

# **High Speed Rail (Crewe – Manchester)**

## **Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement**

### **Volume 3: Route-wide effects**

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## Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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# Structure of the HS2 Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

This report is part of the suite of documents that make up the SES2 and AP2 ES for the High Speed Rail (Crewe – Manchester) Bill. The SES2 and the AP2 ES are separate documents; however, they are bound together and presented in a number of volumes shown in Figure 1 and described below:

- **Non-technical summary (NTS).** This provides a summary in non-technical language of the SES2 (Part 1) and the AP2 ES (Part 2). It presents a summary of any likely residual significant environmental effects (i.e. effects which are likely to remain after mitigation measures are put in place), both beneficial and adverse, which are new, different or have been removed compared to those reported in the main ES or the SES1 and AP1 ES, where relevant;
- **Glossary of terms, list of abbreviations and references.** This contains any terms and abbreviations used throughout the SES2 and the AP2 ES, and provides all references cited in each of the volumes listed below;
- **Volume 1: Introduction to the SES2 and the AP2 ES.** This introduces the supplementary environmental information and changes to the design and to the construction assumptions included within the SES2 and amendments within the AP2 ES. The report explains the environmental impact assessment (EIA) process which has been applied;
- **Volume 2: Community area reports and map books.** These report the supplementary environmental information and changes to the design and to the construction assumptions included within the SES2 (Part 1), amendments within the AP2 ES (Part 2) and any new, different or removed likely significant environmental effects arising from these changes and amendments in the following community areas:
  - MA01: Hough to Walley's Green;
  - MA02: Wimboldsley to Lostock Gralam;
  - MA03: Pickmere to Agden and Hulseheath;
  - MA06: Hulseheath to Manchester Airport;
  - MA07: Davenport Green to Ardwick; and
  - MA08: Manchester Piccadilly Station.
- Note, through the SES1, the removal of the HS2 West Coast Main Line (WCML) connection, included in the original scheme, has removed the community areas of Broomedge to Glazebrook (MA04) and Risley to Bamfurlong (MA05) from the HS2 Phase 2b Western Leg. Where changes in the combined traffic assessment result in effects that would have been reported in these two community areas, they are instead reported in the Hulseheath to Manchester Airport (MA06) Community area report;

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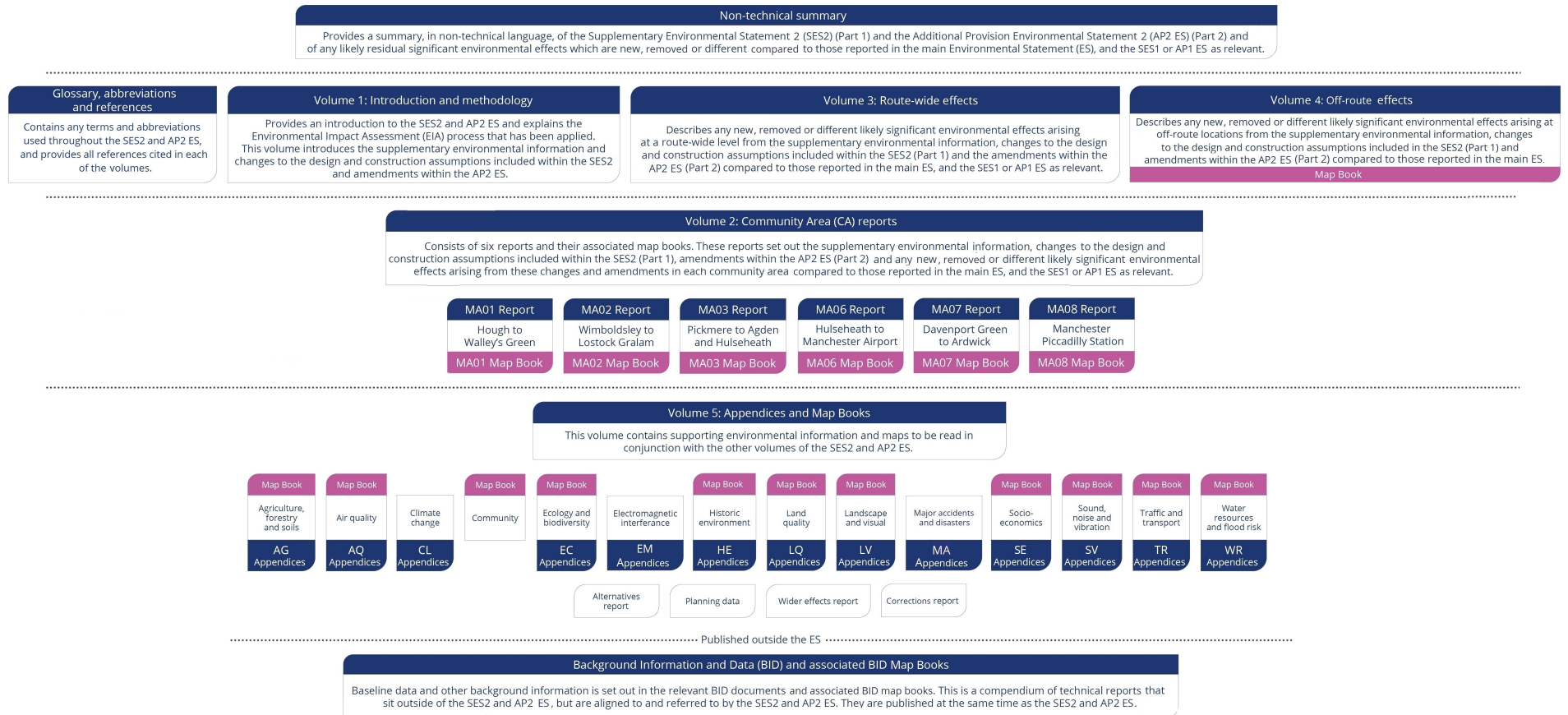
### Volume 3: Route-wide effects

- The environmental effects in the Volume 2 reports are compared to those reported in the main ES, the SES1 or AP1 ES as relevant. The maps relevant to each community area are provided in separate Volume 2 map books and should be read in conjunction with the relevant community area report;
- **Volume 3: Route-wide effects.** This describes any new, different or removed likely significant environmental effects arising at a route-wide level from the supplementary environmental information and changes to the design and to the construction assumptions included within the SES2 (Part 1) and the amendments within the AP2 ES (Part 2) compared to those reported in the main ES, the SES1 or AP1 ES as relevant;
- **Volume 4: Off-route effects.** Describes any new, different or removed likely significant environmental effects arising at locations beyond the route corridor between Crewe and Manchester from the supplementary environmental information, changes to the design and construction assumptions included in the SES2 (Part 1) and amendments within the AP2 (Part 2) compared to those reported in the main ES; and
- **Volume 5: Appendices and map books.** These contain supporting environmental information and associated maps.
- Certain reports and maps containing background information and data (BID) have been produced, which do not form part of the SES2 and AP2 ES. These documents are available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-2-and-additional-provision-2-environmental-statement>. The BID documents and maps present background survey information and other relevant background material.

# Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

## Volume 3: Route-wide effects

Figure 1: Structure of the SES2 and AP2 ES



## Structure of this report

This report is Volume 3 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) for High Speed Two (HS2) Phase 2b Western Leg between Crewe and Manchester. It describes the likely significant environmental effects arising at a route-wide level from the supplementary environmental information, and changes to the design and construction assumptions included within the SES2 (Part 1) and amendments within the AP2 ES (Part 2) compared to those reported in the main ES or the SES1 and AP1 ES as relevant. This report comprises the following sections:

- Part 1 provides supplementary environmental information, where relevant, relating to any route-wide effects of:
  - new and updated environmental baseline information;
  - changes to the design or to the construction assumptions;
  - SES2 design changes; and
  - corrections to information in the main ES and the SES1 and AP1 ES, where relevant.
- Part 2 provides environmental assessment information relating to route-wide effects of proposed amendments to the design that have resulted in the need to alter the powers conferred by the Bill.

Parts 1 and 2 also include the following, where relevant:

- a description of the SES2 changes (Part 1) or the proposed AP2 amendments (Part 2) that have triggered the need for reassessment of route-wide effects;
- an assessment of the environmental effects of the SES2 changes (Part 1) or the proposed AP2 amendments (Part 2) for relevant environmental topics, considering the:
  - scope, assumptions and limitations of the assessment;
  - environmental baseline;
  - effects arising during construction;
  - effects arising from operation; and
  - mitigation and residual effects.
- a summary of any new, removed or different likely residual significant route-wide effects as a result of the SES2 changes (Part 1) and the proposed AP2 amendments (Part 2).

# 1 Introduction

## 1.1 The SES2 and AP2 ES

- 1.1.1 The High Speed Rail (Crewe – Manchester) Bill ('the Bill') was submitted to Parliament together with an Environmental Statement ('the main ES') in January 2022. If enacted by Parliament, the Bill will provide the powers to construct, operate and maintain the HS2 Phase 2b Western Leg. The SES1 and AP1 ES, which was submitted in July 2022, updated the main ES and contained a number of changes and amendments to the design of the original scheme (i.e. the scheme submitted in January 2022).
- 1.1.2 Since the submission of the main ES and the SES1 and AP1 ES, a number of updates or changes to environmental baseline information, the design, and construction assumptions have been identified, which may lead to new, removed or different significant route-wide effects. These effects, depending on the type of change, are reported in SES2 or AP2 ES, which form Part 1 and Part 2 of this document respectively.
- 1.1.3 SES2 contains updated environmental baseline information and scheme information relating to changes within the current limits and powers of the Bill, which therefore do not require an additional provision to the Bill. The SES2 changes of relevance to the route-wide assessment include:
- additional environmental baseline information for climate change, socio-economics, waste and material resources;
  - changes to the design and construction assumptions which do not require changes to the Bill; and
  - corrections to the main ES and the SES1 and AP1 ES.
- 1.1.4 These changes are described in Part 1 and are assessed on a topic by topic basis using the same approach adopted in the main ES and SES1.
- 1.1.5 The purpose of SES2 is to describe the assessment and identify any new, removed or different likely significant environmental effects arising from the changes. These will be compared to the main ES or SES1 as relevant for each topic assessment.
- 1.1.6 The AP2 ES (Part 2) describes the likely significant route-wide effects of amendments to the design of the scheme which require the use of land outside the original limits of the Bill, additional access rights, or other extensions to the powers conferred by the Bill, making it necessary to submit an additional provision to the Bill.
- 1.1.7 The standard measures that will be used to mitigate likely significant adverse environmental effects during construction and operation of the scheme are described in Section 9 of

Volume 1 of the main ES and in the draft Code of Construction Practice (CoCP)<sup>1</sup> submitted in support of the Bill. Implementation of these measures has been assumed in this SES2 and AP2 ES.

## 1.2 Terminology used to describe the scheme

1.2.1 In order to differentiate between the original proposals assessed as part of the main ES and subsequent changes, the following terms are used throughout the SES2 and the AP2 ES to define the scheme:

- ‘the SES1 scheme’ – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
- ‘the AP1 revised scheme’ – the original scheme as amended by SES1 changes and AP1 amendments;
- ‘the SES2 scheme’ – the original scheme with any changes described in SES1 (submitted in July 2022) and the SES2; and
- ‘the AP2 revised scheme’ – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.

1.2.2 The following terms are used to differentiate between changes included in the SES2 and those included in the AP2 ES:

- ‘SES2 design changes’ – changes to the scheme design reported in the SES2 that do not require additional powers;
- ‘SES2 changes’ – all changes reported in the SES2 that do not require additional powers. This may include new baseline information, changes to the design and construction assumptions, and corrections; and
- ‘AP2 amendments’ – changes to the scheme reported in the AP2 ES that include requirements for additional powers in the Bill.

1.2.3 In addition, the following terms are also used in the SES2 and AP2 ES, where relevant:

- ‘SES1 design changes’ – changes to the scheme design reported in the SES1 that do not require additional powers;
- ‘SES1 changes’ – all changes reported in the SES1 that do not require additional powers. These may include new baseline information, changes to the design and construction assumptions, and corrections; and
- ‘AP1 amendments’ – amendments to the scheme reported in the AP1 ES that include requirements for additional powers in the Bill.

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<sup>1</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Draft Code of Construction Practice*, Volume 5, Appendix: CT-002-00000. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

## 1.3 Scope of this report

- 1.3.1 SES2 changes and AP2 amendments have been considered to determine their potential to give rise to any new, removed or different likely significant route-wide environmental effects. Route-wide effects reported in this volume are those considered to be appropriately assessed at a geographical scale greater than that presented within Volume 2 of the SES2 and AP2 ES.
- 1.3.2 The SES2 changes and AP2 amendments are described in detail in the relevant SES2 and AP2 ES Volume 2 Community area reports and SES2 and AP2 ES Volume 4 Off-route effects report. The SES2 changes are described in Part 1 of the Volume 2 reports and Volume 4 report. The AP2 amendments are described in Part 2 of the Volume 2 reports and Volume 4 report. In this report the titles and reference numbers of the SES2 changes and AP2 amendments are included (for example: Relocation of six substations at Manchester Piccadilly High Speed station (SES2-008-004), where relevant.
- 1.3.3 A scoping exercise was undertaken for each topic to determine if any of the SES2 changes or AP2 amendments would be likely to result in any new, removed or different significant route-wide effects from those reported in the main ES.
- 1.3.4 The climate change, electromagnetic interference, major accidents and disasters, and waste and material resources assessments are reported only at a route-wide level rather than within the community area reports (Volume 2) of the SES2 and AP2 ES. This follows the approach taken in the main ES and SES1 and AP1 ES. For these route-wide topics, assessment has been carried out to determine whether there are any new, removed or different likely significant route-wide effects as a consequence of the SES2 changes and AP2 amendments.
- 1.3.5 As a result of the scoping exercise, for topics where it was considered that there was potential for new, removed or different likely significant route-wide effects as a consequence of the SES2 changes and AP2 amendments, further assessment has been carried out. For SES2, agriculture, forestry and soils, air quality, ecology and biodiversity, socio-economics, traffic and transport, and water resources and flood risk are reported. For the AP2 ES, the following environmental topics are reported: agriculture, forestry and soils, air quality, ecology and biodiversity, socio-economics, traffic and transport, and water resources and flood risk. In each of these sections, the environmental topic is introduced and conclusions are presented.
- 1.3.6 A number of environmental topics have been scoped out of further route-wide assessment. This is where effects arising from the SES2 changes and AP2 amendments are localised in extent and no new, removed or different likely significant route-wide effects have been identified. The environmental topics scoped out from SES2 are: community, health, historic environment, land quality, landscape and visual, and sound, noise and vibration. The environmental topics scoped out from the AP2 ES are: community, health, historic environment, land quality, landscape and visual, and sound, noise and vibration.

- 1.3.7 Some route-wide topic assessments of the SES2 changes and AP2 amendments have been assessed collectively due to the nature of the topic assessment methodology. These assessments are reported in Part 2 of this document. For topics which rely on modelled outputs (air quality, greenhouse gases, traffic and transport and waste and material resources), the assessment presented includes SES1 changes and AP1 amendments, as well as SES2 changes and AP2 amendments.

## **1.4 Methodology for the route-wide assessment**

- 1.4.1 The methodology for each environmental topic assesses effects in a way appropriate to that environmental topic, therefore the approach to assessment of route-wide effects varies between environmental topics. The Scope and Methodology Report (SMR)<sup>2</sup> (see Volume 5, Appendix: CT-001-00001 of the main ES) presents the basis of the route-wide assessment for each topic.
- 1.4.2 Following the approach taken in the main ES and SES1 and AP1 ES, committed developments are considered within the assessments, but only referred to if there is the potential for new, removed or different likely significant route-wide cumulative effects.

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<sup>2</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Environmental Impact Assessment Scope and Methodology Report*, Volume 5, Appendix: CT-001-00001. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.



# Part 1: Supplementary Environmental Statement

## 2 Agriculture, forestry and soils

### 2.1 Introduction

- 2.1.1 Since the main ES and the SES1 and AP1 ES, a number of updates or changes to environmental baseline information, the design, and construction assumptions have occurred, which may lead to new or different significant effects. These effects, depending on the type of change, are reported in the SES2 or the AP2 ES, which form Part 1 and Part 2 of this report, respectively.
- 2.1.2 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on agriculture, forestry, and soils arising from the construction and operation of the original scheme. It reported route-wide effects on best and most versatile (BMV) land in England and prime agricultural land in Scotland, and impacts on farm businesses, as a result of the original scheme.
- 2.1.3 Volume 3 of SES1 reported that any variations as a result of the SES1 changes were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 2.1.4 This section of the report identifies any new, removed or different significant effects to those reported in Volume 3 of the main ES or the SES1 as relevant.
- 2.1.5 The changes in the areas of agricultural, BMV and prime agricultural land that will be required temporarily and permanently for the AP2 revised scheme are detailed in Section 12 of this volume.

### 2.2 Changes to the assessment

- 2.2.1 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different significant effects on agriculture, forestry and soils from those reported in the main ES or SES1 as relevant.

#### Corrections to SES1 and AP1 ES

- 2.2.2 There are corrections to the route-wide assessment reported in Volume 3 of the SES1 and AP1 ES. Table 1 provides a description of the corrections, replicates the text from Volume 3 of SES1 and AP1 ES, and provides the revised text.

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**Table 1: Summary of correction to Section 2.2, Agriculture, forestry and soils of SES1 and AP1 ES, Volume 3 Route-wide effects**

Reference in SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
<p>Agriculture, forestry and soils Paragraphs 2.2.4 to 2.12, Volume 3, Route-wide effects of the SES1 and AP1 ES</p>	<p>Incorrect values for the amount of agricultural land impacts were reported.</p>	<p>Paragraphs 2.2.4 to 2.2.12</p> <p>Temporary effects</p> <p>The main ES reported that a total of approximately 1,995ha of agricultural land would be within the original scheme. The total agricultural land within the SES1 scheme is approximately <b>1,052ha</b> with the majority of the reduction as a result of the Removal of the HS2 WCML connection (SES1-004-001).</p> <p>The main ES reported that a total of approximately 1,995ha of agricultural land would be temporarily required within the original scheme, of which 856ha is BMV land. The SES1 scheme will temporarily require an area of agricultural land in England of approximately <b>1,052ha</b>, of which approximately <b>474ha</b> is BMV land.</p> <p>The total area required temporarily for the construction of the SES1 scheme, which will be restored to agriculture, will be approximately <b>556ha</b>.</p> <p>Permanent effects</p> <p>The original scheme permanently required 927ha of agricultural land.</p> <p>The total area of agricultural land in</p>	<p>Paragraph 2.2.4 to 2.2.12</p> <p>Temporary effects</p> <p>The main ES reported that a total of approximately 1,995ha of agricultural land would be within the original scheme. The total agricultural land within the SES1 scheme is approximately <b>1,415ha</b> with the majority of the reduction as a result of the Removal of the HS2 WCML connection (SES1-004-001).</p> <p>The main ES reported that a total of approximately 1,995ha of agricultural land would be temporarily required within the original scheme, of which 856ha is BMV land. The SES1 scheme will temporarily require an area of agricultural land in England of approximately <b>1,415ha</b>, of which approximately <b>462ha</b> is BMV land.</p> <p>The total area required temporarily for the construction of the SES1 scheme, which will be restored to agriculture, will be approximately <b>748ha</b>.</p> <p>Permanent effects</p> <p>The original scheme permanently required 927ha of agricultural land.</p> <p>The total area of agricultural land in</p>	<p>No change to route-wide effects or mitigation</p>

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Reference in SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
		<p>England permanently required for the SES1 scheme will be approximately <b>496ha</b>, of which approximately <b>184ha</b> is BMV land (Grade 2 and Subgrade 3a), compared to 311ha of BMV land (Grade 1, Grade 2 and Subgrade 3a) in the original scheme. The majority of the reduction is as a result of the Removal of the HS2 WCML connection (SES1-004-001). The main ES (as corrected) reports that approximately 115ha of agricultural land would be used for newly planted woodland or trees for visual screening or habitat, and approximately 12ha of agricultural land would be used for floodplain storage. For the SES1 scheme, a total of approximately <b>73ha</b> of land will be used for newly planted woodland or trees on agricultural land for visual screening or habitat. Approximately <b>2ha</b> will be used for providing floodplain storage.</p>	<p>England permanently required for the SES1 scheme will be approximately <b>667ha</b>, of which approximately <b>174ha</b> is BMV land (Grade 2 and Subgrade 3a), compared to 311ha of BMV land (Grade 1, Grade 2 and Subgrade 3a) in the original scheme. The majority of the reduction is as a result of the Removal of the HS2 WCML connection (SES1-004-001). The main ES (as corrected) reports that approximately 115ha of agricultural land would be used for newly planted woodland or trees for visual screening or habitat, and approximately 12ha of agricultural land would be used for floodplain storage. For the SES1 scheme, a total of approximately <b>99ha</b> of land will be used for newly planted woodland or trees on agricultural land for visual screening or habitat. Approximately <b>3ha</b> will be used for providing floodplain storage.</p>	
<p>Agriculture, forestry and soils Paragraphs 13.2.3 to 13.2.5 and 13.2.7 to 13.2.8 Volume 3 Route-wide effects of the SES1 and AP1 ES</p>	<p>Incorrect values for the amount of agricultural land impacts were reported.</p>	<p>Paragraphs 13.2.3 to 13.2.5 Temporary effects An area of <b>1,052ha</b> of agricultural land, including approximately <b>474ha</b> of BMV land in England, would be required temporarily for the construction of the original scheme, as</p>	<p>Paragraphs 13.2.3 to 13.2.5 Temporary effects An area of <b>1415ha</b> of agricultural land, including approximately <b>462ha</b> of BMV land in England, would be required temporarily for the construction of the original scheme, as</p>	<p>No change to route-wide effects or mitigation</p>

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Reference in SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
		<p>amended by SES1.</p> <p>The AP1 revised scheme will temporarily require an area of agricultural land in England of approximately <b>1,060ha</b>, of which approximately <b>417ha</b> is BMV land in England, which is an increase of <b>8ha</b> of agricultural land, compared to the original scheme, as amended by SES1.</p> <p>The original scheme, as amended by SES1, would restore approximately <b>556ha</b> to agriculture. The total area required temporarily for the construction of the AP1 revised scheme, which will be restored to agriculture, will be <b>564ha</b>.</p> <p>Paragraphs 13.2.7 to 13.2.8</p> <p>Permanent effects</p> <p>The original scheme, as amended by SES1, will permanently require <b>496.14ha</b> of agricultural land. The total area of land required permanently required for the AP1 revised scheme will be <b>496.46ha</b>, of which approximately <b>146ha</b> is BMV land (Grade 2 and Subgrade 3a).</p> <p>The original scheme, as amended by SES1, will permanently require <b>72.78ha</b> of agricultural land for newly planted</p>	<p>amended by SES1.</p> <p>The AP1 revised scheme will temporarily require an area of agricultural land in England of approximately <b>1423ha</b>, of which approximately <b>465ha</b> is BMV land in England, which is an increase of <b>8ha</b> of agricultural land, compared to the original scheme, as amended by SES1.</p> <p>The original scheme, as amended by SES1, would restore approximately <b>748ha</b> to agriculture. The total area required temporarily for the construction of the AP1 revised scheme, which will be restored to agriculture, will be <b>757ha</b>.</p> <p>Paragraphs 13.2.7 to 13.2.8</p> <p>Permanent effects</p> <p>The original scheme, as amended by SES1, will permanently require <b>667ha</b> of agricultural land. The total area of land required permanently required for the AP1 revised scheme will be <b>666ha</b>, of which approximately <b>174ha</b> is BMV land (Grade 2 and Subgrade 3a).</p> <p>The original scheme, as amended by SES1, will permanently require <b>99ha</b> of agricultural land for newly planted</p>	

Reference in SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
		woodland or trees for visual screening or habitat, and <b>2ha</b> for floodplain storage. The AP1 revised scheme will permanently require a total of <b>72.96ha</b> of agricultural land for newly planted woodland or trees for visual screening or habitat, and <b>2ha</b> for floodplain storage.	woodland or trees for visual screening or habitat, and <b>3ha</b> for floodplain storage. The AP1 revised scheme will permanently require a total of <b>69ha</b> of agricultural land for newly planted woodland or trees for visual screening or habitat, and <b>2ha</b> for floodplain storage.	

## Assessment of effects during construction

- 2.2.3 This section identifies any new, removed or different likely significant effects on agriculture, forestry and soils during construction as a result of the SES2 changes compared to those reported in Volume 3 of the main ES or SES1 (as corrected above) as relevant.

### Temporary effects

- 2.2.4 The total area of land required temporarily for the construction of the SES2 scheme is 1521ha, with 1408ha in England and 113ha in Scotland. In England 455ha is BMV land and in Scotland 20ha is prime agricultural land.
- 2.2.5 The area of agricultural land required temporarily for the construction of the SES2 scheme has decreased by 7ha in England compared to the SES1 scheme (as corrected). In Scotland there has been no change in land required temporarily for the construction from the main ES.
- 2.2.6 The total area of land to be restored from the construction of the SES2 scheme is 810ha with 734ha in England and 76ha in Scotland.
- 2.2.7 The area of agricultural land to be restored for the construction of the SES2 scheme has decreased by 14ha in England compared to the SES1 scheme (as corrected). In Scotland there has been no change in land required temporarily for the construction from the main ES.
- 2.2.8 The SES2 changes do not result in any new, different or removed temporary significant route-wide effects on agriculture, forestry or soils to those reported in the SES1 and AP1 ES. Table 2 summarises the temporarily required land in England and Scotland for SES2 is given below.

**Table 2: Temporarily required land and restored land in England and Scotland for the SES2 scheme (in hectares)**

	Original scheme	SES1 scheme (as corrected)	SES2 scheme
<b>England</b>			
Total land required temporarily	1,995	1,415	1,408
BMV land required temporarily	856	462	455
Total land required temporarily to be restored	1,068	748	734
<b>Scotland</b>			
Total land required temporarily	113	113	113
Prime agricultural land required temporarily	20	20	20
Total land required temporarily to be restored	76	76	76
<b>England and Scotland</b>			
Total land required temporarily	2,108	1,528	1,521
Total land required temporarily to be restored	1,144	824	810

## Permanent effects

- 2.2.9 The total area of land required permanently for the construction of the SES2 scheme is 711ha, with 674ha in England and 37ha in Scotland. In England 174ha is BMV land and in Scotland 6ha is prime agricultural land.
- 2.2.10 The area of agricultural land required permanently for the construction of the SES2 scheme has increased by 7ha in England compared to the as corrected SES1 scheme. In Scotland there has been no change in land required permanently for the construction from the main ES.
- 2.2.11 The total area of land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage from the SES2 scheme in England is 95ha. This has decreased by 7ha compared to the SES1 scheme (as corrected). In Scotland there is no agricultural land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage, which is unchanged from the main ES.
- 2.2.12 The SES2 changes do not result in any new, different or removed permanent significant route-wide effects on agriculture, forestry or soils to those reported in the main ES or the SES1 and AP1 ES. Table 3 summarises the permanently required land in England and Scotland for SES2 is given below.

**Table 3: Permanently required land in England and Scotland for the SES2 scheme (hectares)**

	Original scheme	SES1 scheme (as corrected)	SES2 scheme
<b>England</b>			
Total land required permanently	927	667	674
BMV land required permanently	311	174	174
Total land to be used for newly planted woodland, trees, visual screening, habitat creation or	127	102	95

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	<b>Original scheme</b>	<b>SES1 scheme (as corrected)</b>	<b>SES2 scheme</b>
floodplain storage			
<b>Scotland</b>			
Total land required permanently	37	37	37
Prime agricultural land required permanently	6	6	6
Total land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage	0	0	0
<b>England and Scotland</b>			
Total land required	964	704	711
Total land to be used for mitigation	127	102	95
Newly planted woodland, trees for visual screening or habitat creation	115	99	95
Floodplain storage	12	3	0.25

## 3 Air quality

### 3.1 Introduction

- 3.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on air quality arising from the construction and operation of the original scheme.
- 3.1.2 This section of the report identifies any new, removed or different significant effects to those reported in Volume 3 of the main ES due to the SES2 changes.

### 3.2 Changes to the assessment

- 3.2.1 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different significant effects on air quality from those reported in the main ES.
- 3.2.2 The SES2 changes and AP2 amendments have been considered together as it is not possible to separate out the impacts and effects of each change within the modelling. This is because alterations in traffic flows cannot generally be directly attributed to particular SES changes or AP amendments. Consequently, the SES2 changes have been combined with AP2 amendments and their air quality impact reported at a route-wide level in Section 13.



## 4 Climate change

### 4.1 Introduction

- 4.1.1 Volume 3 of the main ES reported the route-wide greenhouse gas (GHG) emissions arising from the construction and operation of the original scheme. It also reported the assessment of in-combination climate change impacts and climate change resilience of the original scheme during construction and operation.
- 4.1.2 The GHG assessment in the SES1 and AP1 ES Volume 3 assessed and reported SES1 changes together with the AP1 amendments. The GHG emissions impact reported that, as a result of the SES1 changes and AP1 amendments, variations were not sufficient in scale to alter the conclusions presented in Volume 3 of the main ES.

### 4.2 Changes to the assessment

#### Greenhouse gases assessment

- 4.2.1 The SES2 changes have been assessed together with AP2 amendments and their GHG emissions impact reported at a route-wide level in Section 14. This is because the global atmosphere is the receptor of all GHG emissions contributing to climate change. It is also our professional judgement that GHG data for SES2 changes and AP2 amendments separately would not make any discernible difference to the effects reported in the main ES.

#### Corrections to SES1 and AP1 ES

- 4.2.2 There is a correction to the GHG emissions reported in Volume 3 of the SES1 and AP1 ES. Table 7 in Volume 3 of the SES1 and AP1 ES presents route-wide GHG emissions in terms of construction and operation, which incorporate emissions associated with land use change (see paragraph 14.2.2 in Volume 3 of the SES1 and AP1 ES). Table 4 below presents revised route-wide GHG emissions due to corrections made to the land use change assessment, replicating text from Volume 3 of the SES1 and AP1 ES.

**Table 4: Summary of corrections to Section 14, Climate Change of SES1 and AP1 ES, Volume 3: Route-wide effects**

Reference in the SES1 and AP1 ES	Reason for correction	Text in the SES1 and AP1 ES	Revised text	Change to significant effects and mitigation
Climate change Table 7, SES1 and AP1 ES Volume 3, Route-wide effects	Corrections to the land use change assessment (i.e. losses/gains in different land types) have resulted in a change to the construction and	Table 7 Construction: <b>3,921,000</b> tCO <sub>2</sub> e Operation (Up to 2050): <b>200,000</b> tCO <sub>2</sub> e Operation (120 years): <b>2,996,000</b>	Table 7 Construction: <b>3,958,000</b> tCO <sub>2</sub> e Operation (Up to 2050): <b>194,000</b> tCO <sub>2</sub> e Operation (120 years): <b>2,927,000</b>	No change to reported significant effects and mitigation

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Reference in the SES1 and AP1 ES	Reason for correction	Text in the SES1 and AP1 ES	Revised text	Change to significant effects and mitigation
	operational emissions figures	tCO <sub>2</sub> e	tCO <sub>2</sub> e	
Climate change Paragraph 14.2.7, SES1 and AP1 ES Volume 3, Route-wide effects	Corrections to the land use change assessment (i.e. losses/gains in different land types) has resulted in a change to the reported difference in emissions between the main ES and AP1	Paragraph 14.2.7 “Construction GHG emissions are estimated to reduce by <b>22% (1,101,000 tCO<sub>2</sub>e)</b> in comparison to the main ES...”	Paragraph 14.2.7 “Construction GHG emissions are estimated to reduce by <b>21% (1,064,000 tCO<sub>2</sub>e)</b> in comparison to the main ES...”	No change to reported significant effects and mitigation
Climate change Paragraph 14.2.8, SES1 and AP1 ES Volume 3, Route-wide effects	Corrections to the land use change assessment (i.e. losses/gains in different land types) has resulted in a change to the reported difference in emissions between the main ES and AP1	Paragraph 14.2.8 “Operational GHG emissions are projected to reduce by <b>49% (-191,000 tCO<sub>2</sub>e)</b> between 2038 (opening year) and 2050, and <b>48% (-2,773,000 tCO<sub>2</sub>e)</b> over the 120-year design life. The changes to operational train flows that will arise from the Removal of the HS2 WCML connection (SES1-004-001) account for approximately <b>95%</b> of operational emissions reduction.”	Paragraph 14.2.8 “Operational GHG emissions are projected to reduce by <b>50% (-197,000 tCO<sub>2</sub>e)</b> between 2038 (opening year) and 2050, and <b>51% (-2,842,000 tCO<sub>2</sub>e)</b> over the 120-year design life. <b>The Removal of the HS2 WCML connection (SES1-004-001) reduces rolling stock operational and replacement emissions which account for approximately 97% of total operational emissions over 120 years.</b> ”	No change to reported significant effects and mitigation
Climate change Paragraph 14.2.9, SES1 and AP1 ES Volume 3, Route-wide effects	Corrections to the land use change assessment (i.e. losses/gains in different land types) has resulted in a change to the reported difference in emissions between the main ES and AP1	Paragraph 14.2.9 “...construction GHG emissions have decreased by <b>1,101,000 tonnes</b> of carbon dioxide (tCO <sub>2</sub> e), and operational emissions by <b>2,773,000 tCO<sub>2</sub>e</b> over the scheme’s 120-year design life.”	Paragraph 14.2.9 “...construction GHG emissions have decreased by <b>1,064,000 tonnes</b> of carbon dioxide (tCO <sub>2</sub> e), and operational emissions by <b>2,842,000 tCO<sub>2</sub>e</b> over the scheme’s 120-year design life.”	No change to reported significant effects and mitigation
Climate change Paragraph 14.2.10, SES1 and AP1 ES	Corrections to the land use change assessment (i.e.	Paragraph 14.2.10 “As a result of the AP1 revised scheme	Paragraph 14.2.10 “As a result of the AP1 revised scheme	No change to reported significant effects and

Reference in the SES1 and AP1 ES	Reason for correction	Text in the SES1 and AP1 ES	Revised text	Change to significant effects and mitigation
Volume 3, Route-wide effects	losses/gains in different land types) has resulted in a change to the reported difference in emissions between the main ES and AP1	there will be a <b>22%</b> decrease in construction GHG emissions, and <b>49%</b> decrease in operational GHG emissions between 2038 (scheme opening year) and 2050..."	there will be a <b>21%</b> decrease in construction GHG emissions, and <b>50%</b> decrease in operational GHG emissions between 2038 (scheme opening year) and 2050..."	mitigation

## In-combination climate change impacts assessment

4.2.3 A scoping exercise was undertaken to determine if the SES2 changes would be likely to result in a material difference to the assessment of in-combination climate change impacts reported in Volume 3 of the main ES. This determined that there would be no changes to the outcome of the in-combination climate change impacts, as reported in the main ES.

## Climate change resilience assessment

4.2.4 A scoping exercise was undertaken to determine if the SES2 changes would be likely to result in a material difference to the assessment of climate change resilience reported in Volume 3 of the main ES. This determined that there would be no changes to the outcome of the climate change resilience assessment, as reported in the main ES.

## 5 Ecology and biodiversity

### 5.1 Introduction

- 5.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on ecology and biodiversity arising from the construction and operation of the original scheme.
- 5.1.2 Volume 3 of SES1 reported that any variations as a result of the SES1 changes were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 5.1.3 This section of the report identifies the route-wide impacts and any new, removed or different likely significant effects compared to those reported in Volume 3 of the SES1 scheme.

### 5.2 Changes to the assessment

#### Corrections to the main ES, SES1 and AP1 ES

- 5.2.1 There are corrections to the route-wide assessment reported in Volume 3 of the main ES and the SES1 and AP1 ES. Table 5 provides a description of the corrections, replicates the text from Volume 3 of the main ES and the SES1 and AP1 ES, and provides the revised text.

**Table 5: Summary of corrections to Section 6.3, Ecology and biodiversity of the main ES, Volume 3: Route-wide effects and Section 4.2, Ecology and biodiversity of SES1 and AP1 ES, Volume 3: Route-wide effects**

Reference in the main ES or SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
Ecology and Biodiversity Paragraph 6.3.4, Volume 3 of the main ES	Reported number of non-statutory wildlife sites requires correction	Paragraph 6.3.4: There are <b>34</b> non-statutory wildlife sites where there will be significant adverse effects due to the Proposed Scheme. These include 30 Local Wildlife Sites (LWS) in Cheshire and four Sites of Biological Importance in Greater Manchester. These sites are of county/metropolitan value.	Paragraph 6.3.4: There are <b>35</b> non-statutory wildlife sites where there will be significant adverse effects due to the Proposed Scheme. These include 30 Local Wildlife Sites (LWS) in Cheshire and five Sites of Biological Importance in Greater Manchester. These sites are of county/metropolitan value.	This correction will not lead to a new or different route-wide significant effect.
Ecology and Biodiversity Paragraph 4.2.6, SES1, Volume 3 of the SES1 and	Reported number of non-statutory wildlife sites requires	Paragraph 4.2.6: As a result, there will be <b>30</b> non-statutory nature conservation sites affected by the SES1	Paragraph 4.2.6: As a result, there will be <b>31</b> non-statutory nature conservation sites affected by the SES1	This correction will not lead to a new or different route-wide significant effect.

Reference in the main ES or SES1 and AP1 ES	Reason for correction	Text in the relevant report	Revised text	Changes to significant effects and mitigation
AP1 ES	correction	scheme, four less than the <b>34</b> identified in the main ES.	scheme, four less than the <b>35</b> identified in the main ES.	

## Designated sites

### Statutory designations

- 5.2.2 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects on ecology and biodiversity from those reported in Volume 3 of the main ES, as amended by SES1.
- 5.2.3 A precautionary adverse effect on Sandbach Flashes SSSI was reported in the SES1 and AP1 ES associated with the potential for a reduction in water flow from the Tributary of Fowle Brook 1 to the SSSI, that was significant at the national level. Additional hydrological surveys provide an update to the environmental baseline for the SES2 scheme. These surveys have confirmed that there is no connectivity of the Tributary of Fowle Brook 1 beneath the WCML with Sandbach Flashes SSSI. Therefore, the adverse significant effect on the SSSI reported in the SES1 and AP1 ES is removed.
- 5.2.4 The SES2 changes will not result in any other new, removed or different likely significant effects on statutory designated nature conservation sites compared to those reported in Volume 3 of the main ES.

### Non-statutory designations

- 5.2.5 There are two Local Wildlife Sites (LWS) that are non-statutory nature conservation sites of relevance to the SES2 scheme that have been newly designated since SES1. These are Sugar Brook Farm Grasslands LWS and Birkin Brook LWS. In addition, the status of one other relevant LWS (Ashley Brickworks) has been amended. Information on the impacts for the newly-designated sites is provided in the following sections and listed in Table 6 and details of the changes for both newly designated sites and those where they have been amended are provided in SES2 and AP2 ES Volume 5, Appendix: EC-001-00000 and Map Series: EC-01.

**Table 6: New LWS relevant to the SES2 scheme**

Site name	Community area	Change	Distance from the SES2 scheme
Sugar Brook Farm Grasslands	MA06: Hulseheath to Manchester Airport	LWS designated since publication of the SES1	Partially within the SES2 scheme – directly affected
Birkin Brook	MA06: Hulseheath to Manchester Airport	LWS designated since publication of the SES1	Partially within SES2 scheme - directly affected

5.2.6 The direct effects on Birkin Brook LWS and Sugar Brook Farm Grasslands LWS are different adverse effects that are significant at the county/metropolitan level. In the SES1 scheme the losses of the undesignated habitats that are now included in these sites were identified as being significant at the county/metropolitan level. As a result there will be 33 non-statutory nature conservation sites affected by SES2 scheme, two more than the 31 affected by the SES1 scheme as corrected in Table 5. However, the regional level effect identified in the SES1 scheme will not be changed.

## Species

- 5.2.7 Additional surveys have confirmed that one population of great crested newt in the Hulseheath to Manchester Airport area (MA06) (GCNP 1.6.2), where an adverse effect at up to the county/metropolitan level was identified in the main ES, will no longer be affected. However, this does not change the route-wide level of effect on this species.
- 5.2.8 The main ES reported 10 bat population assemblages where there were significant effects at the regional level, the effect on two populations were removed by the SES1 changes. As a result of new desk study information, the bat assemblage in the Manchester Piccadilly Station area (MA08) has been upgraded to regional value, so the number of bat assemblages of this value that are affected is nine.
- 5.2.9 With the implementation of the mitigation measures proposed, the SES2 changes do not result in any new, removed or different significant route-wide effects on species.

## Habitats

- 5.2.10 There will be at least 24 veteran trees lost as a result of the SES2 scheme, compared to at least 22 reported in SES1.
- 5.2.11 The SES2 scheme will result in losses to the following habitats compared to SES1:
- ancient woodland – the SES2 scheme will result in the loss of 4.5ha of ancient woodland, compared to 5.1ha reported in SES1;
  - semi-natural broadleaved woodland – the SES2 scheme will result in the loss of 20.7ha of semi-natural broadleaved woodland, which is the same area as that reported in SES1;
  - grassland – the SES2 scheme will result in the loss of 30.7ha of unimproved and semi-improved grassland likely to qualify as a habitat of principal importance, compared to 24.9ha reported in SES1;
  - hedgerow – the SES2 scheme will result in the loss of 237.4km of hedgerows, compared to 245.9km reported in SES1; and
  - ponds – the SES2 scheme will result in the loss of 254 ponds, compared to 265 reported in SES1.
- 5.2.12 The SES2 changes do not result in any new, removed or different significant route-wide level effects on habitats.

## 6 Electromagnetic interference

### 6.1 Introduction

- 6.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on electromagnetic interference (EMI) arising from the construction and operation of the original scheme. It summarised the route-wide effects on human health, electrical equipment, third party assets and infrastructure running parallel to the original scheme, for example other railway infrastructure, metallic fences, pipelines, overhead power cables and telecommunications cables on motorways.
- 6.1.2 Volume 3 of the main ES identified a likely significant effect to three third-party receptors on a precautionary basis. These were Pickmere Radio Telescope, Manchester Airport and The Christie NHS Foundation Hospital, which contain very sensitive equipment or systems.
- 6.1.3 Volume 3 of SES1 reported that any variations as a result of the SES1 changes were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 6.1.4 This section of the report identifies any new, removed or different significant effects to those reported in Volume 3 of the main ES or SES1 as relevant.

### 6.2 Changes to the assessment

- 6.2.1 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects on EMI from that reported in Volume 3 of the main ES or SES1 as relevant.
- 6.2.2 SES2 and AP2 ES Volume 5, Appendix: EMI-001-00000, describes the EMI assessment and documents the differences to effects to potentially affected receptors as a result of the SES2 design changes and updated baseline data.
- 6.2.3 The SES2 changes, including updated baseline data, are not considered to result in any new, removed or different likely significant route-wide effects from those presented in Volume 3 of the main ES or SES1.

## 7 Major accidents and disasters

### 7.1 Introduction

- 7.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects arising directly from the construction and operation of the original scheme if it were to be affected by a major accident and/or disaster.
- 7.1.2 Volume 3 of SES1 reported that any variations as a result of the SES1 changes were not sufficient in scale to result in any new, removed or different significant route-wide effects.
- 7.1.3 This section of the report identifies any new, removed or different likely significant effects due to the SES2 changes.

### 7.2 Changes to the assessment

- 7.2.1 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects on the vulnerability of the SES2 scheme to major accidents and disasters from that reported in Volume 3 of the main ES, as amended by SES1.
- 7.2.2 Foreseeable risks have been recorded in a risk register, as required under the Construction (Design and Management) (CDM) 2015 Regulations<sup>3</sup>. Foreseeable risks recorded within the risk register include those attributable to SES2 changes and AP2 amendments, in addition to foreseeable risks identified as part of the ongoing CDM risk assessment process.
- 7.2.3 A review of the risk register has been undertaken. This review has identified an additional route-wide risk event, for which impact on an environmental receptor has the potential to be a major accident, relating to risk of spillage or longer-term seepage of pollutants into groundwater during operation (OM20). This additional route-wide risk event has been identified and recorded as part of the ongoing CDM risk assessment process and is not introduced as a direct result of any SES2 change or AP2 amendment. This risk event is presented in Table 7.
- 7.2.4 The review of the risk register has also identified some additional hazard sources, pathways, and receptors for risk events reported and assessed in the main ES and SES1. As a result, for some of those risk events the reasonable worst consequence if the event did occur and embedded mitigation measures to manage the risk as low as reasonably practicable (ALARP) has changed from that reported in the main ES and SES1. These changes include those represented by **bold text** in Table 7. These changes to route-wide risk events have been

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<sup>3</sup> *The Construction (Design and Management) Regulations 2015. (SI 2015 No. 51)*. Her Majesty's Stationery Office, London. Available online at: <https://www.legislation.gov.uk/uksi/2015/51/contents>.



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identified and recorded as part of the ongoing CDM risk assessment process, and are not introduced as a direct result of any SES2 changes or AP2 amendments.

7.2.5 No new or different likely residual significant flood risk effects from those reported in Volume 3 of the main ES have been identified as a result of the SES2 changes. The SES2 change in Environment Agency climate change guidance and climate allowances has led to the removal of some of the previously reported significant effects on flood risk associated with the presence of Palatine Road vent shaft at Northenden (in the MA07 area). No changes to the climate change resilience assessment from that reported in Volume 3 of the main ES have been identified as a result of the SES2 changes.

7.2.6 A full record of risk identification, risk screening and final risk assessment is provided in Major accidents and disasters risk screening in SES2 and AP2 ES Volume 5, Appendix: MA-001-00000.

**Table 7: Assessment of potential major accident and/or disaster events during construction and operation**

ID	Risk event	Reasonable worst case if event did occur	Summary of key risk management and mitigation measures present to demonstrate risks to be ALARP (refer to SES2 and AP2 ES Volume 5, Appendix: MA-001-00000 for full details).
C12	Fatality/injury to member of public i.e. pedestrians, equestrians, Network Rail train occupants and operatives on Network Rail mainline due to interfaces with construction activities/ <b>traffic</b> .	Fatality/injury to member(s) of public/ <b>Network Rail staff and passengers</b> .	Consultation with Network Rail and other rail service providers, local authorities, utility providers etc. to manage interfaces and define appropriate control measures. Implementation of HS2 Ltd Supply Chain Health and Safety standard. Appropriate construction planning, sequencing and site controls. Network Rail level crossings to be manned during possession of Network Rail lines when operations are affected by the construction of the Proposed Scheme. Use of hoarding/barriers to prevent interfaces with members of public. Application of the measures set out in the draft CoCP and necessary management plans, including how community relations will be managed and requirements for traffic management. Stakeholder engagement and grievance mechanism.
OM16	Exposure to live conductor/arcng	Fatality/injury to member(s) of public or Network Rail staff.	Earthing and bonding will be undertaken in line with relevant industry standards. Isolation and earthing procedures in place. Provision of a secure boundary and other appropriate measures to reduce likelihood of contact with overhead lines. Overhead lines designed to appropriate parameters, including adverse weather and climate change. <b>Detailed design to consider materials and separation distances between fencing.</b>
OM17	Impact upon emergency response/evacuation procedures, including for hazardous	Delay to emergency response leading to fatality/injury to member(s) of public. Irreversible damage	Consultation with emergency services, Greater Manchester Fire and Rescue Service, Transport for Greater Manchester, owners/operators of hazardous facilities, the Health and Safety Executive (HSE), local authorities and utility providers to manage interfaces and define

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ID	Risk event	Reasonable worst case if event did occur	Summary of key risk management and mitigation measures present to demonstrate risks to be ALARP (refer to SES2 and AP2 ES Volume 5, Appendix: MA-001-00000 for full details).
	facilities due to permanent closure/diversion/ congestion of emergency response routes.	to environmental receptor (listed building, ecological site, watercourse etc.).	<p>appropriate control measures.</p> <p>Early engagement with the emergency services and affected sites so that emergency response strategies can be revised, if required. Permanent diversions/alternative routes to be identified and agreed.</p> <p><b>Vent shaft spacing has been based on the Common Safety Method, with separate passages to be provided for emergency services and passengers.</b></p> <p><b>Engagement with Transport for Greater Manchester to consult on the design of the Manchester Airport High Speed Station to ensure fire protection measures are included in the design and dedicated emergency access is provided.</b></p> <p><b>Early engagement with emergency services and operators to ensure coordinated response in the event of an emergency.</b></p>
OM19	Electromagnetic interference – <b>Interference with safety monitoring systems or broadcasts</b> , failure of safety critical functions and systems. Possible causes include cyber terrorism leading to train failure, signal failure, runaway train, failure in controlling the train service, high winds.	Severe disruption to rail transportation. Major accident causing injury/fatality to <b>member of the public/Network Rail staff/Metrolink Staff</b> , and adjacent receptors, Spillage of pollutants.	Signalling and telecommunications designs have and will continue to follow appropriate standards to mitigate the risk of failure of safety critical functions and systems.
OM20	<b>Spillage or longer-term seepage of pollutants into groundwater</b>	<b>Harm to environmental receptor in the vicinity of the event.</b>	<p><b>Appropriate primary, secondary, and tertiary mitigation measures (including drainage systems and interceptors) to be incorporated in design, including containment measures to minimise the risk of a loss of containment event impacting on water and ecological resources.</b></p> <p><b>Operating and maintenance procedures will set out pollution prevention measures and measures to reduce potential impacts to water resources.</b></p> <p><b>Risks of leaks and spills addressed in water resources and flood risk sections of the main ES, SES1 and AP1 ES, and SES2 and AP2 ES, Volume 3 and Volume 5.</b></p>

7.2.7 The SES2 changes do not result in any new, removed or different likely significant effects.

## 8 Socio-economics

### 8.1 Introduction

- 8.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects in relation to socio-economics arising from the construction and operation of the original scheme. It reported route-wide effects as a result of the original scheme in relation to:
- route-wide construction employment created (direct and indirect);
  - employment in businesses directly and indirectly affected by construction;
  - operational employment; and
  - operational effects on existing business employment.
- 8.1.2 Volume 3 of the SES1 reported that the proposed SES1 changes will result in the removal of a significant adverse effect in relation to job displacement as a result of the removal of in-combination and isolation effects during construction.
- 8.1.3 This section of the report identifies any new, removed or different significant effects to those reported in Volume 3 of the main ES or SES1 as relevant.

### 8.2 New environmental baseline information

- 8.2.1 Since the main ES, the following baseline information has been updated:
- datasets reflecting changes to economic activity and the labour market across the UK and North West Region from the Office for National Statistics, namely:
    - Gross Domestic Product (GDP) estimates;
    - Annual Population Survey; and
    - Business Register and Employment Survey.
- 8.2.2 This data is presented below and has informed the socio-economic assessment.

#### Gross domestic product

- 8.2.3 GDP measures the size of the economy over a period of time. The UK's GDP in 2020<sup>4</sup> was £2,156 billion, of which the North West region contributed £208 billion<sup>5</sup>. GDP per person in

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<sup>4</sup> Due to recent updates to the calculation methodology, annual regional GDP estimates are only available around 18 to 24 months after the reference period. As a result of this, the most recent annual GDP estimates available are for 2020.

<sup>5</sup> Office for National Statistics (2022), *Regional economic activity by gross domestic product, UK: 1998 to 2020*. Available online at:

<https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/regionaleconomicactivitybygrossdomesticproductuk/1998to2020>

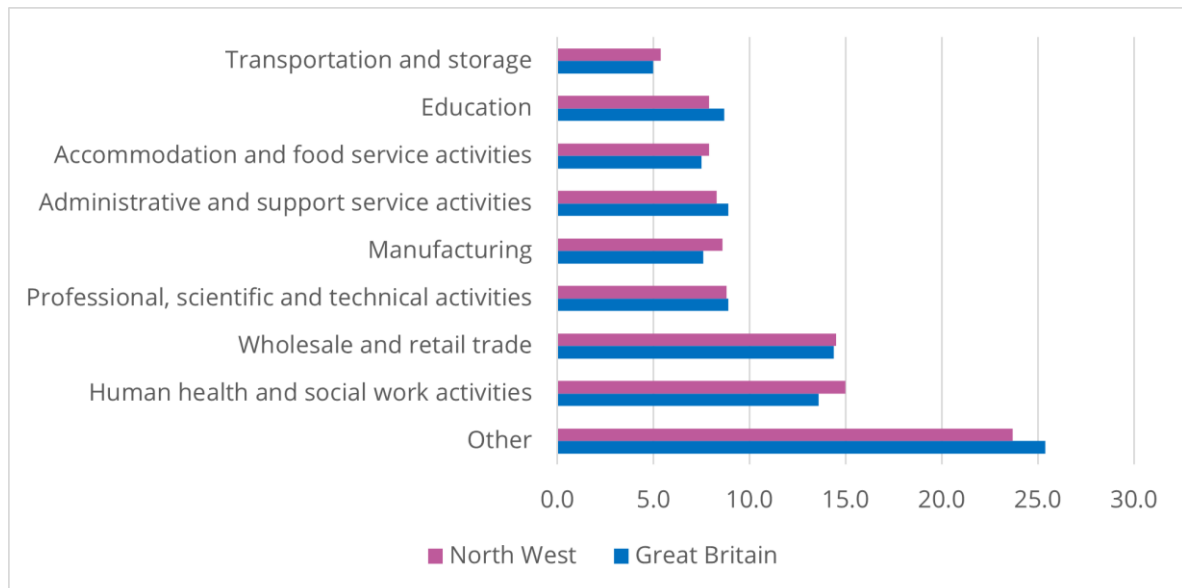
2020 was £32,000 in the UK and £28,300 in the North West<sup>5</sup>. While the overall GDP for the UK is higher than that reported in the main ES, the GDP for the North West region and the GDP per person for both the UK and the North West region is slightly lower than that reported in the main ES.

- 8.2.4 GDP in the UK was estimated to have decreased by 9.7% and the North West GDP was estimated to have decreased by 10.9% in 2020<sup>5</sup>. This decrease was mainly due to the coronavirus (COVID-19) pandemic, which caused widespread business closures and restricted the mobility of consumers. The Bank of England has predicted that the UK economy is expected to enter into and remain in a recession throughout 2023 and 2024, with GDP expected to recover gradually thereafter<sup>6</sup>. This predicted decrease in GDP is partly due to the high global energy and tradeable goods prices and the pressure that this has put on incomes<sup>6</sup>.

## Employment

- 8.2.5 In 2021, 30.4 million people were employed in Great Britain<sup>7</sup>, of whom 3.5 million were in the North West<sup>8</sup>. A sectoral breakdown of employment in the North West benchmarked against Great Britain, is shown in Figure 2.

**Figure 2: Proportion of employment by industry in the regional economies of the North West and Great Britain**



<sup>6</sup> Bank of England (2022), *Monetary Policy Report*. Available online at: <https://www.bankofengland.co.uk/-/media/boe/files/monetary-policy-report/2022/november/monetary-policy-report-november-2022.pdf>

<sup>7</sup> Does not include employment data for Northern Ireland.

<sup>8</sup> Office for National Statistics (2021), *Business Register and Employment Survey*. Available online at: <https://www.nomisweb.co.uk/datasets/newbres6pub>.

Note: 'Other' includes construction, public administration and defence, arts, entertainment and recreation, other service activities, information and communication, financial and insurance activities, mining and quarrying, utilities, real estate activities and agriculture, forestry and fishing.

- 8.2.6 Figure 2 shows some minor differences between the employment profile of the North West compared to that of Great Britain. There is a slightly higher proportion of employment in manufacturing, accommodation and food services, human health and social work activities, and transportation and storage and a slightly lower proportion of employment in education and administrative and support services.
- 8.2.7 In the period January 2021 to December 2021 the average employment rate for those aged 16-64 was 73% in the North West compared with 75% for Great Britain as a whole. The average unemployment rate in the same period for those aged 16-64 was 4.7% in the North West compared with 4.5% for Great Britain as a whole<sup>9</sup>.

## 8.3 Changes to the assessment

### Corrections to the main ES, SES1 and AP1 ES

- 8.3.1 There are corrections to the route-wide assessment reported in Volume 3 of the main ES and SES1 and AP1 ES. Table 8 and Table 9 provide a description of the corrections, replicate the text from Volume 3 of the main ES and the SES1 and AP1 ES, and provide the revised text.

**Table 8: Summary of corrections to Section 12, Socio-economics of the main ES, Volume 3: Route-wide effects**

Reference	Reason for correction	Text in the main ES	Revised text	Changes to significant effects and mitigation
Paragraph 12.7.13 and 12.7.14; Table 28, Volume 3, Route-wide effects	The magnitude for route-wide effect on businesses did not take into account relocated jobs, and was reported as medium instead of high.	The direct loss of businesses and employment will have knock-on effects through the business supply chain and expenditure effects alongside other economic adjustment factors. As a consequence, it is estimated that approximately 300 additional jobs may be lost through indirect effects, route-wide.	The direct loss of businesses and employment will have knock-on effects through the business supply chain and expenditure effects alongside other economic adjustment factors. As a consequence, it is estimated that approximately 300 additional jobs may be lost through indirect effects, route-wide.	Change of significance from moderate adverse to major adverse.

<sup>9</sup> Office for National Statistics (2021), *Annual Population Survey, NOMIS*. Available online at: <https://www.nomisweb.co.uk/datasets/apsnew>.

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Reference	Reason for correction	Text in the main ES	Revised text	Changes to significant effects and mitigation
		In total, approximately 1,100 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. It is considered that the route-wide impact will be of medium magnitude. The route-wide sensitivity of businesses is assumed to be medium. As such, there will be a moderate adverse significant effect.	In total, approximately 1,100 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. <b>There is predicted to be a total relocation of 6,500 jobs from businesses as a result of land required for construction of the Proposed Scheme.</b> It is considered that the route-wide impact will be of high magnitude. The route-wide sensitivity of businesses is assumed to be medium. As such, there will be a major adverse significant effect.	

**Table 9: Summary of corrections to Sections 9 and 20, Socio-economics of SES1 and AP1 ES, Volume 3: Route-wide effects**

Reference	Reason for correction	Text in SES1 and AP1 ES	Revised text	Changes to significant effects and mitigation
Paragraph 9.2.5, Volume 3, Route-wide effects	The magnitude for route-wide effect on businesses did not take into account relocated jobs, and was reported as medium instead of high.	With the SES1 changes, 1,050 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. The significance of effect will remain moderate adverse as reported in the main ES.	With the SES1 changes, 1,050 jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase. <b>There is predicted to be a total relocation of 6,210 jobs as a result of land required for construction of the Proposed Scheme.</b> The significance of effect will be major adverse.	Change of significance from moderate adverse to major adverse.
Paragraph 20.2.2, Volume 3,	The magnitude for route-wide effect on businesses did not	As reported in Section 9, in total approximately 1,050	As reported in Section 9, in total approximately 1,050	There is no change in significance to that reported in the

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Reference	Reason for correction	Text in SES1 and AP1 ES	Revised text	Changes to significant effects and mitigation
Route-wide effects	take into account relocated jobs, and was reported as low instead of high.	jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase of the original scheme as amended by the SES1. With the AP1 amendment for Additional land permanently required for the provision of a power supply to Crewe tunnel (AP1-001-002), this will reduce to 920 jobs directly and indirectly affected during the construction phase. This will reduce the magnitude of effect from high to medium, therefore changing the significance of effect from moderate adverse to a minor adverse effect, which is not significant.	jobs may be lost route-wide from businesses directly and indirectly affected during the construction phase of the original scheme as amended by the SES1. With the AP1 amendment for Additional land permanently required for the provision of a power supply to Crewe tunnel (AP1-001-002), this will reduce to 920 jobs directly and indirectly affected during the construction phase. <b>There is predicted to be a total relocation of 5,400 jobs as a result of land required for construction of the proposed scheme. There is no change in magnitude or significance to the major adverse effect reported in the corrected SES1 (see above row).</b>	corrected SES1 (see above row).

- 8.3.2 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects on socio-economics from that reported in Volume 3 of SES1.
- 8.3.3 The SES2 changes relevant to socio-economics relate primarily to changes to the construction compounds and programme associated with railway installation works, as described in the SES2 and AP2 ES Volume 2, Community area reports (Part 1) and change in the construction full time equivalent employees required.
- 8.3.4 There will be an increase from 67,800 person years of construction employment (equivalent of 6,800 permanent full-time construction jobs) reported in SES1 to 70,500 person years of construction employment (equivalent of 7,100 permanent full-time construction jobs) for the SES2 scheme. There will be no change to the major beneficial significant effect reported in SES1 as a result of the SES2 scheme.

- 8.3.5 The SES2 scheme will have a minimal impact on total numbers of existing employment directly and indirectly affected by construction. Whilst the employment figures given in Volume 3 of the SES1 and AP1 ES will change, the change is considered to be negligible and will not result in any new or different likely significant route-wide effects from those presented in the Volume 3 of the SES1.
- 8.3.6 The total number of jobs that are estimated to be lost due to businesses being displaced as a result of in-combination or isolation effects is expected to increase from a total of 470 jobs, as reported in Volume 3 of SES1, to 560 jobs as a result of the SES2 scheme. This will increase the magnitude of impact from medium to high, therefore changing the effect reported in SES1 from a minor to a moderate adverse effect, which is significant.
- 8.3.7 There will be no changes to operational employment or businesses during operation from that reported in Volume 3 of SES1 and AP1 ES as a result of the SES2 scheme.



## 9 Traffic and transport

### 9.1 Introduction

- 9.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on traffic and transport arising from the construction and operation of the original scheme.
- 9.1.2 The traffic and transport assessment within SES1 and AP1 ES Volume 3 assessed and reported the effects of the SES1 changes together with the AP1 amendments from the construction of the AP1 revised scheme. The traffic and transport assessment reported that as a result of the SES1 changes and AP1 amendments combined, variations during the construction of the AP1 revised scheme were not sufficient in scale to alter the conclusions presented in Volume 3 of the main ES. No route-wide operational assessment was undertaken for traffic and transport for the SES1 and AP1 ES Volume 3.

### 9.2 Changes to the assessment

- 9.2.1 For construction, the SES2 changes and AP2 amendments have been considered together as it is not possible to separate out the impacts and effects of each change within the modelling. This is because alterations in construction traffic flows cannot generally be directly attributed to particular SES changes or AP amendments. Consequently, the SES2 changes have been combined with AP2 amendments and their traffic and transport impact reported at a route-wide level in Section 19.
- 9.2.2 For operation, the SES1 and SES2 changes have been assessed together with AP1 and AP2 amendments as no operational route-wide assessment was carried out for AP1 and it is not possible to separate out the impacts and effects of each change on rail passengers within the assessment. This is because changes in rail passenger demand, modal shift and reduced highway use cannot generally be directly attributed to particular changes or amendments. Consequently, the SES1 and SES2 changes and AP1 and AP2 amendments have been combined and their traffic and transport impact reported at a route-wide level in Section 19.

## 10 Waste and material resources

### 10.1 Introduction

- 10.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects associated with the off-site disposal to landfill of solid waste that will be generated by the construction and operation of the original scheme.
- 10.1.2 The waste and material resources assessment within SES1 and AP1 ES Volume 3 assessed and reported SES1 changes together with the AP1 amendments. The waste and material resources assessment reported that as a result of the SES1 changes and AP1 amendments, variations were not sufficient in scale to alter the conclusions presented in Volume 3 of the main ES.

### 10.2 Changes to the assessment

- 10.2.1 An assessment has been undertaken for the SES2 changes to identify if they would generate new or different quantities of solid waste compared to those reported in the main ES and to identify any new or different likely significant effects on waste requiring off-site disposal to landfill from that reported in Volume 3 of the main ES, as amended by SES1.
- 10.2.2 The SES2 changes are considered likely to change the quantities of waste generated during construction and operation of the SES2 scheme, when compared with the quantities reported for the original scheme in Volume 3 of the main ES, as amended by SES1. However, the majority of the changes are generally considered to have a low impact with respect to waste and material resources.
- 10.2.3 Due to the integrated route-wide approach to managing waste and excavated materials, it is not possible to disaggregate changes to waste generation resulting from SES2 changes from those arising due to AP2 amendments. In particular, excavated materials will be shared freely between construction elements and community areas to optimise the use of these materials, replacing the requirement for off-site disposal and imported fill. This integrated approach precludes a separate assessment of the SES2 changes from the AP2 amendments.
- 10.2.4 Therefore, the SES2 changes and the resulting changes to waste arisings during construction and operation are assessed in combination with the AP2 amendments in Section 20, as part of changes to the AP2 revised scheme.

# 11 Water resources and flood risk

## 11.1 Introduction

- 11.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on water resources and flood risk arising from the construction and operation of the original scheme. It reported route-wide effects on surface water and groundwater resources (quality and quantity) and flood risk as a result of the original scheme.
- 11.1.2 Volume 3 of SES1 reported that any variations as a result of the SES1 changes were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 11.1.3 This section of the report identifies any new, removed or different significant effects to those reported in Volume 3 of the SES1.

## 11.2 Changes to the assessment

- 11.2.1 Since the main ES, the following changes to baseline information have taken place:
- in July 2021, the Environment Agency published updated climate change guidance and peak river flow allowances using percentiles from UK Climate Projections 2018 (UKCP18) which are now based on management catchments instead of river basin districts; and
  - in May 2022, the Environment Agency published updated peak rainfall intensity allowances using UKCP local projections of extreme rainfall.
- 11.2.2 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects on water resources and flood risk from those reported in Volume 3 of the SES1.
- 11.2.3 None of the SES2 changes have been identified as likely to result in any new, removed or different significant route-wide effects on surface water and groundwater resources (quality and quantity) from those presented in Volume 3 of the SES1.
- 11.2.4 An assessment of the effects of the SES2 changes in relation to the objectives of the Water Framework Directive (WFD) and the alignment of the SES2 scheme with the principles of the Sequential Test and the Exception Test in the National Planning Policy Framework (NPPF) was undertaken.

## Water Framework Directive compliance

- 11.2.5 An assessment was undertaken to determine if the SES2 changes would likely result in any new, removed or different effects on the current status and/or future achievement of status objectives of the WFD water bodies affected by the HS2 route, from those effects reported in Volume 3 of the main ES, as amended by SES1. Full details of all the changes are provided in SES2 and AP2 ES Volume 5, Appendix: WR-001-00000.

11.2.6 A summary is provided below of the changes in any adverse (amber) effects, which have the potential to result in a non-compliance with the statutory objectives of the WFD Regulations.

## **Water bodies affected**

11.2.7 A total of 24 WFD water bodies have been identified as being affected by the HS2 route, including 21 surface water bodies and three groundwater bodies.

11.2.8 New environmental baseline data relevant to these WFD water bodies have been derived since the main ES. This updated baseline data is provided in the SES2 and AP2 ES BID WR-002-00001 report.

## **Adverse effects on current status**

11.2.9 Volume 3 of the SES1, identified adverse (amber) effects with the potential to cause a deterioration in the current status of two surface water bodies. These were:

- Wade Brook (GB112068060370): amber risk of deterioration associated with potential impacts on surface water quality from highway drainage; and
- Timperley Brook (GB112069064520): amber risk of deterioration associated with potential impacts on surface water quality from highway drainage.

11.2.10 No SES2 design changes have been identified as being relevant to WFD.

11.2.11 However, new environmental baseline data relevant to the WFD have been derived since publication of SES1. This includes:

- new WFD survey data, including reconnaissance surveys and additional information from the Environment Agency, which has resulted in changes to watercourse receptor values. These changes are reported in the SES2 and AP2 ES BID WR-002-00001 report; and
- new water quality sampling data, which has been used to refine and update assessments of WFD compliance risks to surface water and groundwater quality arising from highway drainage. In line with WFD best practice guidance and industry standard assessment principles, this new water quality data has been used to carry out a metal bioavailability assessment using the Environment Agency metal bioavailability assessment tool (M-BAT)<sup>10</sup>. Further information on the assessments is reported in SES2 and AP2 ES Volume 5, Appendix: WR-003-00000 and the SES2 and AP2 ES Volume 5, Appendix: WR-003-0MA06, Water resource assessment.

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<sup>10</sup> Water Framework Directive (2014), *Rivers & lakes – Metal Bioavailability Assessment Tool (M-BAT)*. Available online at: <http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat>.

- 11.2.12 As a result, the WFD compliance risks reported for the SES1 scheme have been updated as follows:
- Wade Brook (GB112068060370): The previously reported amber effect and risk of deterioration associated with potential impacts on surface water quality from highway drainage to Wade Brook has been removed following the M-BAT assessment, which suggests that the bioavailable copper concentration in the drainage discharge will be lower than the background concentrations in this watercourse; and
  - Timperley Brook (GB112069064520): The previously reported amber effect and risk of deterioration associated with potential impacts on surface water quality from highway drainage to Timperley Brook has been removed following the M-BAT assessment, which suggests that the bioavailable copper concentration in the drainage discharge will be lower than the background concentrations in this watercourse. However, a new potential amber effect and risk of deterioration associated with potential impacts on surface water quality from highway drainage to Tributary of Timperley Brook 1 has been identified, following the change to the watercourse receptor value resulting from new WFD reconnaissance survey data.
- 11.2.13 In addition, a recent site visit has confirmed that the measures previously identified in the main ES to mitigate the amber effect of the Manchester Airport High Speed Station inverted siphon on Timperley Brook are not feasible. In the original scheme, a 330m permanent realignment of the watercourse away from an assumed existing 300m culvert along Brooks Drive was proposed in consultation with the Environment Agency, in order to mitigate for the loss of open channel that would result from the inverted siphon upstream. However, a site visit by the Environment Agency has confirmed that the culvert alongside Brooks Drive does not exist, and so the proposed channel realignment would not remove an existing culvert nor create additional open river channel habitat to mitigate for the footprint impacts of the inverted siphon upstream. Accordingly, as a result of the new SES2 baseline information at this site, there will be an adverse (amber) effect from the Manchester Airport High Speed Station inverted siphon on the hydromorphological status of Timperley Brook.

### **Adverse effects on future achievement of status objectives**

- 11.2.14 Volume 3 of the SES1 identified adverse (amber) effects with the potential to prevent the future achievement of the status objectives of the Timperley Brook (GB112069061260) surface water body. These effects relate to a potential worsening of existing urban diffuse pollution pressures, and the potential to inhibit the implementation of measures identified to address these pressures, associated with highway drainage discharges.
- 11.2.15 As in paragraphs 11.2.11 and 11.2.12, based on newly available environmental baseline data, the SES2 changes will remove the potential impact on surface water quality from highway drainage to Timperley Brook. However, the SES2 changes will introduce a new potential impact on the Tributary of Timperley Brook 1. Therefore, an adverse (amber) effect with the potential to prevent the future achievement of the status objectives of the Timperley Brook water body will remain.

## Summary of compliance

- 11.2.16 The assessment has concluded that the new SES2 baseline information will result in the following new and removed adverse effects on current WFD status and WFD status objectives:
- Removal of the two adverse (amber) effects reported in SES1 with the potential to cause a deterioration of the current status of the Wade Brook and Timperley Brook surface water bodies, related to potential impacts on surface water quality from highway drainage;
  - Introduction of new adverse (amber) effects on the Timperley Brook water body, related to potential impacts on surface water quality from high drainage, due to the change in the receptor value of the Tributary of Timperley Brook 1 watercourse; and
  - Introduction of a new adverse (amber) effect on the Timperley Brook water body, related to the footprint impacts of the Manchester Airport High Speed Station inverted siphon, due to new baseline information, which means that measures included in the design of the original scheme will not sufficiently mitigate for the loss of open channel resulting from the siphon.
- 11.2.17 These new adverse (amber) effects may give rise to the potential risk of the SES2 scheme being non-compliant with the statutory objectives of the WFD. Additional mitigation measures are therefore required to manage the risk of status deterioration within the Timperley Brook water body. These mitigation measures are included within the assessment of the AP2 revised scheme in Section 21.2 of this report.

## Flood risk

- 11.2.18 An assessment was undertaken to determine if the SES2 changes would be likely to result in any new, removed or different likely significant effects from those reported in Volume 3 of the SES1.
- 11.2.19 Volume 3 of the SES1, identifies the potential for significant adverse effects related to flood risk at two locations along the HS2 route, requiring development of additional mitigation in order to fully comply with the requirements of the Exception Test, i.e. to ensure that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, to reduce flood risk overall.
- 11.2.20 The SES2 change in Environment Agency climate change guidance and climate allowances has led to the removal of some of the previously reported significant effects associated with the presence of Palatine Road vent shaft at Northenden (in the MA07 area). These removed effects are reported in SES2 and AP2 ES Volume 2, Community area report: Davenport Green to Ardwick (MA07).
- 11.2.21 The SES2 changes do not alter the mitigation currently proposed for the Palatine Road vent shaft and the diversion of tributaries of Birkin Brook due to the Ashley Railhead (in the MA06

area). Therefore, the SES2 scheme remains aligned with the principles of the Sequential Test and Exception Test policies in the National Planning Policy Framework (NPPF).

## Part 2: Additional Provision Environmental Statement

### 12 Agriculture, forestry and soils

#### 12.1 Introduction

- 12.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on agriculture, forestry and soils arising from the construction and operation of the original scheme. It reported route-wide effects on best and most versatile (BMV) land in England and prime agricultural land in Scotland, and impacts on farm businesses, as a result of the original scheme.
- 12.1.2 Volume 3 of AP1 ES reported that any variations as a result of the AP1 amendments were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES, as amended by SES1.
- 12.1.3 Section 2 of this volume reports the new, removed or different significant effects due to the SES2 changes.
- 12.1.4 This section of the AP2 ES identifies any new, removed or different likely significant effects on agriculture, forestry and soils as a result of the AP2 amendments compared to SES2.
- 12.1.5 The assessment presented in this section of the report also considers any combined effects of the AP1 revised scheme and AP2 revised scheme.

#### 12.2 Changes to the assessment

- 12.2.1 An assessment was undertaken to determine if the AP2 amendments will be likely to result in any new, removed or different likely significant effects on agriculture, forestry and soils from those reported in SES2.

#### Assessment of effects during construction

- 12.2.2 This section of the AP2 ES identifies any new, removed or different likely significant effects on agriculture, forestry and soils during construction as a result of the AP2 revised scheme compared to those reported in SES2.

#### Temporary effects

- 12.2.3 The total area of land required temporarily for the construction of the AP2 revised scheme is 1644ha with 1520ha in England and 124ha in Scotland. In England 471ha is BMV land and in Scotland 22ha is prime agricultural land.



- 12.2.4 The area of agricultural land required temporarily for the construction of the AP2 revised scheme has increased by 112ha in England and 11ha in Scotland compared to the SES2 scheme.
- 12.2.5 The total area of land to be restored from the construction of the AP2 revised scheme is 880ha with 818ha in England and 62ha in Scotland.
- 12.2.6 The area of agricultural land to be restored for the construction of the AP2 revised scheme has increased by 84ha in England and decreased by 14ha in Scotland compared to the SES2 scheme.
- 12.2.7 The AP2 revised scheme does not result in any new, removed or different temporary significant route-wide effects on agriculture, forestry or soils to those reported in the SES2. Table 10 summarises the temporarily required land in England and Scotland for AP2 is given below.

**Table 10: Temporarily required land and restored land in England and Scotland for the AP2 revised scheme (hectares)**

	SES2 scheme	AP2 revised scheme	Difference
<b>England</b>			
Total land required temporarily	1,408	1,520	+112
BMV land required temporarily	455	471	+26
Total land required temporarily to be restored	734	818	+84
<b>Scotland</b>			
Total land required temporarily	113	124	+11
Prime agricultural land required temporarily	20	22	+2
Total land required temporarily to be restored	76	62	-14
<b>England and Scotland</b>			
Total land required temporarily	1,521	1,644	+123
Total land to be restored	810	880	+70

## Permanent effects

- 12.2.8 The total area of land required permanently for the construction of the AP2 revised scheme is 764ha with 702ha in England and 62ha in Scotland. In England 178ha is BMV land and in Scotland 8ha is prime agricultural land.
- 12.2.9 The area of agricultural land required permanently for the construction of the AP2 revised scheme has increased by 28ha in England and 25ha in Scotland compared to the SES2 scheme.
- 12.2.10 The total area of land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage of the AP2 revised scheme is 107ha in England which has increased by 11ha compared to the SES2 scheme. In Scotland there is no agricultural land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage. This remains unchanged from the main ES.

12.2.11 The AP2 revised scheme does not result in any new, removed or different permanent significant route-wide effects on agriculture, forestry or soils to those reported in the SES2. No changes in the assessment of impacts on forestry land have been made as a result of the AP2 revised scheme. Table 11 summarises the permanently required land in England and Scotland for AP2 is given below.

**Table 11: Permanently required land in England and Scotland for the AP2 revised scheme (hectares)**

	SES2 scheme	AP2 revised scheme	Difference
<b>England</b>			
Total land required permanently	674	702	+28
BMV land required permanently	174	178	+4
Total land to be used for newly planted woodland, trees, visual screening, habitat creation and/or floodplain storage	95	106	+11
<b>Scotland</b>			
Total land required	37	62	+25
Prime agricultural land required	6	8	+2
Total land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage	0	0	0
<b>England and Scotland</b>			
Total land required permanently	711	764	+53
Total land to be used for mitigation	95	107	+11
Newly planted woodland or trees for visual screening or habitat creation	95	106	+11
Floodplain storage	0.25	1	+0.75

## 12.3 Combined effects of AP1 revised scheme and AP2 revised scheme

12.3.1 This section of the report considers whether the AP2 revised scheme in combination with all relevant AP1 amendments would result in a new or different route-wide level effect.

**Table 12: Combined effects of AP2 amendments and AP1 amendments**

Type of land	SES1 and AP1 ES	SES2 and AP2 ES	Combined effect
Temporarily required land	No temporary significant route-wide level effects on agriculture, forestry or soils	No temporary significant route-wide level effects on agriculture, forestry or soils	Should all the AP1 and AP2 amendments be adopted the total area of agricultural land required temporarily for construction would be: <ul style="list-style-type: none"> <li>1,649 hectares with 1,525 hectares in England and 124 hectares in Scotland</li> </ul> The total area of land required temporarily to be restored to agriculture would be: <ul style="list-style-type: none"> <li>874 hectares with 812 hectares in England and 62.28</li> </ul>

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Type of land	SES1 and AP1 ES	SES2 and AP2 ES	Combined effect
			<p align="center">hectares in Scotland</p> <p>The AP2 revised scheme combined with AP1 amendments will not result in any new, removed or different temporary significant route-wide effects on agriculture, forestry and soils.</p>
Permanently required land	No permanent significant route-wide level effects on agriculture, forestry or soils	No permanent significant route-wide level effects on agriculture, forestry or soils	<p>Should all the AP1 and AP2 amendments be adopted for the total area of agricultural land required permanently for construction would be:</p> <ul style="list-style-type: none"> <li>• 774 hectares with 712 hectares in England and 62 hectares in Scotland</li> </ul> <p>To total area of land to be used for newly planted woodland, trees, visual screening, habitat creation or floodplain storage would be:</p> <ul style="list-style-type: none"> <li>• 106 hectares with 106 hectares in England and 0 hectares in Scotland</li> </ul> <p>The AP2 revised scheme combined with AP1 amendments will not result in any new, removed or different permanent significant route-wide effects on agriculture, forestry and soils.</p>

## 13 Air quality

### 13.1 Introduction

- 13.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on air quality arising from the construction and operation of the original scheme.
- 13.1.2 This section of the AP2 ES identifies any new, removed or different likely significant effects on air quality as a result of the AP1 revised scheme and AP2 revised scheme combined compared to those reported in Volume 3 of the main ES. The AP1 revised scheme and AP2 revised scheme have been considered together as the modelled traffic flows cannot generally be directly attributed to particular SES changes or AP amendments.

### 13.2 Changes to the assessment

- 13.2.1 An assessment was undertaken to determine if the AP1 revised scheme and AP2 revised scheme combined will be likely to result in any new, removed or different likely significant effects on air quality from those reported in the main ES.

### 13.3 Benefits beyond the project boundary

- 13.3.1 An air quality assessment of the AP1 revised scheme and AP2 revised scheme combined, based on updated baseline and future baseline traffic models for the SES2 scheme and AP2 revised scheme, has been undertaken for the modal shift assessment. This assessment calculates the change in emissions for nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>). The following data sources have been used for this assessment:
- Traffic data PLANET Framework Model (PfM) version 10a; and
  - Department for Environment, Food and Rural Affairs (Defra) Emissions Factors Toolkit (EFT)<sup>11</sup>.
- 13.3.2 These data sources have been refined from those presented in the main ES due to the most recent update of Defra's EFT.
- 13.3.3 The change in annual vehicle kilometres between the 'with scheme' and 'without scheme' scenarios for 2039 (obtained from PfM) are presented in Table 13 for each transport mode alongside those from the main ES.

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<sup>11</sup> Department for Environment, Food and Rural Affairs (2021), *Emissions Factors Toolkit (version 11)*. Available online at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>.

**Table 13: Annual vehicle kilometres per travel mode (absolute numbers from (PfM))**

Transport mode	Change in annual vehicle kilometres	
	Original scheme as reported in main ES	AP1 revised scheme and AP2 revised scheme combined
Car vehicle kilometres access to long distance rail (including London)	161,806,269	112,162,569
Highway long distance trips vehicle kilometres	-385,689,058	-277,666,599
Highway local trips vehicle kilometres (from regional models)	-62,462,317	-61,808,656
Air access vehicle kilometres	-23,921,413	-8,572,540
Total	-310,266,518	-235,885,226

- 13.3.4 In the main ES it was reported that there would be a reduction of over 310 million vehicle kilometres travelled because of the modal shift to rail. As a result of the AP1 and AP2 revised schemes combined, it is anticipated that the modal shift to rail will result in a reduction of over 235 million vehicle kilometres travelled.
- 13.3.5 In the main ES vehicle emissions were set to the latest Euro standard (Euro 6c/6d). However, for this assessment EFT vehicle fleet projections for 2039 have been used instead, which incorporates these latest Euro standards.
- 13.3.6 Table 14 presents the difference between the pollutant emissions reported in the main ES and the AP2 ES, taking into account the change in vehicle kilometres travelled, the predicted fleet mix and vehicle emission factors.

**Table 14: Pollutant emissions (in tonnes)**

Change between the 'with scheme' and 'without scheme' 2039	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Original scheme reported in the main ES	-20.7	-5.4	-3.3
AP1 revised scheme and AP2 revised scheme combined	-19.9	-4.5	-2.7

- 13.3.7 The main ES reported a predicted reduction in air pollutant emissions in 2039 of 20.7 tonnes of NO<sub>x</sub>, 5.4 tonnes of PM<sub>10</sub> and 3.3 tonnes of PM<sub>2.5</sub>.
- 13.3.8 The AP1 revised scheme and AP2 revised scheme combined is predicted to bring a reduction in air pollutant emissions in 2039 of 19.9 tonnes of NO<sub>x</sub>, 4.5 tonnes of PM<sub>10</sub> and 2.7 tonnes of PM<sub>2.5</sub>.

## 14 Climate change

### 14.1 Introduction

- 14.1.1 Volume 3 of the main ES reported the assessment of the greenhouse gas (GHG) emissions for the original scheme during construction and operation. It also reported the assessment of in-combination climate change impacts and climate change resilience during construction and operation.
- 14.1.2 The GHG assessment in the SES1 and AP1 ES Volume 3 assessed and reported SES1 changes together with the AP1 amendments. The GHG emissions impact reported that as a result of the SES1 changes and AP1 amendments, variations were not sufficient in scale to alter the conclusions presented in Volume 3 of the main ES.
- 14.1.3 This section of the AP2 ES identifies any material changes to the GHG assessment reported in the SES1 and AP1 ES, due to SES2 changes and AP2 amendments combined (referred to below as the AP2 revised scheme).
- 14.1.4 This section of the AP2 ES also identifies any new, removed or different likely significant in-combination climate change effects as a result of the AP2 amendments compared to those reported in Volume 3 of the main ES.

### 14.2 Changes to the assessment

#### GHG scope and methodology

- 14.2.1 The methodology used to assess the AP2 revised scheme's GHG emissions remains the same as in the main ES and the SES1 and AP1 ES. Data was collected from design teams covering elements such as: volumes of construction material and waste, water consumption, energy consumption and mass haul distances. Volume 5, Appendix: CL-004-0000 of the main ES presents the GHG calculation methodology in detail. However, some of the underlying assumptions and data sources behind the GHG assessment have been updated:
- The Department for Business, Energy and Industrial Strategy (BEIS) 2021 GHG Conversion factors were updated to reflect the latest 2022 publication<sup>12</sup>;
  - The GHG assessment's operational opening year for the AP2 revised scheme has changed from 2038 to 2039; and
  - The inclusion of modal shift impacts (i.e. changes in GHG emissions associated with car, conventional rail and domestic aviation trips switching to high speed rail) which were not

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<sup>12</sup> Department for Business, Energy and Industrial Strategy (2022), *Greenhouse gas reporting: conversion factors 2022*. Available online at: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022>.

reported in the SES1 and AP1 ES. The modal shift modelling is based on the Planet Framework Model (PFM)<sup>13</sup>.

- 14.2.2 The SES2 changes have been assessed together with AP2 amendments since all GHG emissions, irrespective of their source, contribute to climate change. It is our professional judgment that reporting GHG emissions for SES2 changes and AP2 amendments separately would not make any discernible difference to the effects reported in the main ES.
- 14.2.3 This GHG assessment is based on the combined AP1 and AP2 revised schemes, assuming that all AP1 and AP2 amendments will be implemented. This section identifies whether there is a material difference to the GHG assessment reported in SES1 and AP1 ES.

## **GHG implications of SES2 changes and AP2 amendments**

- 14.2.4 Operational GHG emissions are expected to gradually decrease as the UK grid decarbonises over time. This is reflected in the per passenger kilometre emissions (gCO<sub>2</sub>e/p.km) associated with the operation of the rolling stock, presented in Table 15. The latest Government UK grid electricity projections has resulted in a decrease in GHG emissions per passenger kilometre compared to the AP1 revised scheme. The Removal of the HS2 WCML connection (SES1-004-001) and updated Train Service Specification (TSS) has altered the rolling stock fleet mix resulting in a slight increase in GHG emissions per passenger kilometre reported in the SES1 and AP1 ES.

**Table 15: The AP2 revised scheme’s operational GHG emissions per passenger kilometre (gCO<sub>2</sub>e/p.km) for 2039 (opening year) and 2050 compared to the main ES and AP1 revised scheme**

	<b>GHG emissions</b>	<b>2039<sup>14</sup></b>	<b>2050</b>
Original scheme	gCO <sub>2</sub> e/p.km	1.85	1.10
AP1 revised scheme		1.94	1.16
AP2 revised scheme		0.81	0.29

- 14.2.5 Table 16 compares the AP2 revised scheme GHG emissions to the original scheme reported in the main ES and the AP1 revised scheme reported in the SES1 and AP1 ES. GHG emissions are reported twice, the first covering the period between 2039 (opening year) and 2050, and the second time over 120 years to reflect the assumed design life of the railway.
- 14.2.6 Further details of the GHG assessment are included in the SES2 and AP2 ES Volume 5, Appendix: CL-003-00000.

<sup>13</sup> The PFM is a strategic transport model developed by HS2 Ltd. and covers all long-distance rail, car and air movements across England, Scotland and Wales. The PFM was updated between the main ES and the SES2 and AP2 ES, from PFM v9.6 to PFM v10a.

<sup>14</sup> In the main ES and the AP1 revised scheme assessment an opening year of 2038 was assumed, now updated to 2039 for AP2.

**Table 16: AP2 revised scheme GHG emissions from construction and operation compared against the original scheme as reported in the main ES and the SES1 and AP1 ES**

Work stage	Life cycle stage	Original scheme GHG emissions (tCO <sub>2</sub> e)		AP1 revised scheme GHG emissions (tCO <sub>2</sub> e)		AP2 revised scheme GHG emissions (tCO <sub>2</sub> e)	
		2039 to 2050	120 years	2039 to 2050	120 years	2039 to 2050	120 years
Construction		5,022,000		3,958,000		4,758,000	
Operation	Use stage	391,000	5,769,000	194,000	2,927,000	56,000	1,325,000
	Benefits and loads beyond project boundaries <sup>15</sup>	-618,000	-3,888,000	n/a	n/a	-62,000	-511,000

- 14.2.16 The AP2 revised scheme construction GHG emissions are estimated to be 20% higher (800,000 tCO<sub>2</sub>e) than the AP1 revised scheme. This is mainly due to an increase in construction plant fuel use, but also due to changes to the design of: viaducts, retaining walls, depots and highways works.
- 14.2.17 Operational GHG emissions for the period between 2039 (opening year) and 2050 are estimated to be 71% (-138,000 tCO<sub>2</sub>e) lower for the AP2 revised scheme compared to the AP1 revised scheme. Over the 120-year design life operational GHG emissions are estimated to be 55% (-1,602,000 tCO<sub>2</sub>e) lower for AP2 compared to that reported in the SES1 and AP1 ES. Operational emissions include the maintenance, repair and replacement of construction material, and assets over the HS2 scheme's lifetime, as well as the operation of rolling stock, stations, depots and other assets, and land use change. The reduction in operational emissions is mainly due to the updated UK grid decarbonisation projections by the UK Government<sup>14</sup>. Where the GHG intensity of UK electricity generation in 2039 was previously projected at 49 gCO<sub>2</sub>e/kWh, it is now 19 gCO<sub>2</sub>e/kWh, a significant decarbonisation impacting multiple elements of HS2.
- 14.2.18 Benefits and loads beyond project boundaries (i.e. modal shift) was not reported in the SES1 and AP1 ES. When compared to the main ES, the combined AP1 and AP2 revised schemes show a reduction in GHG savings associated with modal shift of 556,000 tCO<sub>2</sub>e (from -618,000 to -62,000 tCO<sub>2</sub>e) between 2039 (opening year) and 2050. Over the 120 year design life this is a reduction in savings of 3,377,000 tCO<sub>2</sub>e (from -3,888,000 to -511,000 tCO<sub>2</sub>e). The reduction is the net effect of the removal of the HS2 WCML connection on car and aviation trips (-414,000 to -65,000 tCO<sub>2</sub>e up to 2050) and the wider rail network (-6,000 to 3,000 tCO<sub>2</sub>e up to 2050), as well as updates to transport modelling parameters. Without the HS2 WCML connection there is no additional benefit in freight capacity compared to Phase 2a.
- 14.2.19 GHG emissions reported in the main ES, SES1 and AP1 ES and SES2 and AP2 ES represent a reasonable worst case and likely overestimate the HS2 scheme GHG emissions. HS2's Net

<sup>15</sup> This represents the modal shift from road, rail and air transport on to HS2 as a result of the scheme.



Zero Carbon Plan sets out a pathway for HS2 to be net zero from 2035. For example, it includes objectives to remove diesel on all HS2 construction sites from 2029 onwards, and to achieve a 50% reduction in embodied GHG emissions from steel and concrete compared to 2021, by 2030.

- 14.2.20 Furthermore, HS2's Net Zero Carbon Plan<sup>16</sup> published in January 2022 includes a commitment to use 100% zero carbon electricity to power trains from the opening year. Achieving this commitment would result in per passenger kilometre emissions of 0 gCO<sub>2</sub>/p.km for 2039 (opening year) and 2050. For the AP2 revised scheme this would lead to a reduction in the total operational emissions from 56,000 to 7,000 tCO<sub>2</sub>e between 2039 (opening year) and 2050, and from 1,325,000 to 989,000 tCO<sub>2</sub>e over the 120-year design life.

## Conclusions

- 14.2.21 The AP2 revised scheme changes the GHG emissions reported in the SES1 and AP1 ES. Construction emissions have increased by 20% (800,000 tCO<sub>2</sub>e), operational emissions have decreased by 55% (-1,602,000 tCO<sub>2</sub>e) and emissions savings through modal shift have reduced by 87% (-3,337,000 tCO<sub>2</sub>e from -3,888,000 to -512,000 tCO<sub>2</sub>e) over the 120-design life. However, this does not alter the conclusions presented in the main ES and the SES1 and AP1 ES.

## In-combination climate change impacts assessment

- 14.2.22 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different significant in-combination climate change effects from those reported in the main ES.
- 14.2.23 The main ES identified a significant in-combination climate change effect at Annandale depot, an off-route works location. The effect identified in the main ES related to the planned on-site wastewater treatment plant at Annandale depot which would release treated wastewater into a nearby watercourse. The release of treated wastewater to surface watercourses and associated water bodies could have had a negative impact on water quality. The potential in-combination impact identified was that an increased frequency of dry spells could reduce flows in watercourses near the depot, increasing sensitivity to wastewater treatment discharges which could increase the negative impact on water quality.
- 14.2.24 As a result of the AP2 revised scheme, the significant in-combination climate change effect reported in Volume 3 of the main ES is now no longer relevant and has been removed. This change is as a result of the AP2 amendment for additional land permanently required for

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<sup>16</sup> High Speed Two Ltd (2022), Net Zero Carbon Plan: A cleaner, green future. Available online at: [https://assets.hs2.org.uk/wp-content/uploads/2022/01/25357\\_HS2\\_NetZeroCarbonPlan\\_CS1656\\_Final\\_InteractiveWeb.pdf](https://assets.hs2.org.uk/wp-content/uploads/2022/01/25357_HS2_NetZeroCarbonPlan_CS1656_Final_InteractiveWeb.pdf).

modifications to wastewater drainage at Annandale depot (AP2-ORW-001), which provides an alternative means of wastewater drainage. The AP2 revised scheme will therefore no longer include an on-site wastewater treatment plant at Annandale depot and treated wastewater will not be released into surface watercourses near the depot. Wastewater disposal will instead be diverted to discharge into the Scottish Water wastewater treatment works. This AP2 amendment removes the potential for increased frequency of dry spells to exacerbate the effect on water quality, which removes the significant in-combination climate change effect reported in Volume 3 of the main ES.

14.2.25 Table 17 provides a description of the differences to the assessment in relation to the effect previously identified at Annandale depot as a result of the AP2 revised scheme.

**Table 17: Water resources and flood risk in-combination climate change impact assessment**

<b>1. Resources/receptors potentially impacted by the Proposed Scheme</b>	<b>2. Project Phase and effects of Proposed Scheme on receptors/resources</b>	<b>3. Existing/embedded mitigation measures</b>	<b>4. Climate change trend and potential in-combination climate impact on: (i) Proposed Scheme effect (Column 2) and/or (ii) effectiveness of existing/embedded mitigation (Column 3)</b>	<b>5. Are additional/amended mitigation measures/monitoring required? (to address potential increase in the significance of the residual effect due to climate change)</b>	<b>6. Additional/amended mitigation measures/monitoring to address adverse effects on resources and receptors as a result of climate change (as identified in Column 4)</b>
Off-Route Works Annandale depot Hotspot: Surface water resources	Operational effects – (15) Effects on water quality due to release of treated wastewater into surface watercourses	As part of the AP2 revised scheme, an update to drainage design has provided an alternative means of wastewater drainage. Annandale depot will no longer include an on-site wastewater treatment plant, with treated wastewater being released into surface water courses. Wastewater disposal will instead be diverted to discharge into	Direct impact on effect: (15) None identified	No – As a result of the changes to drainage design, Annandale depot will no longer include an on-site wastewater treatment plant, with treated wastewater being released into surface watercourses. Therefore, there is no longer considered to be a risk of pollutants entering the watercourse at Annandale depot; nor is there considered to be an increase	Additional Mitigation Not required Additional Monitoring Not required

1. Resources/ receptors potentially impacted by the Proposed Scheme	2. Project Phase and effects of Proposed Scheme on receptors/ resources	3. Existing/ embedded mitigation measures	4. Climate change trend and potential in-combination climate impact on: (i) Proposed Scheme effect (Column 2) and/or (ii) effectiveness of existing/ embedded mitigation (Column 3)	5. Are additional/ amended mitigation measures/ monitoring required? (to address potential increase in the significance of the residual effect due to climate change)	6. Additional/ amended mitigation measures /monitoring to address adverse effects on resources and receptors as a result of climate change (as identified in Column 4)
		the Scottish Water wastewater treatment works.		in this effect as a result of dry conditions.	

## Climate change resilience assessment

- 14.2.26 A scoping exercise was undertaken to determine if the AP2 amendments would be likely to result in a material difference to the assessment of climate change resilience reported in the main ES. This determined that there would be no changes to the outcome of the climate change resilience assessment, as reported in the main ES.

## 15 Ecology and biodiversity

### 15.1 Introduction

- 15.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on ecology and biodiversity arising from the construction and operation of the original scheme.
- 15.1.2 Volume 3 of the AP1 ES reported that any variations as a result of the AP1 amendments were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 15.1.3 Section 5 of this volume reports the new, removed or different significant effects due to the SES2 changes.
- 15.1.4 This section of the AP2 ES identifies any new, removed or different likely significant effects on ecology and biodiversity compared to those reported in SES2, due to the AP2 amendments.
- 15.1.5 The assessment presented in this section of the report also considers the combined effects of the AP1 revised scheme and AP2 revised scheme.

### 15.2 Changes to the assessment

- 15.2.1 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different likely significant effects on ecology and biodiversity from those reported in SES2.

## Designated sites

### Statutory designations

- 15.2.2 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different likely significant effects on ecology and biodiversity from those reported in SES2.
- 15.2.3 There are 13 statutory designated nature conservation sites where it has not been possible to rule out significant effects as a result of the AP2 revised scheme at this stage of the assessment. These effects arise as a result of construction and/or operational phase traffic emissions effects. These designated sites comprise sites of international conservation value and national conservation value. The international value sites are: Manchester Mosses SAC; Rostherne Mere Ramsar site; Midland Meres and Mosses Ramsar Site Phase 1; Midland Meres and Mosses Ramsar Site Phase 2; and Rochdale Canal SAC. The national value sites, five of which are component parts of the above international sites are: Oakhanger Moss SSSI; Wettenhall and Darnhall Woods SSSI; The Mere, Mere SSSI; Tabley Mere SSSI; Holcroft Moss SSSI; Rostherne Mere SSSI; Cotterill Clough SSSI; and Rochdale Canal SSSI.

- 15.2.4 Further assessment of the potential effects will continue in accordance with the requirements of Regulation 63 of the Conservation of Habitats and Species Regulations 2017.
- 15.2.5 Other than for these sites, the AP2 revised scheme will not result in any new, removed or different likely significant effects on statutory designated nature conservation sites compared to those reported in SES2.

## **Non-statutory designations**

- 15.2.6 The AP2 revised scheme will reduce but not remove the adverse effect on Ryecroft Covert LWS, and will have a significant effect on two additional LWS and one Site of Biological Importance (SBI) that were not significantly affected by the SES2 scheme. These are Hancock's Bank North LWS, Jackson's Bank East LWS, and Rossmill SBI. The AP2 revised scheme therefore results in an adverse effect on 32 LWS and 4 SBI.
- 15.2.7 The AP2 revised scheme will remove the significant adverse effect at the national level on two Ancient Woodland Inventory (AWI) sites, these are Millington Clough AWI and Rye Covert AWI, but would have a significant effect on two additional ancient woodlands. These are Hancock's Bank North AWI, and Sunbank Wood AWI. The number of AWIs where there will be a significant adverse effect at the national level therefore remains at 15, as reported in the SES2. This is a different significant effect to that in the SES2 but the level of the route-wide effect remains the same.

## **Species**

- 15.2.8 The AP2 revised scheme will result in new significant effects at up to the county/metropolitan level on three populations/metapopulations of great crested newt. These are GCNMP1.3.24, GCNP1.3.17 and GCNP1.3.18. The main ES reported an adverse effect at up to county/metropolitan level on GCNP1.7.5. The AP2 revised scheme will remove this adverse effect.
- 15.2.9 The AP2 revised scheme does not result in any new, removed or different significant route-wide level effects on species compared to SES2.

## **Habitats**

- 15.2.10 There will be at least 24 veteran trees lost as a result of the AP2 revised scheme, which is the same as the number lost in the SES2 scheme.
- 15.2.11 The AP2 revised scheme will result in the following losses to the most notable habitats that are described in SES2:
- ancient woodland – the AP2 revised scheme will result in the loss of 4.9ha of ancient woodland, compared with 4.5ha in the SES2 scheme;
  - semi-natural broadleaved woodland – the AP2 revised scheme will result in the loss of 32.9ha of semi-natural broadleaved woodland, compared to 20.7ha in the SES2 scheme;

- grassland – the AP2 revised scheme will result in the loss of 37.5ha of unimproved and semi-improved grassland likely to qualify as a habitat of principal importance, compared to 30.7ha in the SES2 scheme;
- hedgerow – the AP2 revised scheme will result in the loss of 253.5km of hedgerows, compared to 237.4km in the SES2 scheme; and
- ponds – the AP2 revised scheme will result in the loss of 273 ponds, compared to 254 in the SES2 scheme.

15.2.12 The AP2 revised scheme will result in new adverse effects on ancient woodland as described above. However, this does not change the level of significance of the route-wide effect. With the implementation of the mitigation measures described in the SES2 and AP2 ES Volume 2 Community area reports, the AP2 amendments do not result in any other new, removed or different significant route-wide level effects on habitats.

## 15.3 Combined effects of AP1 revised scheme and AP2 revised scheme

- 15.3.1 This section of the report considers the AP2 revised scheme in combination with all relevant AP1 amendments to identify the potential for new, removed or different route-wide level effects to those reported above.
- 15.3.2 An assessment was undertaken to determine if the AP2 revised scheme combined with AP1 amendments would be likely to result in any new, removed or different likely significant effects on ecology and biodiversity.

**Table 18: Combined effects of AP2 amendments and AP1 amendments**

Type of receptor	AP1 revised scheme	AP2 revised scheme	Combined effect of AP1 and AP2
Statutory designations	<p>The AP1 revised scheme will (on a precautionary basis) result in significant effects on one additional statutory site compared to the main ES.</p> <p>No other, new, removed or different likely significant effects on statutory designated nature conservation sites.</p>	<p>It has not been possible to rule out significant effects of the AP2 revised scheme on the following statutory designated sites:</p> <ul style="list-style-type: none"> <li>• Holcroft Moss SSSI;</li> <li>• Manchester Mosses SAC;</li> <li>• Rostherne Mere Ramsar Site;</li> <li>• Rostherne Mere SSSI</li> <li>• The Mere, Mere SSSI;</li> <li>• Rochdale Canal SAC;</li> <li>• Rochdale Canal SSSI;</li> <li>• Oakhanger Moss SSSI;</li> <li>• Midland Meres and Mosses Ramsar Site</li> </ul>	<p>It has not been possible to rule out significant effects of the AP2 revised scheme combined with AP1 amendments on the following statutory designated sites:</p> <p>Holcroft Moss SSSI;</p> <p>Manchester Mosses SAC;</p> <p>Rostherne Mere Ramsar Site;</p> <p>Rostherne Mere SSSI;</p> <p>The Mere, Mere SSSI;</p> <p>Rochdale Canal SAC;</p> <p>Rochdale Canal SSSI;</p> <p>Oakhanger Moss SSSI;</p> <p>Midland Meres and Mosses Ramsar Site Phase 1;</p> <p>Midland Meres and Mosses</p>

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Type of receptor	AP1 revised scheme	AP2 revised scheme	Combined effect of AP1 and AP2
		Phase 1; <ul style="list-style-type: none"> <li>• Midland Meres and Mosses Ramsar Site Phase 2;</li> <li>• Wettenhall and Darnhall SSSI;</li> <li>• Tabley Mere SSSI; and</li> <li>• Cotterill Clough SSSI.</li> </ul> No other new, removed or different likely significant effects on statutory designated nature conservation sites.	Ramsar Site Phase 2; Wettenhall and Darnhall SSSI; Tabley Mere SSSI; and Cotterill Clough SSSI.  The AP2 revised scheme combined with AP1 amendments will not result in any other new, removed or different likely significant route-wide effects compared to the AP2 revised scheme alone on statutory designated nature conservation sites.
Non statutory designations	No new, removed or different likely significant effects on non-statutory designated nature conservation sites.	The AP2 revised scheme will result in significant effects on two additional non statutory sites. No other new, removed or different likely significant effects on non-statutory designated nature conservation sites.	The AP2 revised scheme combined with AP1 amendments will result in significant effects on two additional non statutory sites. It will not result in any other new, removed or different likely significant route wide effects compared to the AP2 revised scheme alone on non-statutory designated nature conservation sites.
Ancient Woodlands	No new, removed or different likely significant effects on AWIs.	The AP2 revised scheme will remove significant adverse effects on two AWIs and result in significant effects on two additional AWIs. No other new, removed or different likely significant effects on AWIs.	The AP2 revised scheme combined with AP1 amendments will remove significant adverse effects on two AWIs and result in significant effects on two additional AWIs. It will not result in any other new, removed or different likely significant route wide effects compared to the AP2 revised scheme alone on AWI sites.
Species	No new, removed or different likely significant effects on species	No new, removed or different likely significant effects on species	The AP2 revised scheme combined with AP1 amendments will not result in any new, removed or different significant route-wide level effects compared to the AP2 revised scheme alone on species.

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Type of receptor	AP1 revised scheme	AP2 revised scheme	Combined effect of AP1 and AP2
Habitats	No new, removed or different likely significant effects on habitats	No new, removed or different likely significant effects on habitats	<p>There will be at least 24 veteran trees lost as a result of the AP2 revised scheme combined with AP1 amendments.</p> <p>The AP2 revised scheme combined with AP1 amendments will result in the following losses to the most notable habitats:</p> <ul style="list-style-type: none"> <li>• ancient woodland – the AP2 revised scheme combined with AP1 amendments will result in the total loss of 5.4ha of ancient woodland;</li> <li>• semi-natural broadleaved woodland – the AP2 revised scheme combined with AP1 amendments will result in the total loss of 33ha of semi-natural broadleaved woodland;</li> <li>• grassland – the AP2 revised scheme combined with AP1 amendments will result in the total loss of 38.5ha of unimproved and semi-improved grassland likely to qualify as a habitat of principal importance;</li> <li>• hedgerow – the AP2 revised scheme combined with AP1 amendments will result in the total loss of 250.7km of hedgerows; and</li> <li>• ponds – the AP2 revised scheme combined with AP1</li> </ul>



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Type of receptor	AP1 revised scheme	AP2 revised scheme	Combined effect of AP1 and AP2
			<p>amendments will result in the total loss of 271 ponds.</p> <p>The AP2 revised scheme combined with AP1 amendments will not result in any new, removed or different significant route-wide level effects on habitats compared to the AP2 revised scheme alone.</p>

## 16 Electromagnetic interference

### 16.1 Introduction

- 16.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on electromagnetic Interference (EMI) arising from the construction and operation of the original scheme. It summarised the route-wide effects on human health, electrical equipment, third party assets and infrastructure running parallel to the original scheme for example other railway infrastructure, metallic fences, pipelines, overhead power cables and telecommunications cables on motorways.
- 16.1.2 Volume 3 of AP1 ES reported that any variations as a result of the AP1 amendments were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 16.1.3 Section 6 of this volume reports that the SES2 changes would result in no changes to the significant route-wide effects reported in the main ES.
- 16.1.4 This section of the AP2 ES identifies any new, removed or different likely significant effects on EMI compared to those reported SES2, due to the AP2 amendments.

### 16.2 Changes to the assessment

- 16.2.1 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different likely significant effects on EMI from those reported in SES2.
- 16.2.2 SES2 and AP2 ES Volume 5, Appendix: EMI-001-00000, describes the EMI assessment and documents the differences to effects to potentially affected receptors as a result of the AP2 amendments.
- 16.2.3 The AP2 amendments are not considered to result in any new, removed or different likely significant route-wide effects from those presented in SES2.

## 17 Major accidents and disasters

### 17.1 Introduction

- 17.1.1 Volume 3 of the main ES reported an assessment of the route-wide impacts and likely significant effects arising directly from the construction and operation of the original scheme if it were to be affected by a major accident and/or disaster.
- 17.1.2 Volume 3 of AP1 ES reported that any variations as a result of the AP1 amendments were not sufficient in scale to result in any new, removed or different likely significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 17.1.3 Section 7 of this volume reports that the SES2 changes would result in no changes to the effects reported in the main ES.
- 17.1.4 This section of the report identifies any new, removed or different likely significant effects to those reported in SES2, due to the AP2 amendments.

### 17.2 Changes to the assessment

- 17.2.1 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different likely significant effects on the vulnerability of the AP2 revised scheme to major accidents and disasters from that reported SES2.
- 17.2.2 A review of the foreseeable risks associated with the AP2 revised scheme, recorded in a risk register as required under the CDM 2015 Regulations, has been undertaken. This review concluded that the AP2 amendments are not considered to result in new, removed or different likely significant effects from those reported in SES2.
- 17.2.3 A full record of risk identification, risk screening and final risk assessment is provided in Major accidents and disasters risk screening in SES2 and AP2 ES Volume 5, Appendix: MA-001-00000.
- 17.2.4 As reported in Section 21 Water resources and flood risk new or different likely residual significant flood risk effects from those reported in Volume 3 of the main ES and the AP1 ES have been identified as a result of the AP2 changes. Previously reported significant effects on flood risk have been removed. The new, different, and removed likely residual significant effects will not result in any changes to the associated major accidents and disasters risk events and embedded mitigation measures reported in the main ES (risk events CM9 and OM7). No changes to the climate change resilience assessment from that reported in Volume 3 of the main ES and the AP1 ES have been identified as a result of the AP2 changes.
- 17.2.5 The AP2 revised scheme does not result in any new, removed or different likely significant effects.

## 18 Socio-economics

### 18.1 Introduction

- 18.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on socio-economics arising from the construction and operation of the original scheme. It reported route-wide effects as a result of the original scheme in relation to:
- route-wide construction employment created (direct and indirect);
  - employment in businesses directly and indirectly affected by construction;
  - operational employment; and
  - operational effects on existing business employment.
- 18.1.2 Volume 3 of AP1 ES reported that the AP1 amendments to the original scheme, as amended by the SES1, will result in the removal of a significant effect in relation to job displacement as a result of direct and indirect construction effects.
- 18.1.3 This section of the AP2 ES identifies any new, removed or different likely significant socio-economic effects compared to those reported SES2, due to the AP2 amendments.

### 18.2 Changes to the assessment

- 18.2.1 An assessment was undertaken to determine if the AP2 amendments will be likely to result in any new, removed or different likely significant effects on socio-economics from those reported in SES2.
- 18.2.2 The AP2 revised scheme will increase the total number in existing employment affected by construction but will not alter the conclusions of the assessment. There will be minimal impact on the total number employed constructing the revised scheme.
- 18.2.3 None of the amendments proposed as part of the AP2 revised scheme have been identified as likely to result in any new or different significant route-wide socio-economic effects from those reported in SES2.
- 18.2.4 There will be no changes to operational employment or businesses during operation as a result of the AP2 revised scheme.

## 19 Traffic and transport

### 19.1 Introduction

- 19.1.1 Section 9 of Volume 3 of the main ES reported the route-wide impacts and likely significant effects on traffic and transport arising from the construction and operation of the original scheme.
- 19.1.2 Section 21 of Volume 3 of the SES1 and AP1 ES reported any new, removed or different likely route-wide significant effects on traffic and transport arising from the construction of the AP1 revised scheme.
- 19.1.3 This section of the AP2 ES identifies any new, removed or different likely significant effects on traffic and transport on the highway and rail network during construction as a result of the SES2 changes and AP2 amendments (referred to as the AP2 revised scheme) compared to those reported in Volume 3 of the main ES and Volume 3 of the SES1 and AP1 ES.

### 19.2 Changes to the assessment

- 19.2.1 This section identifies whether the SES2 changes and AP2 amendments combined have the potential to result in a material difference to the traffic and transport assessments reported in Volume 3 of the main ES and Volume 3 of the SES1 and AP1 ES.
- 19.2.2 For construction, the SES2 changes have been assessed together with AP2 amendments as it is not possible to separate out the impacts and effects of each change within the assessment. This is because alterations in construction traffic flows cannot generally be directly attributed to particular SES changes or AP amendments.
- 19.2.3 For operation, the SES1 and SES2 changes have been assessed together with AP1 and AP2 amendments as no route-wide operational assessment was carried out for the AP1 revised scheme and it is not possible to separate out the impacts and effects of each change within the assessment. This is because changes in rail passenger demand, modal shift and changes in highway use cannot generally be directly attributed to particular SES changes or AP amendments.
- 19.2.4 The scheme described in this this section is referred to as the AP2 revised scheme.

## Assessment of the effects of construction

### Impacts arising on the highway network during construction

- 19.2.5 The impacts of construction traffic are primarily focussed on the road network close to the original scheme, which includes the principal routes for movement of excavated material. These local impacts are considered within the Volume 2, Community area reports, Section 14

of the main ES. These assessments consider the effects of construction activity on roads extending from the original scheme to the strategic road network (SRN).

- 19.2.6 The AP2 revised scheme results in a net reduction in the total number of construction HGV compared to the main ES of 1.175 million lorry movements. This is an increase of 7% or 0.39 million lorry movements from the AP1 revised scheme but a net reduction of 17% compared to the original scheme as reported in the Volume 3 of the main ES. The following changes make a particular contribution to the changes in traffic flows:
- Additional land permanently required to reconfigure M56 junction 6 (AP2-006-014);
  - Additional land permanently required for changes to design elements managed by the Manchester tunnel north portal main compound (AP2-007-008); and
  - Additional land permanently required for modifications to the multi-modal transport hub (AP2-008-003).
- 19.2.7 At a route-wide level these changes are not considered to represent a significant effect, which is unchanged from the Volume 3 of the main ES and the AP1 ES. In addition, the impacts on the SRN across and outside community areas are not considered likely to result in any route wide effects, which is also unchanged from the main ES and AP1 ES.

## **Impacts on the railway network during construction**

- 19.2.8 The type and number of possessions required for the original scheme on existing railway lines are summarised in Table 32, Section 14 of Volume 3 of the main ES. The change in the number of possessions and blockades between the original scheme and the AP1 revised scheme are set out in Table 8, Section 21 of Volume 3 of the AP1 ES.
- 19.2.9 The changes in the numbers of possessions and blockades between the AP1 revised scheme and the AP2 revised scheme are set out in Table 19 below. This indicates that there are only minor differences in possessions and blockades as a result of the AP2 revised scheme. There will be a change in the Hough to Walley's Green area (MA01) from a 54 hour to 27 hour possession, and four additional 54 hour possessions with two in the Hulseheath to Manchester Airport area (MA06), one in the Davenport Green to Ardwick area (MA07) and one in the Annandale depot off-route works location.
- 19.2.10 At a route-wide level, there were 153 non-standard possessions and blockades affecting passengers and freight on the WCML for the original scheme reported in the main ES. For the AP1 revised scheme, this reduced to 119, a reduction of 34 as reported in the SES1 and AP1 ES. For the AP2 revised scheme this is increased to 123, an increase of 4.
- 19.2.11 At a route-wide level, the substantial number and extended duration of possessions and blockades will lead to a significant major adverse effect on West Coast Main Line (WCML) rail passengers and freight, which is unchanged from the conclusions in the main ES and the SES1 and AP1 ES.

**Table 19: Summary of changes to likely route-wide possession and blockade requirements**

Changes to Route-wide possessions and blockades affecting WCML users with the potential for route-wide impacts	27-hour (difference between AP1 revised scheme and AP2 revised scheme)	54-hour (difference between AP1 revised scheme and AP2 revised scheme)	72-hour (difference between AP1 revised scheme and AP2 revised scheme)	100-hour (difference between AP1 revised scheme and AP2 revised scheme)	Blockades (difference between AP1 revised scheme and AP2 revised scheme)
Hough to Walley's Green area (MA01)	1	-1	-	-	-
Hulseheath to Manchester Airport area (MA06)	-	2	-	-	-
Davenport Green to Ardwick area (MA07)	-	1	-	-	-
Annandale Depot (MA09)	-	1	-	-	-
Total change	1	3	-	--	-

## Assessment of the effects of operation

### Updates since the main ES and the SES1 and AP1 ES

- 19.2.12 The removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001) reported in the SES1 and AP1 ES, impacts both journey time savings to destinations on the WCML north of Manchester and passenger demand including the extent of changes in mode share and changes in vehicle and passenger kilometres by mode.
- 19.2.13 As reported in the main ES, the PLANET Framework Model (PFM)<sup>17</sup> is used to estimate travel by HS2, other rail services and other transport modes. It provides mode share information for rail, car and air travel both without and with HS2. For the assessment of the original scheme, PFM9.6 was used. This has been updated to PFM10a for the assessment of the AP2 revised scheme and reflects the re-estimation of the long-distance demand model using

<sup>17</sup> The PLANET Framework Model (PFM) is the Department for Transport forecasting model which has been used to develop rail demand forecasts for the AP2 revised scheme. PFM has been developed by HS2 Ltd from a suite of models originally developed by the Strategic Rail Authority (SRA). PFM is the most appropriate modelling tool to be used in terms of forecasting the demand impacts of the AP2 revised scheme given its strategic capability, covering all long-distance rail, car and air movements across England, Scotland and Wales. PFM has evolved over a number of years and builds on existing model components.

more recent survey data from the National Travel Survey (NTS) and updated values of travel time savings from the Department for Transport (DfT) 2015 study<sup>18</sup>.

- 19.2.14 Forecasts show increased demands for long distance rail travel in the future. Without HS2, the WCML will become increasingly congested. HS2 will introduce new capacity with accompanying reductions in journey times, enhanced passenger experience and reduced congestion and passenger crowding on the conventional rail network.

## **Changes to train patterns and services during operation**

- 19.2.15 The train service specification (TSS) for the original scheme, including Phase One and Phase 2a, comprised 11 services per hour per direction to and from London Euston and three services per hour per direction starting at Birmingham Curzon Street.
- 19.2.16 The 11 services per hour for the original scheme to and from London Euston comprised: three services per hour London-Birmingham; three services per hour London-Manchester; two services per hour London-Scotland; and three services per hour London-North West (Liverpool, Liverpool/Lancaster and Macclesfield). In addition to the three services per hour London-Birmingham, three further services per hour to and from Birmingham Curzon Street for the original scheme comprised: two services per hour to Manchester and one service per hour to Scotland.
- 19.2.17 For the original scheme, the two trains to Scotland from Euston split at Carlisle to serve Glasgow and Edinburgh. For the AP2 revised scheme this reduces to one service per hour between London and Glasgow, with no service to Edinburgh. In addition, the Birmingham to Scotland service is removed.

## **Impacts on journey times during operation**

- 19.2.18 Journey time savings for the original scheme were reported in Section 14.6 of the Volume 3 main ES. The removal of the HS2 WCML connection (SES1-004-001) at SES1 will result in changes to journey times to stations north of Manchester on the WCML. The current fastest journey times, the journey times with HS2 Phase One and Phase 2a, the journey times with the original scheme including HS2 Phase One and 2a (as reported in Volume 3 of the main ES) and the journey times with the AP2 revised scheme including HS2 Phase One and 2a are set out in Table 20. The minor differences between some destinations is a result of reworking of the train service specification associated with the removal of the HS2 WCML connection.
- 19.2.19 When combined with Phase One and 2a, the journey time savings between London Euston and Manchester Piccadilly, Preston and Glasgow Central and between Birmingham Curzon

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<sup>18</sup> Department for Transport (2015), *Values of travel time savings and reliability: final reports*. Available online at: <https://www.gov.uk/government/publications/values-of-travel-time-savings-and-reliability-final-reports>.



Street and Manchester Piccadilly and Glasgow Central were assessed in the main ES as a major beneficial effect which was significant. This is unchanged for the AP2 revised scheme.

- 19.2.20 When compared to a baseline containing both Phase One and 2a, the incremental journey time reductions of the original scheme were assessed as a minor beneficial effect, which was significant, on journey times between London Euston and Manchester Piccadilly and Preston and between Birmingham and Manchester Piccadilly and Scotland.
- 19.2.21 For the AP2 revised scheme, the minor beneficial effects on journey time savings between London Euston and Manchester Piccadilly and between Birmingham Curzon Street and Manchester Piccadilly remain as minor beneficial. However, with the removal of the HS2 WCML connection (SES1-004-001) at SES1, the minor beneficial effects on journey time savings between London Euston and Preston and the major beneficial effects between Birmingham Curzon Street and Preston and Scotland are removed.

**Table 20: Journey times between key destinations ‘without’ and ‘with’ the AP2 revised scheme in operation**

Train origin/destination	Train destination/origin	Current fastest standard hour journey time by conventional rail (hours: minutes)	Fastest standard hour journey time with HS2 Phase One and Phase 2a alone (hours: minutes)	Fastest standard hour journey time with the original Phase 2b scheme (including Phase One and Phase 2a) as reported in Volume 3 of the main ES	Fastest standard hour journey time with the Phase 2b AP2 revised scheme (including Phase One and Phase 2a) (hours: minutes)
London Euston	Crewe	1:30	0:56	0:56	0:55
	Manchester Airport	2:24 to conventional rail station	1:43 via Manchester Piccadilly High Speed station	1:03 to Manchester Piccadilly High Speed station	1:02 to Manchester Airport High speed station
	Manchester Piccadilly	2:06	1:30	1:11	1:11
	Preston	2:08	1:31	1:18	1:30
	Liverpool Lime Street	2:14	1:34	1:34	1:34
	Glasgow Central	4:29	3:48	3:46	3:48
Birmingham Curzon Street	Manchester Piccadilly	1:28	1:29	0:41	0:41

## Impacts on travel demand during operation

- 19.2.22 Daily HS2 boardings and alightings for the original scheme are reported for 2038 and 2046 in Section 14.6 and Table 34 of the Volume 3 main ES. For the AP2 revised scheme, Table 21 below replaces Table 34 in Volume 3 of the main ES and updates the assessment years for 2038 and 2046 with 2039 and 2051 respectively. A number of stations reported in Table 34 of the main ES are not included in Table 21 below due to changes in the train service specification for the AP2 revised scheme. Compared with the forecasts for the original

scheme as reported in the main ES, the forecasts for the AP2 revised scheme are lower, with an overall reduction in HS2 boarders and alighters for those stations shown in Table 21 of 19% for both 2039 and 2051. However, the reduction in HS2 boardings and alightings in 2051 for journeys to the two Manchester stations combined is 4%.

- 19.2.23 The largest percentage reductions in HS2 passengers between the original scheme and the AP2 revised scheme are at those stations impacted by the Removal of the HS2 WCML connection (SES1-004-001), namely Wigan North Western (-57%), Preston (-55%), Lancaster (-35%), Carlisle (-65%) and Glasgow Central (-42%).
- 19.2.24 Volume 3 of the main ES reported that, with the original scheme new capacity for long-distance rail journeys will be introduced with accompanying reductions in journey times and enhanced passenger experience. This would result in released capacity and reduced congestion and passenger crowding on the conventional rail network. This is unchanged for the AP2 revised scheme.

**Table 21: HS2 boardings and alightings by station for AP1 and AP2 revised schemes - all phases, 2039 and 2051**

HS2 station	Total boarders 2039	Total alighters 2039	Total boarders 2051	Total alighters 2051
Manchester Airport High Speed station	7,986	7,915	8,582	8,500
Manchester Piccadilly High Speed station	17,310	17,156	18,618	18,438
Euston	45,439	47,165	47,883	49,707
Old Oak Common	26,648	25,669	28,395	27,368
Birmingham Interchange	11,960	11,966	12,684	12,691
Birmingham Curzon Street	19,315	18,787	20,527	19,975
Stafford	1,566	1,766	1,667	1,881
Stoke-On-Trent	699	683	748	730
Crewe	6,574	6,652	6,917	6,991
Macclesfield	434	435	465	466
Runcorn	3,173	3,049	3,331	3,203
Warrington Bank Quay	1,099	1,032	1,165	1,092
Liverpool Lime Street High Level	5,269	5,209	5,592	5,527
Wigan North Western	1,033	1,043	1,098	1,109
Preston	5,208	5,139	5,519	5,424
Lancaster	1,389	1,542	1,476	1,664
Carlisle	1,495	1,334	1,577	1,408
Glasgow Central	4,231	4,280	4,498	4,554
Total	160,828	160,822	170,742	170,728

## Impacts on long distance travel and modal share

- 19.2.25 Changes in mode share from car and potentially air, together with newly generated rail trips as a result of increased capacity, improved journey times and the additional services

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provided to take advantage of released capacity, are reported in Section 14.6 of the Volume 3 main ES. Tables 35 and 36 in the main ES report the sources of HS2 demand for the original scheme on a daily and annual basis and are replaced in this report by Table 22 and Table 23 below for the AP2 revised scheme.

- 19.2.26 The main ES reported that the combined Phase One, Phase 2a and original scheme would attract 70m passengers per annum in 2046. This was an increase of 18.2 million passenger per annum compared to HS2 Phase One and Phase 2a alone. The AP2 revised scheme will attract 54.5m passengers per annum in 2051. This is an increase of 5.6m passengers per annum as a result of the AP2 revised scheme compared to Phase One and Phase 2a alone.
- 19.2.27 With the AP2 revised scheme in combination with Phase One and Phase 2a, 21% of the total demand is newly generated, compared to 20% for Phase One and Phase 2a, due to new journey opportunities, reduced travel times and higher frequencies. The percentage of HS2 demand abstracted from conventional rail reduces slightly compared to previous phases of HS2, from 77% for Phase One and Phase 2a and to 75% for the AP1 and AP2 revised schemes in combination with Phase One and Phase 2a, corresponding to the increase in newly generated demand. The proportion from car and air remain constant between phases, at around 3% and 1% respectively.
- 19.2.28 The overall change in rail travel, with a proportion of HS2 trips being generated as new travel, demonstrates the levels of travel suppressed by capacity constraints and journey times. The overall change in rail travel shows the substantial travel opportunities and aspirations that the AP2 revised scheme in combination with Phase One and Phase 2a and the released capacity services would realise.

**Table 22: Number and mode share of HS2 passenger trips – daily (2039 and 2051), PFM10a**

Source of HS2 demand	2039 Phase One and Phase 2a	2039 Phase One, Phase 2a and AP2 revised scheme	2051 Phase One and Phase 2a	2051 Phase One, Phase 2a and AP2 revised scheme
Total HS2 trips, of which:	144,506	159,960	152,556	169,825
From conventional rail	109,872	119,073	115,002	125,043
From car	3,910	4,939	4,179	5,255
From air	1,107	1,198	1,267	1,381
Newly generated by HS2	29,612	34,745	32,108	38,147

**Table 23: Number and mode share of HS2 passenger trips – annual (millions) (2039 and 2051), PFM10a**

Source of HS2 demand	2038 Phase One and Phase 2a	2038 Phase One, Phase 2a and AP2 revised scheme	2051 Phase One and Phase 2a	2051 Phase One, Phase 2a and AP2 revised scheme
Total HS2 trips, of which:	46.2	51.3	48.9	54.5
From conventional rail	35.7	38.9	37.5	40.9
From car	1.2	1.5	1.3	1.6

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Source of HS2 demand	2038 Phase One and Phase 2a	2038 Phase One, Phase 2a and AP2 revised scheme	2051 Phase One and Phase 2a	2051 Phase One, Phase 2a and AP2 revised scheme
From air	0.3	0.4	0.4	0.4
Newly generated by HS2	8.9	10.5	9.7	11.6

- 19.2.29 The transfer of passengers from the conventional rail network and from mode transfer from car will result in benefits through reducing forecast future congestion on both the SRN and the conventional rail network. The extent of reduction in highway vehicle kilometres as a result of the original scheme is shown in Table 37 of Volume 3 in the main ES; this is replaced by Table 24 below for the AP2 revised scheme.
- 19.2.30 Table 24 shows that the impact of the AP2 revised scheme will be a reduction in total annual vehicle travel by car of 240 million kilometres by 2051. In incremental terms, the AP2 revised scheme compared with a baseline containing Phase One and Phase 2a shows a reduction in annual vehicle kilometres of 30 million vehicle kilometres by 2051. This contributes approximately 13% of the in-combination total vehicle kilometre savings of HS2 Phase One, Phase 2a and the AP2 revised scheme together.
- 19.2.31 The biggest reductions in vehicle kilometres are for journeys to and from Scotland. This is a result of the removal of the HS2 WCML connection (SES1-004-001) and changes to the train service specification which impact these long-distance trips with a consequential impact on highway vehicle kilometres.

**Table 24: Reduction in vehicle kilometres (millions) resulting from mode shift. AP2 revised scheme compared with Phase One and 2a, PFM10a, 2051**

Trip category	Change in annual vehicle kilometres, 2051		
	Phase One and 2a	AP2 revised scheme	Incremental impact of AP2 revised scheme
Car vehicle kilometres access to long distance rail (including London)	108,137,968	121,357,451	13,219,484
Highway long distance trips vehicle kilometres	-236,603,698	-288,483,675	-51,879,977
Highway local trips vehicle kilometres (from regional models)	-72,318,501	-62,998,696	9,319,805
Air access vehicle kilometres	-8,992,620	-9,747,781	-755,161
Total	-209,776,851	-239,872,701	-30,095,849

- 19.2.32 The AP2 revised scheme in combination with Phase One and Phase 2a are shown to increase demand for rail travel and provide beneficial relief to the conventional rail network as well as beneficial reductions in long distance travel by car, both of which are substantial increases compared to Phase One and Phase 2a in combination. Whilst these impacts for the AP2 revised scheme in isolation are lower than for the original scheme as reported in Volume 3 of the main ES, they are considered to provide a major beneficial effect which is significant.

## 20 Waste and material resources

### 20.1 Introduction

- 20.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on waste and material resources arising from the construction and operation of the original scheme. It reported that for inert and hazardous landfill capacity, the effect during construction would be minor adverse, which does not comprise a significant environmental effect. For non-hazardous landfill capacity, the main ES reported a moderate adverse effect, which is considered to constitute a significant effect. The main ES reported a negligible impact on non-hazardous landfill during operation.
- 20.1.2 The waste and material resources assessment within SES1 and AP1 ES Volume 3 assessed and reported SES1 changes together with the AP1 amendments. The waste and material resources assessment reported that as a result of the SES1 changes and AP1 amendments, variations were not sufficient in scale to alter the conclusions presented in Volume 3 of the main ES.
- 20.1.3 Section 10 of this volume reports that whilst the SES2 changes would result in changes to the quantities of waste generated, it is not possible to disaggregate changes to waste generation resulting from SES2 changes, from those arising due to AP2 amendments. This section of the AP2 ES therefore considers both the SES2 changes and AP2 amendments together.

### 20.2 Changes to the assessment

- 20.2.1 An assessment was undertaken to determine if the SES2 changes and AP2 amendments would be likely to result in any new, removed or different likely significant effects on waste and material resources from those reported in Volume 3 of the main ES, as amended by SES1 and AP1 ES.

#### **Policy framework**

- 20.2.2 The policy framework in relation to waste management is as set out in Volume 3 of the SES1 and AP1 ES.

#### **Environmental baseline**

#### **Waste arisings and management**

#### **Construction, demolition and excavation**

- 20.2.3 No update to the data used in developing the national and regional baseline and future baseline for construction, demolition and excavation waste (CDEW) arisings and

management in the North West region has been published, and these remain as set out in Volume 3 of the SES1 and AP1 ES.

## **Commercial and industrial waste**

### **National commercial and industrial waste**

- 20.2.4 Since development of the national commercial and industrial waste baseline in Volume 3 of the SES1 and AP1 ES, a new year of data has been published by Defra<sup>19</sup> for 2020, which has been taken into account in establishing the baseline and future baseline for national commercial and industrial (C&I) waste arisings and management. The latest available data shows that the quantity of C&I waste produced in England in 2020 has reduced to 33.8m tonnes, a decrease of 9% on the quantity reported for 2019 in Volume 3 of the SES1 and AP1 ES.
- 20.2.5 Annual estimates of waste generation by the C&I sectors in England have been calculated by Defra between 2010 and 2020 as part of the Waste Statistics Regulation reporting requirements; the Defra estimates show an average annual C&I waste increase of 0.66%. Based on this growth, the projected quantity and management of C&I waste in England during the construction phase of the AP2 revised scheme (2025 to 2038), and during the first full year of operation of the AP2 revised scheme (2039) has been calculated to develop the baseline and future baseline (see Table 25)

**Table 25: Baseline and future baseline national C&I waste arisings**

<b>Year</b>	<b>Landfill (tonnes)</b>	<b>Diverted from landfill (tonnes)</b>	<b>Total (tonnes)</b>
2022	8,060,875	26,189,270	34,250,145
2025 - 2038	120,214,487	390,569,195	510,783,682
2039	9,020,297	29,306,368	38,326,665

### **Regional commercial and industrial waste**

- 20.2.6 No update to the data used in developing the Regional baseline and future baseline for the North West region has been published, and these remain as set out in Volume 3 of the SES1 and AP1 ES.

## **Waste infrastructure**

- 20.2.7 At the time of writing, no update to the waste infrastructure baseline data has been published since development of the environmental baseline for waste infrastructure in Volume 3 of the SES1 and AP1 ES. The baseline and future baseline with respect to waste infrastructure remains as set out in Volume 3 of the SES1 and AP1 ES.

<sup>19</sup> Department for Environment, Food and Rural Affairs (2022), *UK Statistics on Waste – 12 July 2022*. Available online at: <https://www.gov.uk/government/statistical-data-sets/env23-uk-waste-data-and-management>.

## Assessment of the effects of construction

### Assessment of impacts and effects

#### Construction, demolition and excavation waste

- 20.2.8 Table 26 provides a summary of material and waste quantities forecast to be generated by excavation, demolition and construction works for the AP2 revised scheme during the period 2025 to 2038.
- 20.2.9 In the main ES and SES1 and AP1 ES, it was assumed as a reasonable worst case that all surplus excavated material would be sent to landfill. HS2 Ltd has continued to review this assumption, taking into account published national and regional datasets and current HS2 Phase One diversion and reuse performance.
- 20.2.10 It is not possible to make firm commitments for the reuse of surplus excavated material in nominated third-party schemes due to the uncertainties of those schemes relative to the scope and programme of the earthworks activities of the AP2 revised scheme. However, in the context of current industry practice, the previous assumption is no longer considered representative of the reasonable worst case with respect to landfill diversion performance likely to be achieved during construction. It is assumed for the AP2 revised scheme, as a reasonable worst-case, that 35% of inert surplus excavated material will be diverted from landfill. The assumption that all non-hazardous and hazardous surplus excavated material will be sent to landfill remains unchanged.

**Table 26: Summary of material and waste quantities that will be generated by excavation, demolition and construction works of the AP2 revised scheme, 2025 to 2038**

Source	Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Excavation	24,043,125	20,067,141	3,975,984
Demolition	523,794	471,414	52,379
Construction	1,670,419	1,503,377	167,042
Total AP2 revised scheme	26,237,337	22,041,932	4,195,406
Proportion AP2 revised scheme	100%	84%	16%
Total AP1 revised scheme	23,583,276	17,793,098	5,790,179
% change from AP1 revised scheme	11%	24%	-28%
Total original scheme	31,424,460	26,420,514	5,003,946
% change from original scheme	-17%	-17%	-16%

- 20.2.11 Table 26 shows that the AP2 revised scheme will generate approximately 26 million tonnes of excavated material, demolition material and construction waste during the period 2025 to 2038. This represents an 11% increase on the quantity of excavated material, demolition material and construction waste reported for the AP1 revised scheme, but a 17% decrease

on the excavated material, demolition material and construction waste reported for the original scheme.

- 20.2.12 Of the 26 million tonnes of excavated material, demolition material and construction waste expected to be generated, approximately 84% of this quantity will be diverted from landfill via on and off-site reuse, recycling and recovery. This represents an increase from approximately 75% reported in Volume 3 of the SES1 and AP1 ES, and remains unchanged from approximately 84% reported in Volume 3 of the main ES.

## **Commercial and industrial waste**

- 20.2.13 Worker accommodation site waste will be managed as C&I waste. The AP2 revised scheme is forecast to generate approximately 621 tonnes of worker accommodation site waste during the construction period of 2025 to 2038, arising from the construction compounds proposed with temporary worker accommodation. This represents a decrease of 356 tonnes on the quantity of worker accommodation site waste reported for the AP1 revised scheme, and a decrease of 266 tonnes on the quantity reported for the original scheme.
- 20.2.14 Table 27 presents a summary of the forecast worker accommodation site waste quantities for the AP2 revised scheme.

**Table 27: Forecast worker accommodation site waste quantities for the AP2 revised scheme, 2025 to 2038**

<b>Scheme</b>	<b>Total quantity of waste (tonnes)</b>	<b>Quantity diverted from landfill (tonnes)</b>	<b>Quantity for off-site disposal to landfill (tonnes)</b>
Original scheme	887	488	399
AP1 revised scheme	977	537	440
AP2 revised scheme	621	342	280

## **Likely significant environmental effects**

- 20.2.15 In a small number of instances, construction of the AP2 revised scheme requires works which are geographically removed from the land immediately adjacent to the route. The location and nature of the proposed off-route works are described in Volume 4, Off-route effects, where the local environmental effects are also reported.
- 20.2.16 Due to the isolated nature of the off-route works, it is considered as a reasonable worst-case, that the waste would typically be managed within the region in which it is generated, although in some cases this comprises of the same region as the route-wide works (the North West). The impact of these off-route works, and the combined impact with the route-wide components of the AP2 revised scheme are presented in the Off-route effects section.

## **Inert waste landfill capacity**

- 20.2.17 The quantity of inert waste forecast to arise from the construction of the AP2 revised scheme is 5.8 million tonnes. This represents an increase of 431,667 tonnes (8%) over the quantity reported for the AP1 revised scheme, and an increase of 1,271,042 tonnes (28%)



over the quantity reported for the original scheme. However, due to the revised assumption taken, regarding the proportion of inert surplus excavated material that would be diverted from landfill, the quantity of inert waste arising from the construction of the AP2 revised scheme that will require off-site disposal to landfill during the period 2025 to 2038 has reduced to approximately 3.8 million tonnes (see Table 28). This represents a decrease of 1,610,839 tonnes (30%) over the quantity reported for the AP1 revised scheme, and a decrease of 771,464 tonnes (17%) over the quantity reported for the original scheme.

20.2.18 Inert waste will account for approximately 90% of the total waste generated during construction requiring off-site disposal to landfill. Of the approximately 3.8 million tonnes of inert waste requiring off-site disposal to landfill during construction, 100% is forecast to arise from excavation works.

**Table 28: Quantity of waste requiring off-site disposal to inert waste landfill, 2025 to 2038**

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Total quantity AP2 revised scheme (tonnes)	Proportion AP2 revised scheme
Excavation	4,564,689	5,404,064	3,793,225	100%
Demolition	0	0	0	0%
Construction	0	0	0	0%
Worker accommodation sites	0	0	0	0%
Total	4,564,689	5,404,064	3,793,225	100%

20.2.19 The draw-down of inert waste landfill capacity as a result of the AP2 revised scheme will occur over a period of several years, starting initially with enabling works followed by earthworks such as tunnelling. It is assumed that the generation of surplus excavated material will take place primarily over a four-year period (2028 to 2032) during the construction of the AP2 revised scheme. The duration of earthworks remains unchanged from that reported for the AP1 revised scheme, but with the start and end dates moved back by approximately one year. The changes to the programme for earthworks activities are presented in the indicative construction programmes in the SES2 and AP2 ES Volume 2 Community area reports and the SES2 and AP2 ES Volume 4, Off-route works.

20.2.20 All of the inert waste forecast to arise will be surplus excavated material and assuming that the earthworks take place at a constant rate of generation throughout the assumed four-year period, the total quantity of inert surplus excavated material requiring off-site disposal to landfill will be approximately 948,306 million tonnes per annum.

20.2.21 It is considered that there will be sufficient inert waste landfill capacity available in the North West region to accept the forecast quantity of inert surplus excavated material for off-site disposal to landfill, equivalent to a 62% reduction in inert waste landfill capacity in the North West region, according to the amount of capacity projected to be available at the end of earthworks activities in 2032 (approximately 6.1 million tonnes).

- 20.2.22 Whilst the forecast quantities of wastes requiring disposal to landfill are likely to have a considerable impact on available capacity, the nominated undertaker has an ambition to seek beneficial opportunities for the off-site reuse of surplus excavated material. It has been assumed as a reasonable worst case that 35% of the inert surplus excavated material generated will be diverted from landfill; however, whilst it is not possible to make commitments to specified schemes at this stage, there are likely to be further opportunities for its placement, including as restoration material and in other development projects. Waste planning authorities have a statutory responsibility to make provision for sufficient waste infrastructure capacity, and it is therefore likely that the respective authorities will continue to plan for new inert waste landfill sites and/or to identify other suitable placement locations to enable continued capacity to be available as landfill void space is occupied.
- 20.2.23 Significance criteria for inert waste landfill capacity identified in the Phase 2b Western Leg Environmental Impact Assessment SMR, state that a local scale reduction in inert landfill void space capacity, and a need for additional small-scale disposal capacity of up to 2,000,000 tonnes per annum may be judged to be of low importance.
- 20.2.24 In accordance with these significance criteria, the likely environmental effects associated with the off-site disposal to landfill of inert surplus excavated material generated by construction of the AP2 revised scheme will be minor adverse, which is not considered to constitute a significant effect. This remains unchanged from the AP1 revised scheme, and the original scheme, as reported in Volume 3 of the SES1 and AP1 ES and the main ES respectively.
- 20.2.25 Notwithstanding the conclusion that this will not result in a significant adverse effect, in line with the assessment criteria, HS2 Ltd recognises the potential impact of the AP2 revised scheme on the available landfill capacity. HS2 Ltd is continuing to review assumptions made regarding the generation and management of inert surplus excavated material. The outcomes of this review will be considered as part of future assessments.

### **Non-hazardous waste landfill capacity**

- 20.2.26 The total quantity of non-hazardous waste arising from the construction of the AP2 revised scheme that will require off-site disposal to landfill during the period 2025 to 2038 is approximately 381,508 tonnes (see Table 29). This represents an increase of 14,002 tonnes (4%) over the quantity reported for the AP1 revised scheme, and a decrease of 35,540 tonnes (9%) over the quantity reported for the original scheme.

**Table 29: Quantity of waste requiring off-site disposal to non-hazardous waste landfill, 2025 to 2038**

<b>Waste source</b>	<b>Total quantity original scheme (tonnes)</b>	<b>Total quantity AP1 revised scheme (tonnes)</b>	<b>Total quantity AP2 revised scheme (tonnes)</b>	<b>Proportion AP2 revised scheme</b>
Excavation	232,074	179,768	182,759	47.9%
Demolition	33,912	28,575	31,427	8.2%
Construction	150,663	158,723	167,042	43.8%
Worker	399	440	280	0.1%

<b>Waste source</b>	<b>Total quantity original scheme (tonnes)</b>	<b>Total quantity AP1 revised scheme (tonnes)</b>	<b>Total quantity AP2 revised scheme (tonnes)</b>	<b>Proportion AP2 revised scheme</b>
accommodation sites				
<b>Total</b>	417,048	367,506	381,508	100%

- 20.2.27 It is assumed that non-hazardous waste generated by excavation activities will take place at a constant rate over a four-year period (2028 to 2032). It is assumed that non-hazardous waste generated by demolition activities will take place at a constant rate over a five-year period, and that non-hazardous waste generated by all other construction activities will take place at a constant rate throughout the whole construction period between 2025 and 2038. The peak quantity of non-hazardous waste requiring off-site disposal to landfill will be approximately 63,927 tonnes per annum.
- 20.2.28 It is considered that there will be sufficient non-hazardous waste landfill capacity available in the North West region to accept the forecast quantity of non-hazardous surplus excavated material, demolition, construction waste and worker accommodation site waste for off-site disposal to landfill.
- 20.2.29 Significance criteria in the SMR for non-hazardous waste landfill capacity state that a local-scale reduction in non-hazardous waste landfill capacity of between 50,000 and 250,000 tonnes per annum, may be judged to be of importance in the local planning context.
- 20.2.30 According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of non-hazardous surplus excavated material, construction and demolition waste generated by the AP2 revised scheme will be moderate adverse, which is considered to constitute a significant effect. This remains unchanged from the AP1 revised scheme, and the original scheme, as reported in Volume 3 of the SES1 and AP1 ES and the main ES respectively.

### **Hazardous waste landfill capacity**

- 20.2.31 The total quantity of hazardous waste arising from the construction of the AP2 revised scheme requiring off-site disposal to landfill during the period 2025 to 2038 will be approximately 20,952 tonnes (see Table 30). This represents an increase of 1,902 tonnes (approximately 10%) over the quantity reported for the SES1 and AP1 revised scheme, and a decrease of 1,656 tonnes (approximately 7%) over the quantity reported for the original scheme. This quantity comprises solely of hazardous waste generated by demolition activities; no Unacceptable Class U2 surplus excavated material is forecast to arise as a result of excavation works associated with the AP2 revised scheme.

**Table 30: Quantity of waste requiring off-site disposal to hazardous waste landfill, 2025 to 2038**

Waste source	Total quantity original scheme (tonnes)	Total quantity AP1 revised scheme (tonnes)	Total quantity AP2 revised scheme (tonnes)	Proportion AP2 revised scheme
Excavation	0	0	0	0%
Demolition	22,608	19,050	20,952	100%
Construction	0	0	0	0%
Worker accommodation sites	0	0	0	0%
Total	22,608	19,050	20,952	100%

- 20.2.32 It is assumed that hazardous waste generated by demolition activities will take place at a constant rate over a five-year period. The total quantity of hazardous waste requiring off-site disposal to landfill will be approximately 3,810 tonnes per annum. It is considered that there will be sufficient hazardous waste landfill capacity available in the North West region to accept the forecast quantity of hazardous demolition waste for off-site disposal to landfill.
- 20.2.33 Significance criteria in the SMR for hazardous waste landfill capacity state that a local-scale reduction in hazardous waste landfill void space capacity, or need for additional small-scale hazardous waste disposal capacity of up 20,000 tonnes per annum, may be judged to be of low importance.
- 20.2.34 According to the significance criteria applicable to hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of hazardous surplus excavated material, construction and demolition waste generated by the AP2 revised scheme will be minor adverse, which is not considered to constitute a significant effect. This remains unchanged from the AP1 revised scheme, and the original scheme, as reported in Volume 3 of the SES1 and AP1 ES and the main ES respectively.

## Other mitigation measures

- 20.2.35 Proposed mitigation measures remain unchanged from those presented for the AP1 revised scheme in Volume 3 of the SES1 and AP1 ES.

## Off-route effects

### Assessment of impacts and effects

- 20.2.36 In a small number of instances, construction of the AP2 revised scheme requires works which are geographically removed from the land immediately adjacent to the route. The location and nature of the proposed off-route works are described in Volume 4, Off-route effects, where the local environmental effects are also reported.
- 20.2.37 Due to the route-wide nature of the waste and material resources environmental assessment, the combined effects of the off-route and route-wide works have been assessed, and are reported here.

- 20.2.38 The construction of the following off-route works is considered likely to generate meaningful quantities of CDEW:
- Preston Station;
  - Carlisle Station; and
  - Annandale depot.
- 20.2.39 Due to the isolated nature of the off-route works, it is considered as a reasonable worst-case, that the waste would typically be managed within the region in which it is generated. The materials and waste generated by the proposed off-route works, have been aggregated by the region in which it is generated, and the impact of the material has been reported accordingly.
- 20.2.40 Table 31 provides a summary of material and waste quantities forecast to be generated by excavation, demolition and construction of the off-route works associated with the AP2 revised scheme during the period 2030 to 2035.

**Table 31: Summary of material and waste quantities that will be generated during construction of the off-route works associated with the AP2 revised scheme, 2030 to 2035**

Source	Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity for off-site disposal to landfill (tonnes)
Excavation	1,321,516	1,083,977	237,539
Demolition	0	0	0
Construction	18,364	16,527	1,837
Worker accommodation sites	107	59	48
Total AP2 revised scheme	1,339,880	1,100,563	239,424
Proportion AP2 revised scheme	100%	82%	18%
Total AP1 revised scheme <sup>20</sup>	N/A	N/A	N/A
% change from AP1 revised scheme	N/A	N/A	N/A
Total original scheme	1,369,419	999,041	370,377
% change from original scheme	-2%	10%	-35%

- 20.2.41 Table 31 shows that the off-route works associated with the AP2 revised scheme will generate approximately 1.4 million tonnes of excavated material, construction waste and worker accommodation site waste during the period 2025 to 2038. This represents a 2% decrease on the quantity of excavated material, construction waste, and worker accommodation site waste reported for off-route works for the original scheme.

<sup>20</sup> None of the SES1 and AP1 amendments impacted on the off-route works proposed for the original scheme, and no update waste made to the off-route waste and material resources assessment in the SES1 and AP1 ES.

- 20.2.42 Of the 1.4 million tonnes of excavated material, construction waste and worker accommodation site waste expected to be generated by the off-route works, approximately 82% of this quantity will be diverted from landfill via reuse, recycling and recovery, an increase from approximately 73% reported in Volume 3 of the main ES.

## **Likely significant environmental effects**

### **Dumfries and Galloway**

#### **Inert waste landfill**

- 20.2.43 The quantity of inert waste forecast to arise from the construction of the off-route works associated with the AP2 revised scheme in the Dumfries and Galloway region, is 365,444 tonnes. This has not changed materially compared with the quantity reported for the original scheme. However, due to the revised assumption taken, regarding the proportion of inert surplus excavated material that would be diverted from landfill, the quantity of inert waste arising from the construction of the off-route works associated with the AP2 revised scheme that will require off-site disposal to landfill in the Dumfries and Galloway region, during the proposed construction period 2027 to 2031, has reduced to approximately 237,539 tonnes. This represents a decrease of 128,036 tonnes (35%) over the quantity reported for the original scheme.
- 20.2.44 The inert waste forecast to arise will be generated over a two year period of earthworks (2030-2032) at a constant rate of generation throughout this period; the total quantity of inert surplus excavated material requiring off-site disposal to landfill will be approximately 118,770 tonnes per annum.
- 20.2.45 There are currently no licenced inert waste landfill sites in the Dumfries and Galloway region with capacity remaining; at present all inert waste generated in the region, and requiring disposal to landfill, is required to be transported to neighbouring regions in Scotland or England where inert waste landfill capacity remains. No inert waste landfill capacity is projected to be available in the Dumfries and Galloway region at the end of earthworks in 2032. On this basis, it is considered that there will not be sufficient inert waste landfill capacity to accept the forecast quantity of inert waste within the region.
- 20.2.46 Based on proximity, and the strength of available transport connections to the site, it is considered likely that all inert waste generated by the Annandale depot works, and requiring off-site disposal to landfill, will be managed within the North West region. The assessment of impacts and effects resulting from inert waste generated by the construction of off-route works in the Dumfries and Galloway region has been undertaken in the North West region section.

#### **Non-hazardous waste landfill**

- 20.2.47 The total quantity of non-hazardous waste arising from the construction of the off-route works associated with the AP2 revised scheme that will require off-site disposal to landfill in the Dumfries and Galloway region, during the proposed construction period, 2030 to 2035, is

approximately 1,732 tonnes. This represents a decrease of 1,931 tonnes (53%) over the quantity reported for the original scheme.

- 20.2.48 This will result in an overall reduction of non-hazardous waste landfill capacity of 315 tonnes per annum over the 5.5-year construction period programmed for the Annandale depot.
- 20.2.49 It is considered that there will be sufficient non-hazardous waste landfill capacity to accept the forecast quantity of non-hazardous waste.
- 20.2.50 According to the significance criteria in the SMR applicable to non-hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of non-hazardous waste generated by the construction of off-route works in the Dumfries and Galloway region will be negligible.

### **Hazardous waste landfill**

- 20.2.51 No hazardous waste is forecast to be generated by the off-route works in the Dumfries and Galloway region.

### **North West**

#### **Inert waste landfill**

- 20.2.52 No inert waste is forecast to be generated by off-route works in the North West region; however, the Annandale depot site in Dumfries and Galloway, is located in a Scottish region projected to have no inert waste landfill capacity during the period 2025 to 2038. Based on proximity, and the strength of available transport connections to the site, it is considered likely that all inert waste generated by the Annandale depot works, and requiring off-site disposal to landfill, will be managed within the North West England region.
- 20.2.53 The quantity of inert waste forecast to arise from the construction of the of Annandale depot, is 365,444 tonnes. This has not changed materially compared with the quantity reported for the original scheme. However, due to the revised assumption taken, regarding the proportion of inert surplus excavated material that would be diverted from landfill, the quantity of inert waste arising from the construction of Annandale depot that will require off-site disposal to landfill in the North West, has reduced to approximately 237,539 tonnes. This represents a decrease of 128,036 tonnes (35%) over the quantity reported for the original scheme.
- 20.2.54 The inert waste forecast to arise will be generated over a two year period of earthworks (2030-2032) at a constant rate of generation throughout this period; the total quantity of inert surplus excavated material requiring off-site disposal to landfill will be approximately 118,770 tonnes per annum.
- 20.2.55 Significance criteria in the SMR for inert waste landfill capacity state that a local scale reduction in inert landfill void space capacity and a need for additional small-scale disposal capacity of up to 2,000,000 tonnes per annum may be judged to be of low importance.

20.2.56 In accordance with these significance criteria, the likely environmental effects associated with the off-site disposal to landfill in the North West, of inert surplus excavated material generated by construction of the off-route works associated with the AP2 revised scheme, will be minor adverse, which is not considered to constitute a significant effect.

#### **Non-hazardous waste landfill**

20.2.57 The total quantity of non-hazardous waste arising from the construction of the off-route works associated with the AP2 revised scheme that will require off-site disposal to landfill in the North West region, during the proposed construction period, 2032 to 2035, is approximately 152 tonnes. This represents a decrease of 987 tonnes (87%) over the quantity reported for the original scheme.

20.2.58 This will result in an overall reduction of non-hazardous waste landfill capacity of 51 tonnes per annum over the proposed 2-year construction period.

20.2.59 It is considered that there will be sufficient non-hazardous waste landfill capacity available in the North West region to accept the forecast quantity of non-hazardous waste generated by the off-route works associated with the AP2 revised scheme for off-site disposal to landfill.

20.2.60 According to the significance criteria in the SMR applicable to non-hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of non-hazardous waste generated by the construction of off-route works in the North West region will be negligible.

#### **Hazardous waste landfill**

20.2.61 No hazardous waste is forecast to be generated by the off-route works in the North West region.

#### **Route-wide and off-route combined effects**

20.2.62 It is considered that for inert, non-hazardous and hazardous landfill that there will be sufficient capacity available in the North West region to accept the forecast combined quantity of waste from both the route-wide and off-route works associated with the AP2 revised scheme.

20.2.63 The combined effects and the degree of significance on the available inert, non-hazardous and hazardous waste landfill capacities are considered to be as identified for the main assessment:

- minor adverse in relation to inert waste landfill capacity;
- moderate adverse in relation to non-hazardous waste landfill capacity which is considered to constitute a significant effect; and
- minor adverse in relation to hazardous waste landfill capacity.



## Cumulative effects

### AP2 revised scheme and Phase 2a

- 20.2.64 This assessment considers the cumulative effects during the period in which the construction of the AP2 revised scheme overlaps with the construction of HS2 Phase 2a (Phase 2a). In the Phase 2a Construction Timetable Information Paper<sup>21</sup>, it is assumed that construction will be undertaken during a seven year period between 2021 to 2028. Based on the construction period of the AP2 revised scheme, 2025 to 2038, this presents a potential four-year period during which construction of Phase 2a and the AP2 revised scheme will overlap (2025 to 2028).
- 20.2.65 The quantities of waste forecast to be generated by the Phase 2a construction works in the North West region remain unchanged from those reported in Volume 3 of the main ES.
- 20.2.66 It is considered that for inert, non-hazardous and hazardous landfill there will be sufficient capacity available in the North West region, to accept the forecast combined quantity of waste from both the AP2 revised scheme and Phase 2a.
- 20.2.67 The cumulative effects on the available inert, non-hazardous and hazardous waste landfill capacities are considered to be as identified for the main assessment described previously.

### AP2 revised scheme and other committed developments

- 20.2.68 As reported in Volume 3 of the SES1 and AP1 ES, and Volume 3 of the main ES, no further effects on waste and material resources beyond those stated previously in the assessment have been identified.

## Assessment of the effects of operation

- 20.2.69 During the operation of the AP2 revised scheme, non-hazardous waste will be generated from route-wide and off-route works in railway stations and on passenger trains, and by rolling stock maintenance, track maintenance and ancillary infrastructure activities.
- 20.2.70 None of the AP2 amendments will result in an increase to the operational waste generated by the original scheme, as reported in Volume 3 of the main ES. However, the AP2 amendments will result in an increase of 148 tonnes to the operational waste generation for the AP1 revised scheme, as reported in Volume 3 of the SES1 and AP1 ES (22,667 tonnes). The total quantity of non-hazardous operational waste requiring off-site disposal to landfill in 2039, from the route wide works associated with the AP2 revised scheme, will be 4,564 tonnes. This represents a decrease of 25 tonnes over the quantities reported for the original

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<sup>21</sup> High Speed Two Ltd (2021), *HS2 Phase 2a Information paper – D7: HS2 Phase 2a construction timetable*. Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/960675/D7\\_HS2\\_Phase\\_2a\\_Construction\\_timetable\\_v1.1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960675/D7_HS2_Phase_2a_Construction_timetable_v1.1.pdf).

scheme (4,589 tonnes), and an increase of 65 tonnes compared with the AP1 revised scheme (4,499 tonnes).

- 20.2.71 These changes in the quantities of non-hazardous operational waste requiring off-site disposal to landfill do not result in any new or different likely significant environmental effects with respect to the route-wide or cumulative effects of the AP2 revised scheme. According to the significance criteria in the SMR applicable to non-hazardous waste landfill capacity, the likely residual route-wide and cumulative environmental effects associated with the off-site disposal to landfill of non-hazardous operational waste generated by the AP2 revised scheme remain minor adverse and not significant, as reported in the main ES and AP1 ES.
- 20.2.72 The AP2 amendments also result in an increase of 459 tonnes to the operational waste generated from off-route works associated with both the original scheme and AP1 revised scheme (8,070 tonnes), as reported in Volume 3 of the main ES and the SES1 and AP1 ES respectively. However, the total quantity of non-hazardous operational waste requiring off-site disposal to landfill in 2039, from the off-route works associated with the AP2 revised scheme, will be 1,767 tonnes. This represents a decrease of 50 tonnes over the quantities reported for both the original scheme and AP1 revised scheme (1,817 tonnes).
- 20.2.73 This decrease in non-hazardous operational waste requiring off-site disposal to landfill does not result in any new or different likely significant environmental effects with respect to the off-route effects of the AP2 revised scheme. According to the significance criteria applicable to non-hazardous waste landfill capacity, the likely environmental effects associated with the off-site disposal to landfill of non-hazardous waste generated by the operation of off-route locations will remain negligible and not significant, as reported in the main ES and SES1 and AP1 ES.

## 21 Water resources and flood risk

### 21.1 Introduction

- 21.1.1 Volume 3 of the main ES reported the route-wide impacts and likely significant effects on water resources and flood risk arising from the construction and operation of the original scheme.
- 21.1.2 Volume 3 of AP1 ES reported that any variations as a result of the AP1 amendments were not sufficient in scale to result in any new, removed or different significant route-wide effects compared to those presented in Volume 3 of the main ES.
- 21.1.3 Section 11 of this volume reports the new, removed or different significant effects due to the SES2 changes.
- 21.1.4 This section of the AP2 ES identifies any new, removed or different likely significant effects on water resources and flood risk compared to those reported in SES2, due to the AP2 amendments.

### 21.2 Changes to the assessment

- 21.2.1 An assessment was undertaken to determine if the AP2 amendments would be likely to result in any new, removed or different likely significant effects on water resources and flood risk from those reported in SES2.
- 21.2.2 None of the AP2 amendments have been identified as likely to result in any new or different significant route-wide effects on surface water and groundwater resources (quality and quantity) from those reported in the SES2.
- 21.2.3 An assessment of the effects of the AP2 amendments in relation to the objectives of the Water Framework Directive (WFD) and the alignment of the AP2 revised scheme with the principles of the Sequential Test and the Exception Test in the National Planning Policy Framework (NPPF) is reported below.

#### Water Framework Directive compliance

- 21.2.4 An assessment was undertaken to determine if the AP2 amendments would likely result in any new, removed or different effects on the current status and/or future achievement of status objectives of the WFD water bodies affected by the HS2 route, from those effects reported in SES2. Full details of all the changes are provided in SES2 and AP2 ES Volume 5, Appendix: WR-001-00000.

- 21.2.5 A number of AP2 amendments have been identified as being relevant to the WFD assessment. These include:
- AP2-006-012: Additional land permanently required for the revised realignment of Tributary of Birkin Brook 2 south of Thorns Green embankment;
  - AP2-006-010: Additional land permanently required for watercourse diversions at Mobberley Road;
  - AP2-006-014: Additional land permanently required to reconfigure M56 Junction 6;
  - AP2-006-018: Additional land permanently required for modifications to Water Framework Directive (WFD) mitigation for Timperley Brook;
  - AP2-007-005: Change to Bill powers required for modifications to the Birchfields Road vent shaft headhouse; and
  - AP2-007-009 Additional land temporarily required for the reconfiguration of Ardwick construction sidings.
- 21.2.6 Of these, the AP2-006-014: Additional land permanently required to reconfigure M56 Junction 6 has been identified as having the potential to cause new adverse (amber) effects that may pose a risk of deterioration of the current status and/or prevent the future achievement of the status objectives of WFD water bodies. AP2-006-018: Additional land permanently required for modifications to Water Framework Directive (WFD) mitigation for Timperley Brook will also remove the adverse (amber) effect on the Timperley Brook surface water body from the Manchester Airport High Speed Station, identified in SES2 (see Section 11.2).
- 21.2.7 A summary is provided below of these changes in adverse (amber) effects, which have the potential to result in a non-compliance with the statutory objectives of the WFD Regulations.

## **Adverse effects on current status**

- 21.2.8 SES2 has identified two adverse (amber) effects with the potential to cause a deterioration in the current status of the Timperley Brook (GB112069064520) surface water body, associated with potential impacts on surface water quality from highway drainage and the footprint impacts of the Manchester Airport High Speed Station inverted siphon (see Section 11.2).
- 21.2.9 As described in Section 11.2, new SES2 baseline data from the Environment Agency has identified that the proposed realignment of the Timperley Brook downstream of Brooks Drive included in the original scheme would not create additional open channel and therefore would not be sufficient to mitigate the adverse (amber) effect caused by the footprint impacts of the Manchester Airport High Speed Station inverted siphon.
- 21.2.10 However, the AP2-006-018 amendment includes additional WFD mitigation design to offset the impacts of the station footprint, including several additional watercourse realignments, de-culverting or daylighting of existing culverts, and riparian habitat enhancements. With the inclusion of this additional mitigation design set out in AP2-006-018, the Manchester Airport High Speed Station is assessed as having a localised residual minor adverse (yellow) effect

on the Timperley Brook surface water body. This amendment will therefore remove the adverse (amber) effect and associated risk of deterioration of the current status of the water body set out in the SES2.

- 21.2.11 The amendment AP2-006-014 (Additional land permanently required to reconfigure M56 Junction 6) includes embedded drainage design measures that will mitigate the potential impacts of highway drainage on the Timperley Brook and their tributaries. These measures are described in the SES2 and AP2 ES Volume 2, Hulseheath to Manchester Airport (MA06) Community area report. Accordingly, the amendment removes the potential adverse (amber) effect on the Tributary of Timperley Brook 1 associated with highway drainage impacts on surface water quality, reported at SES2 (see Section 11.2).
- 21.2.12 However, this amendment also has the potential to alter effects on the River Bollin and six of its tributary watercourses. The breadth of the existing M56 bridge crossing of the River Bollin will require widening to introduce new slip roads, and the new junction and approach roads will cross several tributary watercourses in the area. The proposed design therefore incorporates a number of new culverts, watercourse realignments, and drainage infrastructure. These scheme components will have minor, localised adverse effects on hydromorphological and biological quality elements. Whilst individually these scheme components are not considered to present a risk of deterioration to the current status of the water body, combined the culverts will result in the loss of approximately 450 to 500m of open watercourses and approximately 500 to 550m of watercourse realignments are proposed. Due to the physical constraints in the area, it is considered on a precautionary basis that a degree of hard engineering is likely to be required for some of the watercourse realignments and so the potential for the realignments to improve in-channel habitats to offset the footprint impacts of the culverts is likely to be limited.
- 21.2.13 Accordingly, the AP2-006-014 amendment has been identified as having the potential to cause a new adverse (amber) effect that may pose a risk of deterioration of the current status of the Bollin (River Dean to Ashley Mill) (GB112069061381) surface water body, due to the effects of the widening of the M56 bridge crossing of the River Bollin and additional new culverts and watercourse realignments (with the potential to require hard engineering) on a number of its tributaries.

## **Adverse effects on future achievement of status objectives**

- 21.2.14 SES2 has identified an adverse (amber) effect with the potential to prevent the future achievement of the status objectives of the Timperley Brook (GB112069061260) surface water body (see Section 11.2). This effect relates to a potential worsening of existing urban diffuse pollution pressures, and the potential to inhibit the implementation of measures identified to address these pressures, associated with highway drainage discharges.
- 21.2.15 As described above, the AP2 AP-006-014 amendment includes embedded drainage design measures that will mitigate the potential impacts of highway drainage on the River Bollin, Timperley Brook and their tributaries. Accordingly, the amendment removes the potential

adverse (amber) effect on the Tributary of Timperley Brook 1 associated with highway drainage impacts on surface water quality, reported at SES2.

- 21.2.16 The AP2 AP-006-014 amendment will cause a new adverse (amber) effect with the potential to prevent the future achievement of the status objectives of the Bollin (River Dean to Ashley Mill) (GB112069061381) surface water body. This effect relates to a potential worsening of existing physical modification pressures, as a result of the introduction of additional new culverts and watercourse realignments on a number of tributaries of the River Bollin, described above.

## **Summary of compliance**

- 21.2.17 The assessment has concluded that the AP2 revised scheme will remove the two potential adverse (amber) effects on the Timperley Brook surface water body reported at SES2 (see Section 11.2), associated with the footprint impacts of the Manchester Airport High Speed station on Timperley Brook and highway drainage impacts on the surface water quality of on the Tributary of Timperley Brook 1.
- 21.2.18 However, the AP2 amendments will introduce a new adverse effect on the Bollin (River Dean to Ashley Mill) (GB112069061381) surface water body associated with the AP2 AP-006-014 amendment. This effect relates to the proposed widening of the M56 bridge crossing of the River Bollin and the introduction of multiple new culverts and watercourse realignments on a number of its tributaries.
- 21.2.19 These adverse effects may give rise to the potential risk of the AP2 revised scheme being non-compliant with the statutory objectives of the WFD.
- 21.2.20 Additional mitigation measures are required to manage the risk of status deterioration within the Bollin (River Dean to Ashley Mill) (GB112069061381) surface water body and to avoid the necessity of seeking an exemption under the WFD Regulations. A range of initial mitigation measure options have been identified in consultation with the Environment Agency with the aim to ensure no residual non-compliance risks. These potential measures are summarised in SES2 and AP2 ES Volume 5, Appendix: WR-001-00000. Further hydromorphological and biological baseline surveys of the watercourses affected will also be undertaken to inform more detailed impact assessment and the development of mitigation solutions.
- 21.2.21 Every effort will be made to identify sufficient mitigation to ensure that there is no residual risk of deterioration in status for the water body. However, a Regulation 19 exemption assessment will also be prepared for the water body in parallel on a precautionary basis, in consultation with the Environment Agency (as the competent regulatory authority), and reported to Parliament during the passage of the Bill if required. Further details of the Regulation 19 exemption assessment process are provided in Annex M of Volume 5, Appendix: CT-001-00001\_Part 3 of the main ES.

## Flood risk

- 21.2.22 An assessment was undertaken to determine if the AP2 revised scheme would be likely to result in any new, removed or different likely significant effects from those reported in the SES2.
- 21.2.23 The SES2, identifies the potential for significant adverse effects related to flood risk at two locations along the HS2 route, requiring development of additional mitigation in order to fully comply with the requirements of the Exception Test, i.e. to ensure that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, to reduce flood risk overall.
- 21.2.24 The diversion of Birkin Brook under the Ashley Railhead will remove the potential for a significant adverse effect on flood risk at the Mid-Cheshire railway line.
- 21.2.25 The relocation of the Palatine Road vent shaft (renamed The Hollies vent shaft in AP2-007-003) from Withington Golf Course, off Palatine Road, to the disused land to the north-west of the Britannia Country House Hotel will remove the majority of the permanent adverse significant flood risk effects associated with the original scheme during the 1 in 100 year plus allowance for climate change flood event. There are however residual permanent adverse flood risk effects which remain on two residential receptors on Palatine Road (the western two blocks of Riverside Court) as a result of changes to flood conveyance around the operational site for The Hollies vent shaft. These are reported in SES2 and AP2 ES Volume 2, Community area report: Davenport Green to Ardwick (MA07).
- 21.2.26 Assessment work carried out to date has identified the potential for flood water displaced by The Hollies vent shaft site to cause an increase in flood flows downstream (west) of Princess Road. It has been concluded that this could lead to minor increases in peak flood levels in the River Mersey and potentially increased spill of flood water into areas already affected by flooding; potentially resulting in new adverse flood risk effects.
- 21.2.27 A new residual adverse significant effect has also been identified at one commercial property (Northenden Golf Course club house) during a 1 in 100 year flood event as a result of earlier overtopping of River Mersey flood defences; and different adverse significant effects have been identified during the 1 in 100 year flood event at the two residential blocks at Riverside Court.
- 21.2.28 Additional surveys will be carried out during design development to confirm the property threshold levels at the two western blocks of Riverside Court. If following these surveys, residual adverse flood risk effects are confirmed, mitigation could include additional property level flood protection and flood resilience measures to help protect these individual properties from flooding.
- 21.2.29 Additional modelling using a calibrated and extended hydraulic model of the River Mersey is underway, and will continue during the passage of the Bill, to quantify the impacts of the loss of flood storage associated with the AP2 revised scheme on peak flood levels downstream of Princess Road bridge. If the additional modelling concludes that changes to

flood levels could lead to significant adverse flood risk effects, the model will be used to test the effectiveness of a range of avoidance and mitigation measures such that there are no significant residual adverse flood risk effects.

- 21.2.30 The predicted increase in peak flood level at Northenden Golf Course club house is relatively small compared to the substantial flood level predicted by the model under baseline conditions. The predicted baseline flood level results in a Flood Hazard rating of “Danger for All – includes the emergency services”<sup>22</sup> and potentially poses a threat to the structural stability of the building. The predicted increase in level as a result of the AP2 revised scheme is not sufficient to materially alter the flood hazard or the potential consequences of flooding. It would not therefore constitute a measurable increase in flood risk in the context of the NPPF or the published UK Government guidance on Flood risk and coastal change.

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<sup>22</sup> Flood and Coastal Erosion Risk Management Research and Development Programme and Department for Environment, Food & Rural Affairs, 26 March 2021- Flood Risk Assessment Guidance for New Development <https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/flood-risk-assessment-guidance-for-new-development>



## 22 Phase One, Phase 2a and Phase 2b Western Leg combined impacts

### 22.1 Introduction

- 22.1.1 Volume 3 of the main ES<sup>23</sup> presented a tabulated summary of the potential total impacts (individually and combined) of Phase One, Phase 2a and the Phase 2b Western Leg original scheme on a range of environmental receptors.
- 22.1.2 Volume 3 of the SES1 and AP1 ES reported that the AP1 revised scheme would result in very minor or negligible changes to the combined impact figures presented in Volume 3 of the main ES.
- 22.1.3 This section of the report identifies the combined impact figures due to the AP2 amendments.

### 22.2 Corrections to the main ES and SES1 and AP1 ES

- 22.2.1 There are two corrections to the combined impacts section of the route-wide assessment reported in Volume 3 of the main ES. Table 32 provides descriptions of each correction, replicates the text from Volume 3 of the main ES, and provides the revised text.

**Table 32: Summary of corrections to Section 18, Phase One, Phase 2a and the Proposed Scheme combined impacts of Volume 3: Route-wide effects of the main ES**

Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
Phase One, Phase 2a and the Proposed Scheme combined impacts, Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, Volume 3 of the main ES	The main ES incorrectly reported one community demolition (community) as a demolition (commercial/retail/manufacturing/industrial/ other)	Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, seventh and eighth entry Proposed Scheme <b>4</b> community facilities <b>159</b> units	Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, seventh and eighth entry Proposed Scheme <b>5</b> community facilities <b>158</b> units	No change to route-wide effects or mitigation.

<sup>23</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*, Volume 3: Route-wide effects. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement>.

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Reference in the main ES	Reason for correction	Text in the main ES	Revised text	Change to significant effects and mitigation
Phase One, Phase 2a and the Proposed Scheme combined impacts, Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, Volume 3 of the main ES	Changes to the Proposed Scheme, baseline data and updates to the DfT TAG work book (WebTAG)	Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, thirteenth entry Proposed Scheme <b>-£5.2m</b>	Table 75: Combined impacts of Phase One (revised scheme), Phase 2a (revised scheme) and the Proposed Scheme, thirteenth entry Proposed Scheme <b>£2.2m</b>	No change to route-wide effects or mitigation.

22.2.2 There are two corrections to the combined impacts section of the route-wide assessment reported in Volume 3 of the SES1 and AP1 ES. Table 33 provides descriptions of each correction, replicates the text from Volume 3 of the SES1 and AP1 ES, and provides the revised text.

**Table 33: Summary of corrections to Section 24, Phase One, Phase 2a and Phase 2b Western Leg combined impacts of Volume 3: Route-wide effects of the SES1 and AP1 ES**

Reference in the SES1 and AP1 ES	Reason for correction	Text in the SES1 and AP1 ES	Revised text	Change to significant effects and mitigation
Phase One, Phase 2a and Phase 2b Western Leg combined impacts, Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, Volume 3 of SES1 and AP1 ES	The SES1 and AP1 ES incorrectly reported that an additional community facility identified for demolition was within the Manchester Piccadilly community area (MA08). It should have reported that it is within the Hulseheath to Manchester Airport community area (MA06).	Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, footnote 45:  This figure has been corrected from that reported in the main ES, attributable to a correction in <b>Manchester Piccadilly community area (MA08)</b> . The additional community facility was incorrectly reported in the main ES under Demolitions (commercial/retail/manufacturing/industr	Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, footnote 45:  This figure has been corrected from that reported in the main ES, attributable to a correction in <b>Hulseheath to Manchester Airport community area (MA06)</b> . The additional community facility was incorrectly reported in the main ES under Demolitions (commercial/retail/m	No change to route-wide effects or mitigation.

Reference in the SES1 and AP1 ES	Reason for correction	Text in the SES1 and AP1 ES	Revised text	Change to significant effects and mitigation
		ial/miscellaneous). There is no change to the overall number of community facilities demolished from that assessed in the main ES.	ial/miscellaneous). There is no change to the overall number of community facilities demolished from that assessed in the main ES.	
Phase One, Phase 2a and Phase 2b Western Leg combined impacts, Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, Volume 3 of SES1 and AP1 ES	Table 26 incorrectly reported the construction and operation GHG emissions (tCO <sub>2</sub> e)).	Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, 33rd entry Phase 2b Western Leg AP1 revised scheme <b>3,890,000</b> and the 34 <sup>th</sup> entry Phase 2b Western Leg AP1 revised scheme <b>2,999,000</b>	Table 26: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP1 revised scheme, 33rd entry Phase 2b Western Leg AP1 revised scheme <b>3,958,000</b> and the 34 <sup>th</sup> entry Phase 2b Western Leg AP1 revised scheme <b>2,927,000</b>	No change to route-wide effects or mitigation.

## 22.3 Summary of combined impacts

- 22.3.1 Table 34 presents a summary of the potential total impacts of Phase One, Phase 2a and the Phase 2b Western Leg AP2 revised scheme on a range of environmental receptors. The Phase One data is taken from the Phase One SES4 and AP5 ES<sup>24</sup>. The Phase 2a data is taken from the Phase 2a SES2 and AP2 ES<sup>25</sup>.
- 22.3.2 The Phase 2b Western Leg AP2 revised scheme data includes the AP1 revised scheme and the AP2 revised scheme combined, which assumes that the AP1 amendments have been implemented.

<sup>24</sup> High Speed Two Ltd (2015), High Speed Rail (London – West Midlands), *Supplementary Environmental Statement 4 and Additional Provision 5, Environmental Statement*. Available online at:

[https://www.gov.uk/government/collections/additional-provisions-for-the-high-speed-rail-london-to-west-midlands-bill#supplementary-environmental-statement-4-and-additional-provision-5-\(december-2015\)](https://www.gov.uk/government/collections/additional-provisions-for-the-high-speed-rail-london-to-west-midlands-bill#supplementary-environmental-statement-4-and-additional-provision-5-(december-2015)).

<sup>25</sup> High Speed Two Ltd (2019), High Speed Rail (West Midlands – Crewe), *Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement*. Available online at:

<https://www.gov.uk/government/collections/hs2-phase-2a-supplementary-environmental-statement-2-and-additional-provision-2-environmental-statement-february-2019>.

**Table 34: Combined impacts of Phase One, Phase 2a and Phase 2b Western Leg AP2 revised scheme**

	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined total)
<b>Route characteristics (km)</b>				
Total length <sup>26</sup>	216	58	62.2	336.2
Tunnel	49.5	2.9	19.6	72.0
Cutting	74.7	28.3	6.5	109.5
Viaduct	16.3	5.5	4.7	26.5
Embankment	62.5	21.3	18.3	102.1
<b>Property and settlements</b>				
Demolitions (residential)	326 dwellings (218 buildings)	27 dwellings	64 dwellings	417 dwellings
Demolitions (community)	19 community facilities	0 community facilities	6 community facilities <sup>27</sup>	25 community facilities
Demolitions (commercial/retail/manufacturing/industrial/miscellaneous)	372 units (309 buildings) <sup>28</sup>	68 units	146 units	542 units
Total demolitions (including residential)	546 buildings	95 buildings <sup>29</sup>	216 buildings	857 buildings
<b>Employment and housing</b>				
Permanent jobs created	2,200 <sup>30</sup>	140	2,720	5,060
Construction jobs created	14,600 <sup>31</sup>	1,920 <sup>31</sup>	7,100	23,620

<sup>26</sup> Not all route characteristics are defined here hence why the cumulative of route characteristics doesn't equal the total. Characteristics like stations, underground boxes, and tunnel portals are excluded.

<sup>27</sup> This figure has been corrected from that reported in the main ES, attributable to a correction in Hulseheath to Manchester Airport community area (MA06). The additional community facility was incorrectly reported in the main ES under Demolitions (commercial/retail/manufacturing/industrial/miscellaneous). There is no change to the overall number of community facilities demolished from that assessed in the main ES.

<sup>28</sup> This figure includes some properties which also provide community resources, e.g. public houses, local services.

<sup>29</sup> Includes total of residential, community, commercial and miscellaneous buildings including outbuildings associated with residential properties.

<sup>30</sup> Indicative direct operational employment figure was estimated to the nearest 100 jobs.

<sup>31</sup> Number reported as an approximate equivalent of permanent full time construction jobs.

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	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined total)
Jobs displaced <sup>32</sup>	7,950	25	6,100	14,075
<b>Noise</b>				
Monetary valuation of noise impacts <sup>33</sup>	n/a <sup>34</sup>	£-3.12m	£1.4m	n/a
<b>Landscape</b>				
Area of Outstanding Natural Beauty (AONB) crossed at surface (km)	7.6	0	0	7.6
<b>Historic environment</b>				
Scheduled Monuments directly affected	1	0	0	1
Registered Battlefields directly affected	1	0	0	1
Grade I and II* structures directly affected	2	0	1	3
Grade II structures directly affected	17	4	6	27
Registered Parks and Gardens directly affected	2	0	0	2
Conservation Areas directly affected	2	4	2	8
<b>Biodiversity and wildlife</b>				
Natura 2000 sites	0	0	5 <sup>35</sup>	5

<sup>32</sup> 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.

<sup>33</sup> The monetary valuation of noise impacts is calculated using the methodology described in Section 2 'Noise Impacts' of Department for Transport (2013), *TAG Unit 3 Environmental Impact Appraisal published by the Department for Transport*. Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/254128/webtag-tag-unit-a3-environmental-impact-appraisal.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/254128/webtag-tag-unit-a3-environmental-impact-appraisal.pdf).

The assessment utilises the latest available Department for Transport, *TAG data book*, at the time of assessment. The latest version is available online at: <https://www.gov.uk/government/publications/tag-data-book>.

<sup>34</sup> The assessment method has materially changed since that used for the Phase One AP5 revised scheme ES (December 2015) and hence the levels are not directly comparable.

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	Phase One AP5 revised scheme	Phase 2a AP2 revised scheme	Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined	Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined total)
adversely affected				
SSSI directly affected	3	0	3 <sup>36</sup>	6
Ancient Woodlands directly affected	32	11	15	58
<b>Water resources and flood risk</b>				
Major <sup>37</sup> rivers diverted	8	0	1	9
Route through Flood Zone 3 (km)	12.0	2.4	1.3	15.7
Station/depot occupation of Flood Zone 3 (ha)	2.1	0.6	0.9	3.6
Cutting or tunnel through SPZ 1 or 2 (km)	6.7	0.6	0	7.3
<b>Land use resources</b>				
Active landfills crossed <sup>38</sup>	0	0	0	0
Grade 1 and 2 agricultural land (km)	22.0	9.9	1.9	33.8
<b>Waste and material resources</b>				
Excavated material	63.4 <sup>39</sup>	18.9 <sup>40</sup>	10.05 <sup>41</sup>	92.35

<sup>35</sup> Since leaving the European Union the Natura 2000 network sites are now (instead) part of the UK's national site network as defined in the Conservation of Habitats and Species Regulations 2017 (as amended). For consistency with other documents and earlier phases of HS2 the term Natura 2000 site continues to be used here. There are five Natura 2000 sites/Ramsar Sites where it has not been possible to rule out significant effects as a result of the AP2 revised scheme. Further evaluation is being carried out in ongoing further and separate assessments to meet the needs of the Habitats Regulations.

<sup>36</sup> There are three SSSIs where it has not been possible to rule out significant effects as a result of the AP2 revised scheme. There are also five further SSSIs where it has not been possible to rule out significant effects as a result of the AP2 revised scheme, but which form component SSSIs of Natura 2000 sites adversely affected that are reported in the previous row. Further assessment will continue in accordance with the requirements of Regulation 63 of the Conservation of Habitats and Species Regulations 2017.

<sup>37</sup> Major rivers are defined, in the context of this table, as those with a catchment area greater than 50km<sup>2</sup> at the point of the route crossing. This definition is set out in the Phase 2b Sustainability Statement.

<sup>38</sup> Waste storage facilities located deep underground (100 to 350m below ground level) within salt caverns are excluded as the Proposed Scheme will not prevent such facilities from continuing to operate.

<sup>39</sup> 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.

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	<b>Phase One AP5 revised scheme</b>	<b>Phase 2a AP2 revised scheme</b>	<b>Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined</b>	<b>Overall total (Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and Phase 2b Western Leg AP1 revised scheme and AP2 revised scheme combined total)</b>
(million m <sup>3</sup> )				
Concrete (million tonnes)	13.04	2.10	5.08	20.2
Steel (million tonnes)	1.30	0.13	0.46	1.89
<b>Carbon emissions (tCO<sub>2</sub>e)<sup>42</sup></b>				
Construction	6,125,000	1,451,000	4,758,000	12,334,000
Operation – use stage	2,300,000 <sup>43</sup>	315,000	1,325,000	3,940,000
Operation – benefits and loads beyond project boundaries	-5,270,000 <sup>44</sup>	-307,000	-511,000	-6,088,000

<sup>40</sup> This figure is the estimated quantity of excavated material excluding top soil and sub-soil that will be generated from the construction of the Phase 2a as reported in the SES2 and AP2 ES.

<sup>41</sup> This figure includes excavated material from the project’s schedule for quantities for the main route, from highways foundation works and from off-route works.

<sup>42</sup> The combined carbon footprint of the construction and operation of Phase One AP5 revised scheme, Phase 2a AP2 revised scheme and the Phase 2b AP2 revised scheme. Whilst it is informative to look across numbers for both phases to get an overall picture of GHG emissions, these numbers are not directly comparable. This is because the scope, assumptions and methodologies differ slightly between phases and should be used with caution. Phase One emissions are reported over the first 60 years of operation whilst the Proposed Scheme emissions are reported over a 120-year design life.

<sup>43</sup> Phase One use stage carbon emissions are over the first 60 years of operation. It does not account for the years 61-120. This figure underestimates the 120-year impact, however the disparity in temporal scope is not expected to result in a significant underestimate given the rate and extent of the UK grid decarbonisation.

<sup>44</sup> Phase One benefits and loads beyond the project boundary carbon emissions are over the first 60 years of operation. It is possible that this figure underestimates the 120-year impact, however the disparity in temporal scope is not expected to result in a significant underestimate given the rate and extent of forecast electric vehicle uptake and decarbonisation or road and air journeys.

**High Speed Two (HS2) Limited**

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