350
Construction jobs created	14,600 ¹⁷⁷	2,690	16,000
Jobs supported	30,000 ¹⁷⁸	n/a ¹⁷⁹	30,000
Houses supported	5,620 ¹⁷⁸	n/a ¹⁷⁹	5,620
Jobs displaced	7,950 ¹⁸⁰	45	7,995
Noise			
Monetary valuation of noise impacts	n/a ¹⁸¹	Refer to footnote ¹⁸²	-
Landscape			
AONB crossed at surface (km)	7.6	0	7.6
Cultural heritage			
Scheduled Monuments directly affected	1	0	1
Registered Battlefields directly affected	1	0	1
Grade I and II* structures directly affected	2	0	2
Grade II structures directly affected	17	1	18
Registered Parks and Gardens directly affected	2	0	2
Conservation Areas directly affected	2	2	4

¹⁷⁶ Indicative direct operational employment figure was estimated to the nearest 100 jobs.

¹⁷⁷ Number reported as an approximate equivalent of permanent full time construction jobs.

¹⁷⁸ Booz & Co. Temple (2012), High Speed 2 London to West Midlands Appraisal of Sustainability – Post Consultation Route Refinements

¹⁷⁹ Value not available for working draft EIA Report.

¹⁸⁰ Jobs displaced comprise jobs relocated elsewhere in the UK economy and jobs lost, due to land being acquired for the construction and operation of the Proposed Scheme (see Section 11 for details).

¹⁸¹ The assessment method has materially changed since that used for the AP5 Environmental Statement (December 2015) and hence the levels are not directly comparable.

¹⁸² Information to be provided in the formal EIA Report as detailed baseline needed in order to calculate this value.

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	Phase One ¹⁷⁰	Phase 2a West Midlands to Crewe ¹⁷¹	Total
Biodiversity and wildlife			
Natura 2000 sites affected	0	2	2
SSSIs directly affected	3	0	3
Habitats of Principal Importance directly affected	41	Refer to footnote ¹⁸³	Refer to footnote ¹⁸³
Ancient Woodlands directly affected	32	2 ¹⁸⁴	34
Water resources and flood risk			
Major rivers diverted	8	0 ¹⁸⁵	8
Route through Flood Zone 3 (km)	12.0	2.4	14.4
Station/depot occupation of Flood Zone 3 (ha)	2.1	0.2	2.3
Cutting or tunnel through SPZ 1 or 2 (km)	6.7	1.1 ¹⁸⁶	7.8
Land use resources			
Active landfills crossed	0	0	0
Grade 1 and 2 agricultural land (km)	22.0	9.9	31.9
Waste and material resources			
Excavated material (million m ³)	63.4 ¹⁸⁷	12 ¹⁸⁸	75.4
Concrete (million tonnes)	13.04	Refer to footnote ¹⁸⁹	Refer to footnote ¹⁸⁹
Steel (million tonnes)	1.30	Refer to footnote ¹⁸⁹	Refer to footnote ¹⁸⁹

¹⁸³ To be provided in the formal EIA Report when further detailed ecological survey results are available.

¹⁸⁴ There are an additional 10 potential (i.e. not AWIS) ancient woodland sites. Further assessment of the effects of the Proposed Scheme on AWIS and potential AWIS will be undertaken and reported in the formal EIA Report.

¹⁸⁵ There are no main river diversions in Phase 2a.

¹⁸⁶ Includes highway cuttings.

¹⁸⁷ This figure is the total quantity of excavated material that will be generated from the construction of Phase One. This includes excavated material that will be reused in the construction process as well as excavated material that will be made available for use off-site or disposed of on or off site.

¹⁸⁸ This figure is the estimated quantity of excavated material that will be generated from the construction of Phase 2a. It includes excavated material that will be reused in the construction process as well as excavated material that may require off-site disposal.

¹⁸⁹ To be provided in the formal EIA Report.

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