

# High Speed Rail (Crewe – Manchester)

## Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement

### Volume 5 Appendix: CL-003-00000

#### Climate change

Summary greenhouse gas calculation inputs and outputs

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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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# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
1.1	Structure of this appendix	2
<b>2</b>	<b>Revised carbon footprint</b>	<b>3</b>
2.1	Revised land use sources and assumptions	3
2.2	Overall results	4

## Tables

Table 1:	Updated land use carbon factors used for the assessment of the construction phase	3
Table 2:	Updated land use carbon factors used for the assessment of the operational phase	4
Table 3:	The original scheme's GHG emissions from construction and operational emissions between 2038 (opening year) and 2050 as reported in the main ES and amended by the AP1 revised scheme	5

# 1 Introduction

## 1.1 Structure of this appendix

- 1.1.1 This report is an appendix to the climate change assessment which forms part of Volume 5 of the Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES).
- 1.1.2 This appendix provides details of changes to the greenhouse gas (GHG) assessment since the production of the High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES)<sup>1</sup> published in January 2022 (the main ES).
- 1.1.3 This appendix should be read in conjunction with Volume 3, Route-wide effects, and Volume 5, Appendix: CL-003-00000 in the main ES.
- 1.1.4 In order to differentiate between the original proposals assessed as part of the main ES and subsequent changes, the following terms are used:
- ‘the original scheme’ – the Bill scheme submitted to Parliament in January 2022, which was assessed in the main ES;
  - ‘the SES1 scheme’ – the original scheme with any changes described in the SES1 that are within the existing powers of the bill; and
  - ‘the AP1 revised scheme’ – the original scheme as amended by the SES1 changes and AP1 amendments.
- 1.1.5 This report presents the GHG assessment of the original scheme reported in the main ES and the change in emissions from construction and operation between 2038 (assumed opening year) and 2050 (UK’s climate change target year) as a result of the AP1 revised scheme.

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<sup>1</sup> High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

## 2 Revised carbon footprint

### 2.1 Revised land use sources and assumptions

- 2.1.1 The GHG assessment includes emissions associated with land use change during construction and operation. In 2021, Natural England published a review of the scientific evidence behind carbon storage and sequestration rates of British natural habitats and land uses<sup>2</sup>. This report has compiled, what is considered, as the best available information on carbon storage and sequestration in the English and wider European context, and thus was used in updating the GHG assessment.
- 2.1.2 Table 1 presents the carbon storage factors selected from the Natural England report as part of the construction phase land use change GHG emissions assessment.
- 2.1.3 Table 2 presents the carbon sequestration factors selected from the Natural England report as part of the operational phase land use change GHG emissions assessment.

**Table 1: Updated land use carbon factors used for the assessment of the construction phase**

LULUCF category	Source	Carbon factor (tC/ha)	Underlying assumptions
Arable / cultivated land	Natural England 2021 Report which references Cantarello and others (2011) <sup>3</sup>	58	Represents arable / cultivated land with a soil depth of 30cm excluding biomass which is managed and removed annually. Mean value selected from a range.
Natural grassland	Natural England 2021 Report which references Emmett and others (2010) <sup>4</sup>	60	Natural grassland with a soil depth of 15cm excluding biomass.
Peatland / blanket bog	Natural England 2021 Report which references Ostle and others (2019) <sup>5</sup>	259	Blanket bog with a soil depth of 50cm.
Mixed broadleaved native woodland	Natural England 2021 Report which references the Woodland Carbon Code <sup>6</sup>	169	30 year mixed broadleaved native woodland with 15cm soil depth covering both soil and vegetation.

<sup>2</sup> Natural England (2021), *Carbon storage and sequestration by habitat: a review of the evidence (second edition)*. Available online at: <http://publications.naturalengland.org.uk/publication/5419124441481216>.

<sup>3</sup> Cantarello, E., Newton, A.C and Hill, R.A. (2011), *Potential effects of future land-use change on regional carbon stocks in the UK*. Environmental Science & Policy, 14: 40-52.

<sup>4</sup> Emmett, B. et al. (2010), *Countryside survey: soils report from 2007*.

<sup>5</sup> Ostle, N.J. et al. (2009), *UK land use and soil carbon sequestration*. Land Use Policy, 26S:274-83.

<sup>6</sup> Woodland Carbon Code (2021), *Standard Project Carbon Calculation Spreadsheet*, (Version 2.4, 2021). Available online at: <https://www.woodlandcarboncode.org.uk/standard-and-guidance/3-carbon-sequestration/3-3-project-carbon-sequestration>.

**Table 2: Updated land use carbon factors used for the assessment of the operational phase**

LULUCF category <sup>7</sup>	Source	Carbon factor (tCO <sub>2</sub> e/ha)	Underlying assumptions
Improved grasslands	Natural England 2021 report which references Soussana and others (2004) <sup>8</sup>	- 0.36	Carbon factor based on French study, however arable and improved grassland is difficult to characterise and can be located on a wide range of soils.
Near natural fen	Natural England 2021 report which references the 2021 updated Emissions Inventory for UK Peatlands <sup>9</sup>	- 0.93	Undrained land.

## 2.2 Overall results

- 2.2.1 Table 3 presents the GHG assessment of the original scheme reported in the main ES and the change in GHG emissions from construction and operation over a period between 2038 (proposed opening year) and 2050 as a result of the AP1 revised scheme.
- 2.2.2 Aside from construction related GHG emissions, the removal of the HS2 West Coast Main Line (WCML) connection (SES1-004-001) also impacts operational GHG emissions. A shorter route results in lower rolling stock operational emissions as presented in Table 3. The removal of the HS2 WCML connection is also expected to influence modal shift emission (i.e. changes in local and regional travel patterns represented by Module D in Table 3 below). However, modal shift results reflecting the AP1 revised scheme have not been assessed and Table 3 mirrors modal shift results from the original scheme reported in the main ES. An assessment of the changes because of modal shift will be included in a separate, future Supplementary Environmental Statement 2 (referred to as SES2) and Additional Provision 2 ES (referred to as AP2 ES).

<sup>7</sup> Mixed broadleaved native woodland carbon sequestration assumptions remain the same as in the main ES and presented in Greenhouse gas calculation methodology (see Volume 5, Appendix: CL-004-00000 of the main ES). Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

<sup>8</sup> Soussana, J.F. et al. (2004), *Carbon cycling and sequestration opportunities in temperate grasslands*. Soil use and management. 20, 2019-230.

<sup>9</sup> The United Nations National Inventory Submissions (2021). Available online at: <https://unfccc.int/ghg-inventories-annex-i-parties/2021>.

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SES1 and AP1 ES Volume 5, Appendix: CL-003-00000

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**Table 3: The original scheme's GHG emissions from construction and operational emissions between 2038 (opening year) and 2050 as reported in the main ES and amended by the AP1 revised scheme**

Life cycle stage	Module	Description	Original scheme GHG emissions (tCO <sub>2</sub> e)	AP1 revised scheme GHG emissions (tCO <sub>2</sub> e)	Difference between the main ES and AP1 revised scheme GHG emissions (tCO <sub>2</sub> e)
<b>Before use stage</b>	A1-A3	Product manufacturing	3,114,333	2,242,711	871,622
	A4	Transport of construction material to work site	223,303	167,235	56,068
	A5	Construction/installation process	1,684,642	1,511,188	173,454
<b>Use stage</b>	B1	Carbon sequestration from tree planting and wetland and grassland creation	-101,528	-14,262	-87,266
	B2-B3	Repair and maintenance of infrastructure and rolling stock	60,287	11,307	48,980
	B4	Replacement of infrastructure and rolling stock	5,581	4,089	1,492
	B6	Operation of infrastructure	18,909	18,909	0
	B7	Water use in infrastructure	738	319	419
	B9	Operation of rolling stock	407,242	179,468	227,774
<b>Benefits and loads associated with mode shift</b>	D	Conventional rail passengers	-6,160	-6,160	0
		Car passengers	-206,798	-206,798	0
		Surface access journeys	51,407	51,407	0
		Freight	-199,038	-199,038	0
		Aviation	-257,801	-257,801	0





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