



High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 2: Community Area report
CA1: Fradley to Colton



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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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Preface

The Environmental Statement

This document forms part of Volume 2 of the Environmental Statement (ES) that accompanies the deposit of the hybrid Bill for Phase 2a of High Speed Two (HS2). Phase 2a comprises the second section of the proposed HS2 rail network, between the West Midlands and Crewe, and is referred to in this ES as the 'Proposed Scheme'. The ES sets out the Proposed Scheme, its likely significant environmental effects and the measures proposed to mitigate those effects.

Phase 2b comprises the remainder of Phase Two, between Crewe and Manchester and between the West Midlands and Leeds, completing what is known as the 'Y network'. Phase 2b will be the subject of a separate hybrid Bill and therefore is not the subject of this ES.

The hybrid Bill for Phase One of the HS2 network, between London and the West Midlands, was the subject of an ES submitted in November 2013, followed by subsequent ESs deposited with Additional Provisions to that Bill in 2014 and 2015. The Bill received Royal Assent in February 2017 and initial works on Phase One have commenced.

Consultation on the Environmental Statement

The public has an opportunity to comment on this ES as part of the hybrid Bill submission. The period of public consultation on the ES extends for at least 56 days (eight weeks) following the first newspaper notices that follow deposit of Bill documents in Parliament.

Structure of the Environmental Statement

This report is part of the suite of documents that make up the Environmental Statement (ES) for Phase 2a of the proposed High Speed Two (HS2) rail network between the West Midlands and Crewe (the Proposed Scheme). The structure of the ES is shown in Figure 1.

The ES documentation comprises the following:

Non-technical summary

This provides:

- a summary in non-technical language of the Proposed Scheme and the reasonable alternatives studied;
- the likely significant effects of the Proposed Scheme;
- the means to avoid, prevent or reduce likely significant environmental effects; and
- an outline of the monitoring measures to manage the effects of construction and the effectiveness of mitigation post construction, as well as appropriate monitoring during operation.

Glossary of terms and list of abbreviations

This contains terms and abbreviations, including units of measurement used throughout the ES documentation.

Volume 1: Introduction and methodology

This provides:

- a description of HS2, the environmental impact assessment (EIA) process and the approach to consultation and engagement;
- details of the permanent features of the Proposed Scheme and general construction techniques;
- a summary of the scope and methodology for the environmental topics;
- an outline of the general approach to mitigation;
- an outline of the approach to monitoring, including measures to manage the effects of construction, the effectiveness of mitigation post construction, as well as the approach to monitoring during the operational phase; and
- a summary of the reasonable alternatives studied (including local alternatives studied prior to the November 2015 route announcement). Local alternatives studied post November 2015 are discussed in the relevant Volume 2 community area reports.

Volume 2: Community area reports and map books

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

- an overview of the area;
- a description of the construction and operation of the Proposed Scheme within the area;
- a summary of the local alternatives studied since November 2015;
- a description of the environmental baseline;
- a description of the likely significant environmental effects of the Proposed Scheme;
- the proposed means to avoid, prevent or reduce the likely significant adverse environmental effects; and
- the proposals for monitoring, including measures during and post construction, and during the operational phase.

The maps relevant to each community area are provided in separate Volume 2 map books. These maps should be read in conjunction with the relevant community area report. These maps include the location of the key environmental features (Map Series CT-10), key construction features (Map Series CT-05) and key operational features (Map Series CT-06) of the Proposed Scheme. There are also specific maps showing viewpoint and photomontage locations (Map Series LV, to be read in conjunction with Section 11, Landscape and visual of the Volume 2: community area reports) and noise contours (Map Series SV, to be read in conjunction with Section 13, Sound, noise and vibration of the Volume 2: community area reports).

Volume 3: Route-wide effects

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

Volume 4: Off-route effects

This provides an assessment of the likely significant environmental effects of the Proposed Scheme at locations beyond the Phase 2a route corridor and its associated local environment. The maps relevant to the assessment of off-route effects are provided in a separate map book.

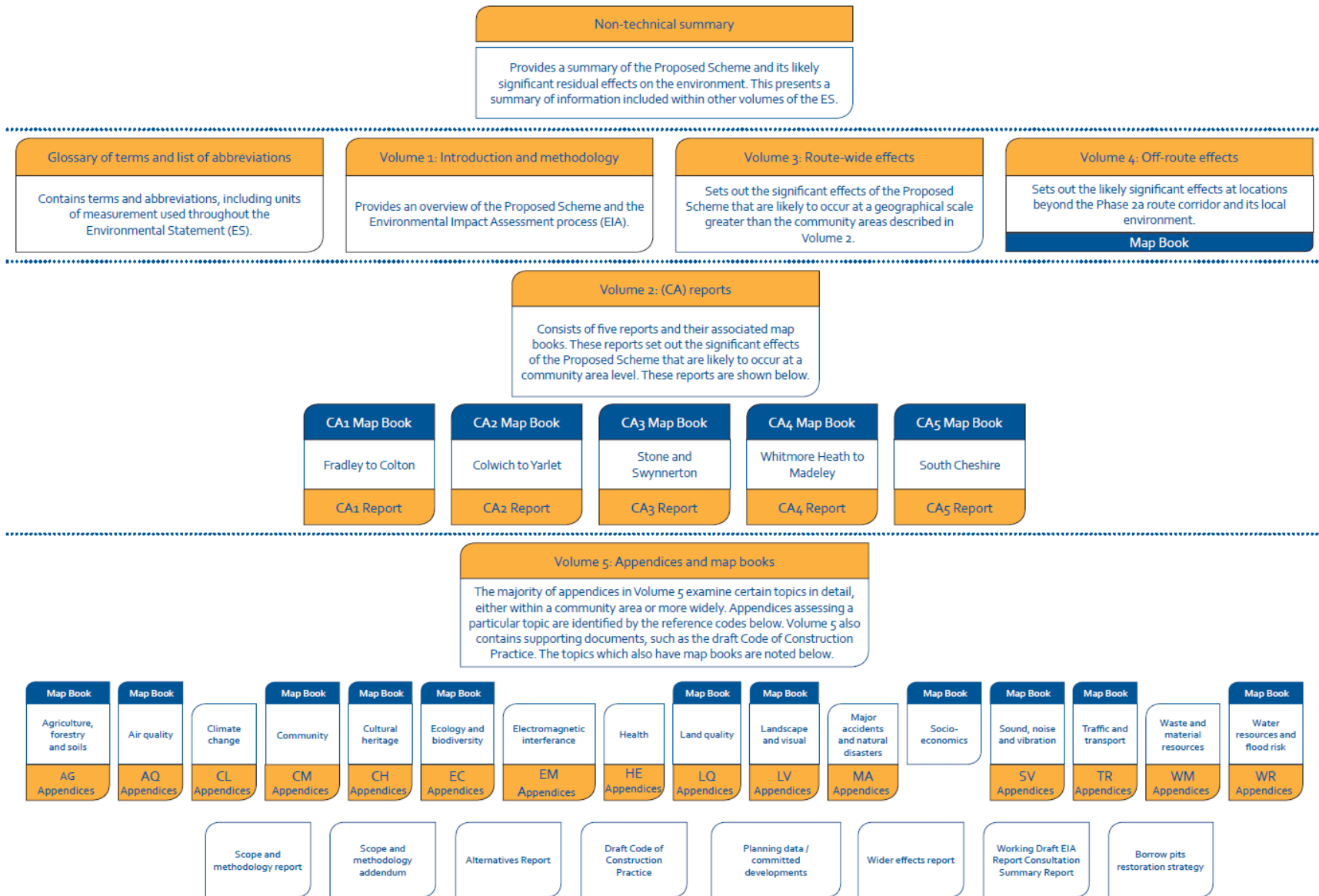
Volume 5: Appendices and map books

This contains supporting technical information and associated map books to be read in conjunction with the other volumes of the ES.

Background information and data (BID)

Certain reports and maps containing background information and data (BID) have been produced, which do not form part of the ES. These documents are available on the HS2 website. The BID reports and maps present relevant survey information, collated from published and unpublished sources, and other relevant background material.

Figure 1: Structure of the Environment Statement



1 Introduction

1.1 Introduction to HS2

- 1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester and East Midlands will be served by high speed trains running at speeds of up to 225mph (360kph). Trains will also run beyond the HS2 network to serve destinations including South Yorkshire, Liverpool, Glasgow, Edinburgh, Newcastle and York.
- 1.1.2 HS2 will be built in phases. Phase One comprises the first section of the HS2 rail network of approximately 143 miles (230km) between London and the West Midlands and is planned to become operational in 2026. It was the subject of an Environmental Statement (ES) deposited with the High Speed Rail (London – West Midlands) Bill in 2013. Subsequent ESs were deposited with Additional Provisions to that Bill in 2014 and 2015. The High Speed Rail (London – West Midlands) Bill received Royal Assent in February 2017 and initial works on Phase One have commenced.
- 1.1.3 Phase Two of HS2 will extend the line to the north-west and north-east: to Manchester, with connections to the West Coast Main Line (WCML) at Crewe and Golborne, and to Leeds, with a connection to the East Coast Main Line approaching York, completing what is known as the ‘Y network’.
- 1.1.4 Phase Two will be constructed in two phases:
- Phase 2a (the Proposed Scheme): the western section of Phase Two between the West Midlands and Crewe, comprising approximately 36 miles (58km) of HS2 main line (including the section which would connect with and form the first part of Phase 2b) and two spurs (approximately 4 miles (6km)) south of Crewe that will allow trains to transfer between the HS2 main line and the existing WCML. Construction of the Proposed Scheme will commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027, six years earlier than originally planned, bringing more of the benefits of HS2 to the North sooner; and
 - Phase 2b: comprising the remainder of Phase Two, between Crewe (where it would connect with the Proposed Scheme) and Manchester, and between the West Midlands and Leeds. Phase 2b will be the subject of a separate hybrid Bill with construction expected to commence in 2023 and operation planned to start by 2033.
- 1.1.5 The Proposed Scheme will connect with Phase One at Fradley, to the north-east of Lichfield, and to the WCML south of Crewe, providing onward services beyond the HS2 network and between the north-west of England and Scotland.
- 1.1.6 The Proposed Scheme has been the subject of an environmental impact assessment (EIA). During the development of the Phase 2a proposals, a working draft EIA Report was consulted on to help inform the design and assessment of the Proposed Scheme.
- 1.1.7 The findings of the assessment of the Proposed Scheme are reported in an Environmental Statement (the ES), of which this Volume 2 report forms a part. The ES

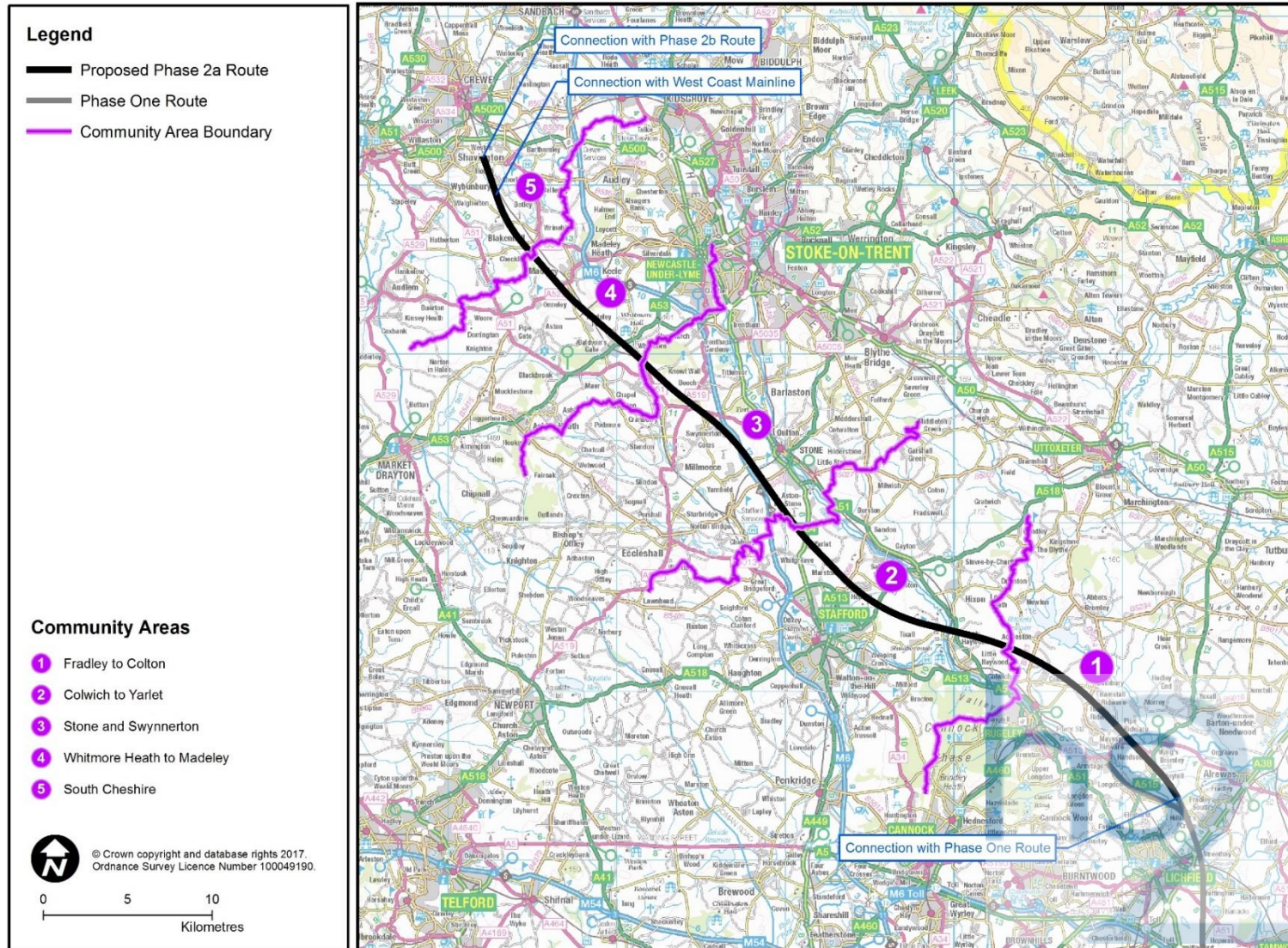
has been deposited alongside a hybrid Bill for Phase 2a, in accordance with the requirements of Parliamentary Standing Order 27A (SO27A)^{1,2}.

- 1.1.8 For the purposes of environmental assessment and community engagement, the Proposed Scheme has been divided into five community areas. These are shown in Figure 2.

¹ Standing Order 27A of the Standing Orders of the House of Commons relating to private business (environmental assessment) – 2015, House of Commons.

² Standing Orders of the House of Lords - Private Business – 2015, House of Lords

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



1.2 Purpose of this report

- 1.2.1 This report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within the Fradley to Colton area. The report also describes the means to avoid, prevent or reduce the likely significant effects of the Proposed Scheme on the environment within the area, along with any proposed monitoring measures.

1.3 Structure of this report

- 1.3.1 This report is divided into the following sections:

- Section 1 – an introduction to HS2 and the purpose and structure of this report;
- Section 2 – overview of the community area, description of the Proposed Scheme within the community area and its construction and operation, and a description of the local alternatives studied;
- Section 3 – consultation and stakeholder engagement; and
- Sections 4 to 15 – an assessment of the following environmental topics:
 - agriculture, forestry and soils (Section 4);
 - air quality (Section 5);
 - community (Section 6);
 - cultural heritage (Section 7);
 - ecology and biodiversity (Section 8);
 - health (Section 9);
 - land quality (Section 10);
 - landscape and visual (Section 11);
 - socio-economics (Section 12);
 - sound, noise and vibration (Section 13);
 - traffic and transport (Section 14); and
 - water resources and flood risk (Section 15).

- 1.3.2 Each environmental topic section comprises:

- an introduction to the topic;
- a description of the existing and future environmental baseline within the community area;
- a description of the impacts and likely significant environmental effects arising during construction and operation of the Proposed Scheme, including cumulative effects; and

- a description of proposed mitigation and any monitoring measures that have been identified.

- 1.3.3 Environmental effects have been assessed in accordance with the methodology set out in Volume 1 (Section 8), the EIA Scope and Methodology Report (SMR) (Volume 5: Appendix CT-001-001) and the EIA SMR Addendum (Volume 5: Appendix CT-001-002). The purpose of the SMR Addendum is to set out where the assessment methodology presented within the SMR has been amended or developed, for example, as a result of changes in legislation or industry best practice guidance or where methodologies have undergone refinement in the course of preparation of the ES.
- 1.3.4 The Proposed Scheme in the Fradley to Colton area is shown in Volume 2: CA1 Map Book on the Map Series CT-05 (construction) and CT-06 (operation), and should be read in conjunction with this report. There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within the limits shown on the plans and sections submitted to Parliament and as set out in the Bill. This flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.
- 1.3.5 In addition to the environmental topics covered in Sections 4 to 15 of this report, electromagnetic interference is addressed in Volume 1 and climate change, major accidents and natural disasters, and waste and material resources are addressed in Volume 3 on a route-wide basis. An assessment of potential environmental effects beyond the Phase 2a route corridor and its associated local environment has also been undertaken and this 'off-route' assessment is reported in Volume 4.
- 1.3.6 Supporting technical information, including technical appendices and map books, relating to the assessment in this Volume 2 report is provided in Volume 5 of the ES.
- 1.3.7 In addition to the technical appendices and map books in Volume 5, certain reports and maps containing background information and data (BID) have been produced, which do not form part of the ES. These documents are available on the HS2 Ltd website. The BID reports and maps present survey information, collated from published and unpublished sources, and other background analysis, and are referenced at various places within the ES.

2 Overview of the area and description of the Proposed Scheme

2.1 Overview of the area

General

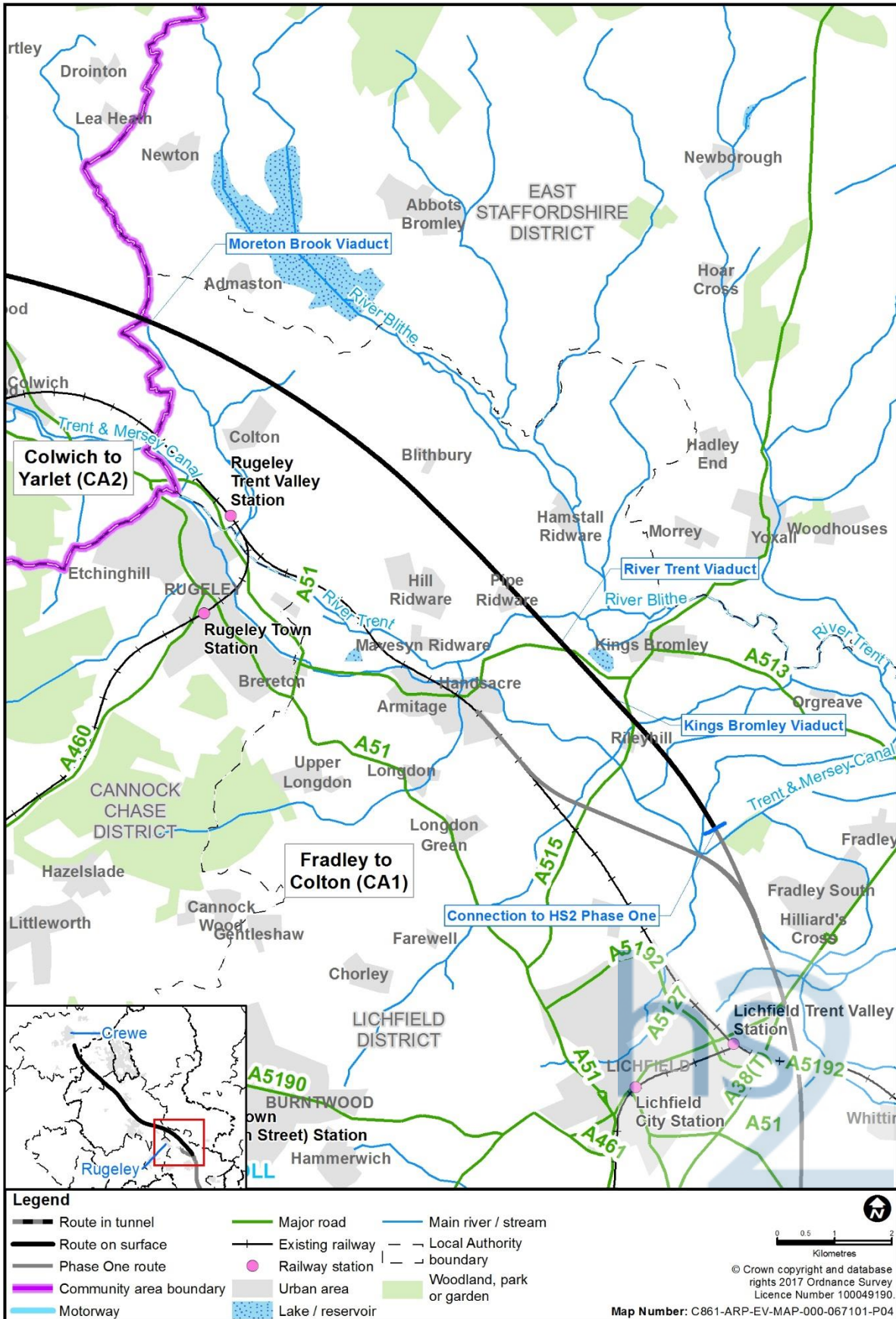
- 2.1.1 The Fradley to Colton area covers an approximately 13.5km section of the Proposed Scheme passing through the parishes of Fradley and Streethay, Alrewas, Kings Bromley (also known as King's Bromley), Armitage with Handsacre, Mavesyn Ridware, Hamstall Ridware and Colton, and within the local authority areas of Lichfield District Council (LDC) and Staffordshire County Council (SCC).
- 2.1.2 The boundary between the Proposed Scheme and HS2 Phase One forms the southern boundary of this section. The boundary between Colton and Colwich parishes form the northern boundary of this section.
- 2.1.3 As shown in Figure 3, the connection with HS2 Phase One north of Fradley lies to the south and with Colwich to Yarlet area (CA2) lies to the north.

Settlement, land use and topography

- 2.1.4 The Fradley to Colton area is predominantly rural in character, encompassing lowland and settled river landscapes, often defined by a network of small-scale historic fields, with agriculture being the main land use.
- 2.1.5 The main residential areas are Fradley, Kings Bromley, Handsacre, Hill Ridware and Colton. Within the wider rural area there are a number of other villages including Hamstall Ridware, Pipe Ridware, Blithbury and Stockwell Heath.
- 2.1.6 There are a number of water bodies in the area, all falling within the catchment of the Staffordshire Trent Valley, including the River Trent, which the route of the Proposed Scheme will cross, and the Blithfield reservoir, located approximately 1.7km north of the route.
- 2.1.7 In the Fradley to Colton area the route of the Proposed Scheme will commence approximately 250m north-west of Fradley Wood and continue towards Kings Bromley, passing over the Bourne Brook and River Trent and associated floodplains on viaducts. The route will pass through Tomlinson's Spinney Local Wildlife Site (LWS), and will cross over Trentside Meadows LWS on viaduct and will run adjacent to Pipe Ridware, where the Grade II* listed Ridware Theatre is located. The route will continue northwards passing the Grade II listed Woodhouse Farm and Bentley Hall Farm, and will pass approximately 500m west of Blithbury before running between Colton and Stockwell Heath.
- 2.1.8 The topography within the Fradley to Colton area undulates from approximately 60m above Ordnance Datum (AOD) to approximately 70m AOD between Fradley and Hill Ridware and then changes between Hill Ridware and Colton where the landform is characterised by moderate gradients, with slopes becoming steeper around Colton to reach elevations of approximately 100m AOD.

Environmental Statement Volume 2: Community area 1, Fradley to Colton

Figure 3: Area context map



Key transport infrastructure

- 2.1.9 The route of the Proposed Scheme will connect with HS2 Phase One approximately 3km north-east of Lichfield. Principal highways within this area include the A38(T) Lichfield Road, the A5192 Eastern Avenue, the A51 Stafford Road, the A515 Lichfield Road and the A513 Rugeley Road, which provide links to Rugeley and the wider transport network.
- 2.1.10 Local roads include the B5014 Uttoxeter Road and the B5013 Uttoxeter Road.
- 2.1.11 Within the area there are a number of footpaths, bridleways and local access roads that provide important links between scattered rural dwellings and villages.
- 2.1.12 The WCML traverses the area in a broadly north-west / south-east alignment to the south of the route of the Proposed Scheme. Rugeley Trent Valley Station is located in Rugeley to the south-west of the route of the Proposed Scheme and is a minor station on the Trent Valley section of the WCML with onward connections to major national destinations, including London, Birmingham and Crewe. Rail users can interchange at Rugeley Trent Valley Station for regional and local destinations.

Socio-economic profile

- 2.1.13 Within the LDC area there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (17%), with construction the second largest (12%), followed by retail (8%)³.
- 2.1.14 According to the Annual Population Survey (2016)⁴, the employment rate⁵ within the LDC area was 80% (49,000 people) and the unemployment rate was 3%, which is lower than the West Midlands and England.
- 2.1.15 According to the Annual Population Survey (2016)⁶, 34% of LDC area residents aged 16-64 were qualified to National Vocational Qualification Level 4 and above, while 10% of residents had no qualifications.

Notable community facilities

- 2.1.16 The main concentrations of community facilities are in the larger settlements of Kings Bromley, Handsacre and Rugeley. The smaller villages of Blithbury and Colton are located closer to the route of the Proposed Scheme and provide a smaller number of local services.
- 2.1.17 Kings Bromley is located approximately 5km east of Rugeley and 5km north of Lichfield and has no defined village centre, with the majority of community facilities being located off the A515 Lichfield Road, Alrewas Road or Manor Road. The village includes the Richard Crosse Church of England Primary School, Kings Bromley Care Home, the Royal Oak public house, Church of All Saints, Kings Bromley Village Hall and a Buddhist monastery.

³ Office for National Statistics; UK Business Count – Local Units 2015, Available online at <https://www.nomisweb.co.uk>

⁴ Annual Population Survey, (2016), NOMIS, Available online at <https://www.nomisweb.co.uk>

⁵ The proportion of working age (16-64 year olds) residents that is in employment.

⁶ Annual Population Survey, (2016), NOMIS, Available online at <https://www.nomisweb.co.uk>

- 2.1.18 Blithbury is located approximately 3.5km to the north-east of Rugeley. Community facilities include the Bull and Spectacles public house and Rugeley School. Rugeley School is an independent specialist residential school associated with Mayfield Children's Home, located within the Grade II-listed Moreton House within the Colwich to Yarlet area (CA2), which provides care for young people with autism and moderate to severe learning difficulties.
- 2.1.19 Colton is linked to the hamlet of Stockwell Heath, providing the majority of local services for Stockwell Heath, including St. Mary's Church of England primary school and Church of Saint Mary the Virgin, Colton.

Recreation, leisure and open space

- 2.1.20 The Fradley to Colton area is predominantly rural in nature, comprising open space, woodland and farmland. It is crossed by several public rights of way (PRoW), including the Rugeley to Colton circular walk and the Way for the Millennium. The Cannock Chase Area of Outstanding Natural Beauty (AONB), which is located 560m to the west of the route of the Proposed Scheme at its closest point, includes a wide range of outdoor recreation facilities.
- 2.1.21 Other open spaces and recreational facilities in the area include Kings Bromley Gravel pits, including fishing and sailing facilities; Kings Bromley Cricket Club; Four Seasons Nature Study Centre and Trentside Meadows owned and managed by the Conservation, Horticulture, Agriculture for the Disabled Society (CHADS); Trent and Mersey Canal; Reindeer Lodge (a visitor attraction); and a number of public houses.

Policy and planning context

Planning framework

- 2.1.22 HS2 is not included or referred to in many local plans, given that it is being developed on a national basis to meet a national need. Exceptions are the Lichfield District Local Plan Strategy and the Cannock Chase Local Plan (Part 1) (Adopted 2014)⁷. All relevant local plan documents and policies have been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context.
- 2.1.23 The following local policies have been considered and are referred to where appropriate to the assessment:
- Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026 (Adopted 2013)⁸;
 - The Minerals Local Plan for Staffordshire 2015 to 2030 (Adopted 2017)⁹;
 - Cannock Chase Local Plan (Part 1) (Adopted 2014)⁷;

⁷ Cannock Chase Local Plan (Part 1) (Adopted 2014). Available online at:

https://www.cannockchasedc.gov.uk/sites/default/files/local_plan_part_1_09.04.14_low_res.pdf

⁸ Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026 (Adopted 2013). Available online at:

[https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-\(2010-to-2026\)-\(adopted-March-2013\).pdf](https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-(2010-to-2026)-(adopted-March-2013).pdf)

⁹ The Minerals Local Plan for Staffordshire 2015 to 2030 (Adopted 2017). Available online at:

<https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/mineralsLocalPlan.aspx>

- Lichfield District Local Plan (Adopted 1998 – saved policies)¹⁰;
- Lichfield District Council Local Plan Strategy 2008-2029 (Adopted 2015)¹¹;
- East Staffordshire Local Plan 2012-2031 (Adopted 2015)¹²; and
- Yoxall Neighbourhood Development Plan 2015 - 2030 (Adopted 2015)¹³.

2.1.24 Emerging policies are not considered as part of the assessment.

2.1.25 There are a number of key planning designations in the area. These include conservation areas, listed buildings, important archaeological assets listed on the National Heritage List for England (NHLE), and mineral safeguarding areas (MSA).

Committed development

2.1.26 Committed developments are defined as developments with planning permission and sites allocated for development, or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. Allocations and MSA in the submission drafts of the Minerals Local Plan for Staffordshire (2015) and the Plan for Stafford Borough: Part 2 (2015) have also been included as committed developments. These are listed in Volume 5: Appendix CT-004-000, Planning data and are shown in Volume 5 Planning Data/Committed Development Map Book: Maps CT-13-101 to CT-13-105a-L1.

2.1.27 Where it is likely that committed developments will have been completed by 2020, these have been identified as 'future baseline' schemes and have been taken into account for the purpose of assessing the likely significant environmental effects of the Proposed Scheme, for example, as new receptors, as appropriate. Where these developments have a particular relevance to an assessment topic, this is noted in Volume 5: Appendix CT-004-000.

2.1.28 Where there are committed developments that are considered likely to be constructed between 2020 and 2027, i.e. at the same time as the Proposed Scheme, they are considered to be receptors for the operation of HS2, but also potentially to give rise to cumulative impacts with the Proposed Scheme during construction. These 'potential cumulative' developments are noted in Volume 5: Appendix CT-004-000.

2.1.29 In the Fradley to Colton area, the only potential cumulative development considered in the assessment is the HS2 Phase One scheme, which is described in further detail below.

2.1.30 Where a committed development lies wholly or partly within the land required for the Proposed Scheme, consideration has been given as to whether it will be commenced

¹⁰ Lichfield District Local Plan (Adopted 1998 – saved policies). Available online at: <https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Local-plan/Downloads/1998-lichfield-district-local-plan-saved-policies.pdf>

¹¹ Lichfield District Council Local Plan Strategy 2008-2029 (Adopted 2015). Available online at: <https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Resource-centre/Local-Plan-documents/Downloads/Local-Plan-Strategy/Lichfield-District-Local-Plan-Strategy-2008-2029-1.pdf>

¹² East Staffordshire Local Plan 2012-2031 (Adopted 2015). Available online at: <http://www.eaststaffsbc.gov.uk/sites/default/files/docs/planning/planningpolicy/localplan2012-2031/Local-Plan-2012-2031-FINAL.pdf>

¹³ Yoxall Neighbourhood Development Plan 2015 - 2030 (Adopted 2015). Available online at: <http://www.eaststaffsbc.gov.uk/sites/default/files/docs/planning/planningpolicy/neighplanning/yoxall/Final%20Made%20Plan.pdf>

or completed in its proposed form and assumptions made. These developments are noted in Volume 5: Appendix CT-004-000.

- 2.1.31 Planning applications yet to be determined and sites that are proposed allocations in development plans that have yet to be adopted, on or close to the Proposed Scheme, are termed 'proposed developments'. These are listed in Volume 5: Appendix CT-004-000, but are not included in the assessment.

Interface with HS2 Phase One

- 2.1.32 The route of the Proposed Scheme will connect to HS2 Phase One at Fradley. The High Speed Rail (London – West Midlands) Bill 2013 received Royal Assent on 23 February 2017 and initial works have commenced. It is therefore considered to be a committed development in the context of this assessment.
- 2.1.33 The significant environmental effects of the Phase One scheme were reported in the Environmental Statement deposited with the HS2 Phase One Bill and subsequent additional provisions. Where there is the potential for cumulative impacts to arise with the Proposed Scheme, this is reported in Sections 4 to 15 of this report. In addition, as a result of the Proposed Scheme a number of changes to the Phase One design will be required at the interface with HS2 Phase One. These changes are described in Section 2.2. Any new or different significant environmental effects arising from these changes are described in the relevant topic sections.

Changes to the design since the working draft EIA Report

- 2.1.34 Since the working draft EIA Report was published a number of changes have been introduced to the Proposed Scheme. The key changes include (all dimensions below are approximate):
- removal of the maintenance loops from the Pipe Ridware embankment, following the relocation of the permanent maintenance facility from Crewe (within the South Cheshire area (CA5)) to near Stone (within the Stone and Swynnerton area (CA3)). The removal of the maintenance loops and other design requirements such as clearances over roads have resulted in the following alterations to the vertical alignment:
 - the central section of the Pyford North embankment has reduced in height from 6m to 2.1m (see Volume 2: Maps CT-06-201, F5 to A5 and CT-06-202, J6 to E5);
 - the height of the southern end of Kings Bromley viaduct has lowered from 8.4m to 7.5m (see Volume 2: Maps CT-06-202, E5);
 - the height at the northern end of the Kings Bromley viaduct and the southern end of the Bourne embankment has increased from 13m to 15.5m (see Volume 2: Maps CT-06-203, H5 to H6);
 - the height at the northern end of the River Trent viaduct and the southern end of the Pipe Ridware embankment has reduced from 15.8m to 8.6m (see Volume 2: Maps CT-06-204, D5 to C5);

- the depth at the southern end of the Blithbury South cutting has increased from a shallow embankment of 0.1m to 3.2m (see Volume 2: Maps CT-06-205, F5); and
- the depth at the southern end of the Blithbury Central cutting has reduced from 8.7m to 4.4m (see Volume 2: Maps CT-06-206, H5).
- changes in the vertical alignment as a result of design development:
 - a reduction in height of the southern end of the Moreton Brook viaduct from 9.2m to up to 7.9m (see Volume 2: Maps CT-06-209, C5); and
 - a reduction in height of the northern end of the Moreton Brook viaduct and the southern end of the Moreton South embankment from 9.7m to up to 8.4m (see Volume 2: Maps CT-06-209, B5)
- changes in length to the following viaducts and embankments:
 - an increase in the length of the Pyford Brook viaduct from 100m to 180m (see Volume 2: Maps CT-06-201, G5 to F5);
 - an increase in the length of the Kings Bromley viaduct from 730m to 980m (see Volume 2: Maps CT-06-202, E5 to A5);
 - a reduction in the length of the Bourne embankment, from 800m to 505m (see Volume 2: Maps CT-06-203, H6 to E5); and
 - an increase in the length of the Moreton Brook viaduct from 100m to 195m (see Volume 2: Maps CT-06-209, C5 to B5).
- removal of the River Trent auto-transformer station from beneath the River Trent viaduct, to avoid the River Trent floodplain. This will be replaced with two auto-transformer stations: the Bourne Brook auto-transformer station, located on the southern side of the Pyford North embankment (see Volume 2: Maps CT-06-202, F6 to F5); and the Pipe Ridware auto-transformer station, located on the northern side of the Pipe Ridware embankment (see Volume 2: Maps CT-06-204, C5);
- relocation of the Newlands Lane auto-transformer feeder station to a location 450m east of the location presented in the working draft EIA Report and to the northern side of the route of the Proposed Scheme (see Volume 2: Maps CT-06-207, E5 to D4);
- inclusion of a 132kV power line from National Grid Rugeley substation to the Newlands Lane auto-transformer feeder station to provide power to the Proposed Scheme (see Volume 2: Map CT-06-207 L3, F2 to E1 and Map CT-06-207 L2, H10 to F7);
- provision of an access track around the northern edge of the Pyford North embankment for access to agricultural land, to Barn Farm and Common Lane Farm, and a balancing pond for railway drainage (see Volume 2: Maps CT-06-202, G6 to E5);

- as a result of the increase in length of the Kings Bromley viaduct, closure of Shaw Lane will not be required. Instead it will be realigned to the west of its existing alignment for 500m (see Volume 2: Maps CT-06-202, B6 to A4);
- addition of the Blithbury package substation¹⁴ 200m north-west of Woodhouse culvert to the southern side of the route of the Proposed Scheme (see Volume 2: Maps CT-06-205, E6);
- the introduction of four borrow pits for the extraction of sand and gravel for construction, described in Section 2.3:
 - one at Kings Bromley South, located on either side of Crawley Lane on the east side and to the south of Ashby Sitch (see Volume 2: Maps CT-05-201, E8 to A1 and CT-05-201-R1, D10 to B8);
 - one at Kings Bromley North, located adjacent to the realigned A515 Lichfield Road (see Volume 2: Maps CT-05-202, B10 to A6 and CT-05-203, J1 to G6);
 - one at Kings Bromley North, located adjacent to the realigned Shaw Lane (see Volume 2: Maps CT-05-202, E5 to B1); and
 - one at Blithbury, located to the east of the River Trent viaduct (see Volume 2: Maps CT-05-204, H5 to E1).
- removal of the Maintenance Loop satellite compound as a result of the removal of the maintenance loops from the Proposed Scheme;
- a pre-cast yard and pre-cast laydown yard will be located at the Bourne embankment satellite compound to facilitate construction of viaducts within the Fradley to Colton area (see Volume 2: Map CT-05-203, G8 to F6);
- transfer nodes for the storage, loading and unloading of bulk earthworks materials will be located at the Pyford North embankment satellite compound and Bourne embankment satellite compound (see Volume 2: Maps CT-05-202, G7 to F6 and CT-05-203, H5 to G5 respectively).

2.1.35 The location and configuration of construction compounds, stockpiles and site haul routes have been considered as part of the design development. In addition, mitigation such as noise barriers, landscape earthworks, compensatory planting and replacement ponds and wetlands have been included throughout the Fradley to Colton area to reduce effects on receptors.

2.2 Description of the Proposed Scheme

General

2.2.1 The following section describes the main features of the Proposed Scheme in the Fradley to Colton area, including the proposed environmental mitigation measures that have been identified. Further information on typical permanent features is provided in Volume 1, Section 5. Similarly, a general description of the approach to

¹⁴ Provides non-traction power to the Proposed Scheme.

mitigation is provided in Volume 1, Section 9. Some of the ecological mitigation described in this section has been provided on a precautionary basis. This is set out in Section 8, Ecology and biodiversity.

- 2.2.2 Land required for operation of the Proposed Scheme is described in this section and is shown on Volume 2: Map Series CT-06. Land also required for construction is described in Section 2.3 and shown on Volume 2: Map Series CT-05.

Overview

- 2.2.3 The route of the Proposed Scheme through the Fradley to Colton area will be approximately 13.5km in length. The route will extend from Fradley, where it will connect to HS2 Phase One, and continue north-west towards Kings Bromley and on towards Colton.
- 2.2.4 All dimensions in the sections below are approximate.
- 2.2.5 In the Fradley to Colton area, the route of the Proposed Scheme will be carried on the following features:
- viaducts for a total length of 3.3km (Pyford Brook, Kings Bromley, River Trent and Moreton Brook viaducts);
 - cuttings for a total length of 4.5km (Blithbury South, Blithbury Central, Blithbury North and Stockwell Heath cuttings); and
 - embankments for a total length of 5.7km (Pyford South, Pyford North, Bourne, Pipe Ridware, Stockton Heath and Moreton South embankments).
- 2.2.6 Embankments and cuttings have been labelled according to their predominant physical characteristics. It is important to note that a number of embankments and cuttings vary as to their depth of cutting or height of embankment as a result of the topography through which the railway passes. Moreover, there are some sections of cutting over which the railway passes at grade or above ground level and sections of embankment which pass at grade or below ground level. In the Fradley to Colton area, this applies to the following embankments and cuttings:
- Pipe Ridware embankment has some sections where the railway passes up to 3m below existing ground level;
 - Blithbury Central cutting has some sections where the railway passes up to 4m above existing ground level; and
 - Moreton South embankment has some sections where the railway passes up to 1m below existing ground level.
- 2.2.7 The Proposed Scheme, including the connection with HS2 Phase One, is described in eight separate sections below.
- 2.2.8 In general, features are described along the route of the Proposed Scheme from south-east to north-west and to the southern and northern sides of the route as they cross the Proposed Scheme, as shown on Map Series CT-06 in the Volume 2: CA1 Map Book.

Connection to Phase One at Fradley

- 2.2.9 The route of the Proposed Scheme will connect to the Manchester spur of the Phase One route at Fradley.
- 2.2.10 The connection with Phase One is illustrated on maps CT-06-200 to CT-06-201 in the Volume 2: CA1 Map Book.
- 2.2.11 At the connection with the Phase One route, the following changes will be made to the Phase One design to accommodate the connection and form part of the Proposed Scheme:
- the addition of noise fence barriers, 115m in length and 2m in height, on both sides of the route of the Proposed Scheme where it will pass onto the Trent and Mersey Canal viaduct, to provide acoustic screening for moorings on the Trent and Mersey Canal at Kings Bromley (see Volume 2: Maps CT-06-200, C5 to B5);
 - an area of 1ha of woodland habitat creation and landscape mitigation planting proposed in the Phase One design will no longer be implemented due to the need to accommodate the connection with the Phase 2a Proposed Scheme. This will be compensated by new woodland habitat creation within the vicinity of Pyford Brook, which will also connect wider areas of Phase One landscape and ecological mitigation planting with the Proposed Scheme (see Volume 2: Maps CT-06-201, I5 and I4); and
 - the addition of an access track from Alrewas Hayes Road for access to a balancing pond for railway drainage, located within the land required for the Proposed Scheme. The access track will pass around the south side of the Pyford South embankment, north of the Trent and Mersey Canal (within Phase One) and beneath the Trent and Mersey Canal viaduct (see Volume 2: Map CT-06-201, J6 to F1, Map CT-06-201-R1, G10 to E1 and Map CT-06-201-R2, F8 to D10).

Fradley Wood to Ashby Sitch culvert

- 2.2.12 The route of the Proposed Scheme will connect to Phase One, 250m north-west of Fradley Wood and continue in a north-west direction towards Pyford Brook. The route will enter this section on the Pyford South embankment before passing onto the Pyford Brook viaduct 250m north-west of Fradley Wood. The route will then continue onto the Pyford North embankment up to the Ashby Sitch culvert.
- 2.2.13 This section of route is illustrated on maps CT-06-201 in the Volume 2: CA1 Map Book.
- 2.2.14 Key features of this 1.5km section will include:
- Pyford South embankment, 305m in length and up to 9m in height, including landscape earthworks, with landscape mitigation planting, to help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Maps CT-06-201, I5 to G5);
 - a balancing pond for railway drainage, within an area of replacement woodland habitat creation and grassland habitat creation, to the southern side

of the route of the Proposed Scheme, 350m north-west of the Trent and Mersey Canal. Access will be provided from Alrewas Hayes Road (see Volume 2: Maps CT-06-201, H6 to H5);

- an area of woodland habitat creation and grassland habitat creation, to the northern side of the route of the Proposed Scheme, to the north-east of the Pyford Brook viaduct (see Volume 2: Maps CT-06-201, G4);
- Pyford Brook viaduct, 180m in length and up to 10m in height (see Volume 2: Map CT-06-201, G5 to F5);
- an area of wetland habitat creation to provide replacement habitat along Pyford Brook, passing beneath the Pyford Brook viaduct and extending to the south of the route of the Proposed Scheme (see Volume 2: Map CT-06-201, I8 to F4);
- a replacement floodplain storage area, to the southern side of the route of the Proposed Scheme, 75m south-west of the Pyford Brook viaduct. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-201, G6 to G5);
- an area of woodland habitat creation, to the southern side of the route of the Proposed Scheme, to provide replacement habitat, including replacement habitat for woodland lost at the interface between HS2 Phase One and the Proposed Scheme, extending for 500m along the western side of Pyford Brook (see Volume 2: Map CT-06-201, I8 to F6);
- two areas of grassland habitat creation, to the southern side of the route of the Proposed Scheme, one area adjacent to Pyford Brook to provide replacement habitat and one area around an existing pond (called Marl Pit), 200m to the south-west of the route, to provide replacement terrestrial habitat for great crested newt (see Volume 2: Maps CT-06-201, G5 to F5 and G6 to G7);
- a section of the Pyford North embankment, 1km in length and up to 9m in height in this section, with landscape earthworks and an area of woodland habitat creation (see Volume 2: Map CT-06-201, F5 to A5; and CT-06-202, J5 to E5);
- an area of woodland habitat creation to the southern side of the route of the Proposed Scheme, 100m north-west of the Pyford Brook viaduct and adjacent to an existing pond, and an area on the northern side of the route, both to provide replacement habitat (see Volume 2: Map CT-06-201, F5 to E4);
- diversion of an unnamed watercourse, for 350m along the southern edge of the Pyford North embankment to join Pyford Brook, to the south-west of the Pyford Brook viaduct (see Volume 2: Map CT-06-201, G5 to E5);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, to the southern side of the route of the Proposed Scheme, 350m to the west of Pyford Brook (see Volume 2: Map CT-06-201, F7 to C5);

- diversion of a 10-inch diameter British Pipeline Agency Fuel pipeline for 150m, 50m from its existing alignment and crossing under the route of the Proposed Scheme 250m north-west of the Pyford Brook viaduct (see Volume 2: Map CT-06-201, E4 to E5);
- diversion of a 600mm diameter National Grid Gas Distribution High Pressure Gas Pipeline for 400m, up to 150m north of its existing alignment and passing under the route of the Proposed Scheme 400m north-west of the Pyford Brook viaduct (see Volume 2: Map CT-06-201, D3 to D6);
- a balancing pond for railway drainage to the northern side of the route of the Proposed Scheme, with areas of grassland and woodland habitat creation, at the south-eastern end of Crawley Lane. Access will be provided from Crawley Lane (see Volume 2: Map CT-06-201, C4);
- an area of woodland habitat creation, to the southern side of the route of the Proposed Scheme, and extending 600m to the west of the route, along the north-western edge of Ashby Sitch, to provide habitat connectivity (see Volume 2: Map CT-06-201, B5 to C10); and
- Ashby Sitch culvert, 1km north-west of the Pyford Brook viaduct, for the realignment of Ashby Sitch under the route of the Proposed Scheme (see Volume 2: Map CT-06-201, B5).

2.2.15 This section of the route of the Proposed Scheme will include two maintenance access points. There will also be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.16 Construction of this section will be managed from the Pyford Brook viaduct satellite compound and the Pyford North embankment satellite compound, which are described in Section 2.3 and shown on Map CT-05-201 and Map CT-05-202 in the Volume 2: CA1 Map Book.

Ashby Sitch culvert to Bourne embankment

2.2.17 This section of the route of the Proposed Scheme will continue on the Pyford North embankment from Ashby Sitch culvert and will then proceed on to the Kings Bromley viaduct crossing over Bourne Brook and the realigned A515 Lichfield Road and continue to the Bourne embankment.

2.2.18 This section of route is illustrated on map CT-06-201, CT-06-202 and CT-06-203 in the Volume 2: CA1 Map Book.

2.2.19 Key features of this 1.8km section will include:

- continuation of the Pyford North embankment, for 770m in length and up to 9m in height in this section. A noise fence barrier, 2m in height, will be located along the southern side of the embankment and will continue on to Kings Bromley viaduct. This barrier will provide acoustic screening for residents at Rileyhill. Landscape earthworks with landscape mitigation planting, to both sides of the route of the Proposed Scheme, will provide visual screening for

properties at Rileyhill and help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-201, F5 to A5 and Map CT-06-202, J5 to E5);

- an area of woodland habitat creation to the northern side of the route of the Proposed Scheme, adjacent to the Pyford North embankment, to provide habitat connectivity (see Volume 2: Map CT-06-201, A5 to A4 and Map CT-06-202, I5 to G5);
- an area of grassland habitat creation around an existing pond to the southern side of the route of the Proposed Scheme, south of Common Lane, to provide terrestrial habitat for great crested newt (see Volume 2: Map CT-06-202, H7 to G7);
- closure of Common Lane where it crosses the route of the Proposed Scheme with access to properties retained on both the southern and northern sides of the route. Users will be diverted along Crawley Lane and the A515 Lichfield Road, increasing the length of the journey by 2.9km (see Volume 2: Map CT-06-202, G5 to G6 and Map CT-06-202R1, J10 to C9);
- Bourne Brook auto-transformer station, 46m by 24m, within an area of grassland habitat creation to the southern side of the route of the Proposed Scheme, 250m north-west of Common Lane (South). Access will be provided from the A515 Lichfield Road (see Volume 2: Map CT-06-202, F5 to F6);
- two areas of landscape mitigation planting, 50m to the south of Bourne Brook on the southern side of the route of the Proposed Scheme, to provide visual screening for the residents at properties on the A515 Lichfield Road and Common Lane (see Volume 2: Map CT-06-202, F6 to F7);
- Kings Bromley viaduct, 980m in length and up to 15.5m in height. A noise fence barrier, 2m in height, will continue from Pyford North embankment on the southern side of the route of the Proposed Scheme and along the southern side of the Kings Bromley viaduct. The barrier will provide acoustic screening for the residents of properties in Rileyhill. A second noise fence barrier, also 2m in height, located on the northern side of the Kings Bromley viaduct will provide acoustic screening for properties in Kings Bromley (see Volume 2: Map CT-06-202, E5 to A5 and Map CT-06-203, J5 to H5);
- access to agricultural land at Common Lane Farm on the southern side of the route of the Proposed Scheme will be provided under the Kings Bromley viaduct via an access road from the retained section of Common Lane on the northern side of the route, increasing the length of journey by 800m (see Volume 2: Map CT-06-202, G6 to E5);
- an area of wetland habitat creation underneath the Kings Bromley viaduct following the course of the Bourne Brook on both sides of the route of the Proposed Scheme, providing habitat creation and connectivity (see Volume 2: Map CT-06-202, F8 to E4);

- raising of an 800m section of a National Grid Electricity Transmission 400kV overhead power line by 14m, to cross the route of the Proposed Scheme on its existing alignment (see Volume 2: Map CT-06-202, E10 to E1);
- extension of Kings Bromley Footpath 12 by 240m, to pass under the Kings Bromley viaduct and join the A515 Lichfield Road on the southern side of the route of the Proposed Scheme (see Volume 2: Map CT-06-202, E5 to E7);
- realignment of the A515 Lichfield Road, 200m west of its existing alignment for 1.4km, with no overall increase in length of the journey (see Volume 2: Map CT-06-202, F7 to C4);
- access to agricultural land beneath the Kings Bromley viaduct via an accommodation access track connecting to the realigned A515 Lichfield Road on the southern side of the route of the Proposed Scheme (see Volume 2: Map CT-06-209, D5 to D6);
- realignment of Kings Bromley Footpath 0.390, 10m south-east of its existing alignment, to pass around a pier of the Kings Bromley viaduct. The northern extent of the footpath will be closed, with users diverted alongside the realigned A515 Lichfield Road. The diversion and closure will increase the length of journey by 10m (see Volume 2: Map CT-06-202, C4 to C6);
- two areas of woodland habitat creation 500m to the north-east of the Proposed Scheme. One area will be located to the north and east of the junction between the A513 Rugeley Road and the A515 Lichfield Road and the second located to the east of A515 Lichfield Road to provide visual screening and help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-202, D1 to B2);
- realignment of Shaw Lane, 50m west of its existing alignment for 500m, to pass beneath the Kings Bromley viaduct and re-join its existing alignment to the south of the junction with A513 Rugeley Road, increasing the length of the journey by 60m (see Volume 2: Map CT-06-202, B6 to A4);
- realignment of Crawley Brook around a pier of the Kings Bromley viaduct, and passing under the realigned Shaw Lane (see Volume 2: Map CT-06-202, A4 to A5 and CT-06-203, I6 to H5);
- an area of wetland habitat creation underneath the Kings Bromley viaduct and on both sides of the realigned Shaw Lane to provide replacement habitat (see Volume 2: Map CT-06-202, B6 to A5 and Map CT-06-203, I6 to H5); and
- a replacement floodplain storage area to the southern side of the route of the Proposed Scheme, 130m west of the Kings Bromley viaduct. Following excavation, the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-202, B7 to A7 and Map CT-06-203, I7 to I8).

2.2.20 This section of the route of the Proposed Scheme will include one emergency access point, along Common Lane on the northern side of the route of the Proposed Scheme, and one maintenance access point allowing vehicle access to the route. There will also be maintenance access routes and hedgerow planting throughout this section. There

will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas, sewers and telecommunication cables.

- 2.2.21 Construction of this section will be managed from the Pyford North embankment satellite compound and the Bourne embankment satellite compound, which are described in Section 2.3 and shown on maps CT-05-202 and CT-05-203 in the Volume 2: CA1 Map Book.

Bourne embankment to Pipe Lane

- 2.2.22 This section of the route of the Proposed Scheme will run from the Bourne embankment to 150m north-west of Pipe Lane. The route will continue from the Kings Bromley viaduct onto the Bourne embankment. The route will then continue onto the River Trent viaduct, passing over the A513 Rugeley Road and Pipe Lane.
- 2.2.23 This section of route is illustrated on maps CT-06-203 and CT-06-204 in the Volume 2: CA1 Map Book.
- 2.2.24 Key features of this 2.4km section will include:
- Bourne embankment, 505m in length and up to 16m in height. Landscape earthworks with landscape mitigation planting, will help to integrate the route of the Proposed Scheme into the landscape. A noise fence barrier, 2m in height, will continue from the Kings Bromley viaduct along the northern side of the route of the Proposed Scheme to provide acoustic screening for properties at Kings Bromley (see Volume 2: Map CT-06-203, H6 to E6);
 - a balancing pond for railway drainage, 150m north-west of Shaw Lane. Access will be provided from the A513 Rugeley Road (see Volume 2: Map CT-06-203, H5 to G5);
 - an area of woodland habitat creation to the northern side of the route of the Proposed Scheme, extending for 450m along the Bourne embankment, on both sides of the A513 Rugeley Road to provide replacement habitat and ecological connectivity between existing woodland areas (see Volume 2: Map CT-06-203, G5 to F3);
 - two ecological mitigation ponds, within areas of wetland habitat creation, to provide replacement habitat for reptiles and amphibians, to the north-east of the route of the Proposed Scheme, 75m east of the A513 Rugeley Road (see Volume 2: Map CT-06-203, G4);
 - an area of wetland habitat creation to the north-east of the route of the Proposed Scheme, 50m from the A513 Rugeley Road (see Volume 2: Map CT-06-203, F4 to G4, H4 to H5);
 - diversion of Kings Bromley Footpath 1, 350m to the north-west of its existing alignment for a length of 725m, passing under the River Trent viaduct at the northern end of the Bourne embankment, and joining the A513 Rugeley Road on the northern side of the route of the Proposed Scheme. The diversion of Kings Bromley Footpath 1 will extend the journey length by 510m (see Volume 2: Map CT-06-203, G7 to E5);

- an area of grassland habitat creation to the north of the Bourne embankment to provide replacement habitat (see Volume 2: Map CT-06-203, F6 to E5);
- River Trent viaduct, 1.9km in length and up to 15m in height. A noise fence barrier, 2m in height, will continue from Bourne embankment on the northern side of the River Trent viaduct to provide acoustic screening for the properties at Kings Bromley. A second noise fence barrier, 2m in height, will be located along the southern side of the viaduct, at its northern end, to provide acoustic screening for properties at Pipe Ridware (see Volume 2: Map CT-06-203, E6 to A6 and CT-06-204, J5 to D5);
- realignment of a drain for 80m, to provide surface water drainage beneath the River Trent viaduct, 200m north of Echills Farm (see Volume 2: Map CT-06-203, E5 to E6);
- an area of grassland habitat creation, 250m to the west of the River Trent viaduct, located adjacent to Trentside Meadows LWS, to provide replacement habitat (see Volume 2: Map CT-06-203, A7 to A10 and Map CT-06-204, I7 to F8);
- two areas of grassland habitat will be created under the River Trent viaduct; one to the east of the Trentside Meadows LWS, the other adjacent to the River Trent to provide replacement habitat and connectivity (see Volume 2: Map CT-06-204, I5 to G5);
- a replacement floodplain storage area to the southern side of the route of the Proposed Scheme, 640m west of the River Trent viaduct, adjacent to the A513 Kings Bromley Lane. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-204-L1, H1 to G3);
- realignment of Mavesyn Ridware Footpath 30, 10m to the north of its existing alignment, to pass around a pier for the River Trent viaduct. The realignment will increase the journey length by 10m (see Volume 2: Map CT-06-204, F5);
- diversion of Pipe Lane (also known as Pipe Wood Lane), 1.1km to the north-east of its existing alignment, on the northern side of the route of the Proposed Scheme, which will increase the journey length by 470m. To the southern side of the route, a 300m section of Pipe Lane will be closed at its southern extent, to the south-east of Quintons Orchard (see Volume 2: Map CT-06-204, D4 to A3);
- a 300m section of Dawson Lane will be closed where it crosses the route of the Proposed Scheme, with users diverted via Pipe Lane to the east (see Volume 2: Map CT-06-204, D6 to C4);
- a balancing pond for highways drainage, with an area of grassland habitat creation, to the north-east of the route of the Proposed Scheme, 225m north-east of Pipe Ridware. Access will be provided from the diverted Pipe Lane (see Volume 2: Map CT-06-204, D4 to D5);
- realignment of Mavesyn Ridware Footpath 32, 10m to the east of its existing alignment, around a pier for the River Trent viaduct. The realignment of the

footpath will increase the journey length by 10m (see Volume 2: Map CT-06-204, D5);

- an area of wetland habitat creation to the southern side of the route of the Proposed Scheme, adjacent to the south-west of the realigned Mavesyn Ridware Footpath 32, to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-204, D6 to C6); and
- diversion of a National Grid Gas Transmission 1,050mm diameter high pressure main for 350m, 100m south of its existing alignment, to pass under the River Trent viaduct (see Volume 2: Map CT-06-204, D4 to C6).

2.2.25 This section of the route of the Proposed Scheme will include one emergency access point, 70m south of the River Trent viaduct, and one maintenance access point allowing vehicle access to the route. There will be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.26 Construction of this section will be managed from the Bourne embankment satellite compound, River Trent viaduct satellite compound and Pipe Ridware embankment satellite compound which are described in Section 2.3 and shown on maps CT-05-203 and CT-05-204 in the Volume 2: CA1 Map Book.

Pipe Lane to Blithbury West drop inlet culvert

2.2.27 The route of the Proposed Scheme in this section will continue from the River Trent viaduct onto the Pipe Ridware embankment. The route will then continue into the Blithbury South cutting, continuing in a north-west direction towards Blithbury to the Blithbury West drop inlet culvert.

2.2.28 This section of route is illustrated on maps CT-06-204, CT-06-205 and CT-06-206 in the Volume 2: CA1 Map Book.

2.2.29 Key features of this 2.7km section will include:

- Pipe Ridware embankment, 1.1km in length and up to 9m in height. Landscape earthworks, with landscape mitigation planting on both sides of the embankment, will provide visual screening for residents at Pipe Ridware and landscape integration. A noise fence barrier, 2m in height, will continue from the River Trent viaduct to provide acoustic screening for properties at Pipe Ridware (see Volume 2: Map CT-06-204, C5 to A6 and Map CT-06-205, J6 to F6);
- an area of woodland habitat creation to the northern side of the route of the Proposed Scheme, along the Pipe Ridware embankment, to provide replacement habitat and help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-204, C5 to A5 and Map CT-06-205, J5 to G5);
- diversion of Mavesyn Ridware Footpath 33, 100m east of its existing alignment, for 500m in length. The footpath will be diverted onto an access track from Pipe Lane for 50m before joining Mavesyn Ridware Footpath 32.

The diversion will increase the length of journey by 100m (see Volume 2: Map CT-06-204, C4 to C5);

- Pipe Ridware auto-transformer station, 46m by 24m, within an area of grassland and woodland habitat creation, to the northern side of the route of the Proposed Scheme, adjacent to the base of the Pipe Ridware embankment. Access will be provided from the diverted Pipe Lane (see Volume 2: Map CT-06-204, C5);
- two balancing ponds, one for railway drainage, within an area of grassland habitat creation, to the northern side of the route of the Proposed Scheme, 100m to the north of the Pipe Ridware auto-transformer station. The second will be for highway drainage, to the northern side of the route, 200m south of Woodhouse Farm, within an area of grassland habitat creation. Access will be provided to both ponds from the diverted Pipe Lane (see Volume 2: Map CT-06-204, C4 to B4 and CT-06-205, J5 to G5);
- two ecological mitigation ponds to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, to the southern side of the route of the Proposed Scheme, 100m south-west of the Pipe Ridware embankment (see Volume 2: Map CT-06-205, I6 to I7);
- Woodhouse culvert for surface water drainage under the route of the Proposed Scheme, 150m south-west of Woodhouse Farm (see Volume 2: Map CT-06-205, G5 to G6);
- a balancing pond for railway drainage and an area of grassland habitat creation, to the southern side of the route of the Proposed Scheme, adjacent to Quintons Orchard, within an area of woodland habitat creation. Access will be provided from Pipe Lane via the Mavesyn Ridware Footpath 38 accommodation overbridge (see Volume 2: Map CT-06-205, G6 to E6);
- Blithbury package substation, within a compound 45m by 10m, located on the southern side of the route of the Proposed Scheme, 200m north of Quinton's Orchard Farm. Access will be provided from Pipe Lane via the Mavesyn Ridware Footpath 38 accommodation overbridge (see Volume 2: Map CT-06-205, E6 to F6);
- Blithbury South cutting, 960m in length, up to 5m in depth and 57m in width (see Volume 2: Map CT-06-205, F6 to A5 and Map CT-06-206, J5 to H5);
- realignment of Mavesyn Ridware Footpath 38, 400m in length, to cross on the Mavesyn Ridware Footpath 38 accommodation overbridge, 10m north-west of its existing alignment, increasing the length of the journey by 10m. The overbridge will be 6.2m in height above existing ground level and 10m above track level (see Volume 2: Map CT-06-205, E5 to E6);
- diversion of Mavesyn Ridware Footpath 8, 500m south-east of its existing alignment for 1km in length, to cross the route of the Proposed Scheme on the Mavesyn Ridware Footpath 38 accommodation overbridge, connecting back

on its existing alignment to the northern side of the route, increasing the length of the journey by 580m (see Volume 2: Map CT-06-205, E6 to B5);

- a landscape bund¹⁵ on the northern side of the route of the Proposed Scheme, beginning 200m north-west of the Mavesyn Ridware Footpath 38 accommodation overbridge. The height of the landscape bund will be between 5m and 7m in height along the northern side of Blithbury South cutting. The landscape bund will provide visual and acoustic screening for residents of properties at Blithbury (see Volume 2: Map CT-06-205, D5 to A5 and CT-06-206, J5 to G4);
- areas of grassland habitat creation to the northern side of the Proposed Scheme, one along the Blithbury South cutting and a second area adjacent to Pipe Lane, around existing ponds, to provide terrestrial habitat for great crested newt (see Volume 2: Map CT-06-205, E5 to D5, D4 to C4);
- a section of Blithbury Central cutting, 65m in length, 5m in depth and 49m in width in this section (see Volume 2: Map CT-06-206, F5 to C4);
- Blithbury drop inlet culvert¹⁶, 180m south-east of the B5014 Uttoxeter Road, for realignment of an unnamed watercourse under the route of the Proposed Scheme (see Volume 2: Map CT-06-206, H5 to H4);
- an area of woodland habitat creation, to the southern and northern sides of the route of the Proposed Scheme, and extending to both sides of the B5014 Uttoxeter Road on the southern side of the route, to provide habitat replacement and help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-206, G6 to F4);
- an ecological mitigation pond, to provide replacement habitat for reptiles and amphibians, within an area of woodland habitat creation, to the northern side of the route of the Proposed Scheme, adjacent to the B5014 Uttoxeter Road overbridge (see Volume 2: Map CT-06-206, G4);
- extension of Mavesyn Ridware Footpath 9 by 120m at its northern extent to join the realigned B5014 Uttoxeter Road on the southern side of the route of the Proposed Scheme (see Volume 2: Map CT-06-206, H7 to G7);
- realignment of the B5014 Uttoxeter Road, 200m to the west of its existing alignment for 1.1km in length, to cross over the route of the Proposed Scheme on the B5014 Uttoxeter Road overbridge. The overbridge will be 5m in height above ground level and 10m above track level. The realignment will not result in any overall change in length of journey for road users. The existing B5014 Uttoxeter Road will remain open for maintenance access but closed to public vehicular traffic to the southern and northern sides of the route of the

¹⁵ A bund is an earthworks structure designed to provide either visual screening or noise attenuation to receptors in proximity.

¹⁶ A drop inlet culvert comprises a circular pipe or rectangular box culvert, usually with an inlet weir and open stepped 'cascade' on the upstream side to dissipate energy. Drop inlet culverts are used when a watercourse (or dry valley) crosses the route or road in cutting or close to existing ground level.

Proposed Scheme, and retained on the northern side of the route as a private access for Pipe Hall Farm and for HS2 maintenance access (see Volume 2: Map CT-06-206, H10 to F2);

- diversion of Stonyford Lane in two places. At its south-eastern extent, it will be realigned 20m to the east of its existing alignment to join the realigned B5014 Uttoxeter Road. At its north-western extent, it will be diverted 75m east of its existing alignment to join the realigned Blithbury Road, with an area of grassland habitat creation to the west. The diversion of Stonyford Lane will decrease the overall journey length by 330m (see Volume 2: Map CT-06-206, C7 to B7);
- three balancing ponds for highway drainage, within areas of grassland habitat creation, along the south-eastern side of the realigned B5014 Uttoxeter Road. The balancing ponds will be accessed from the B5014 Uttoxeter Road (see Volume 2: Map CT-06-206, G3, G6 and H9);
- access to agricultural land via the Manor Farm overbridge, 8m in height above existing ground level and 10m above track level, with an adjacent area of grassland and woodland habitat creation around an existing pond to provide terrestrial habitat for great crested newt, 100m north-west of the B5014 Uttoxeter Road overbridge (see Volume 2: Map CT-06-206, F4 to F5);
- a landscape bund, 5m in height, beginning at the Manor Farm overbridge and continuing along the northern side of Blithbury Central cutting. The landscape bund will provide acoustic and visual screening for properties in Blithbury (see Volume 2: Map CT-06-206, F4 to C4);
- Blithbury West drop inlet culvert, 250m north-west of Manor Farm overbridge, for the diversion of a tributary of Bentley Brook under the route of the Proposed Scheme (see Volume 2: Map CT-06-206, E4 to E5); and
- an area of woodland habitat creation, 500m south-west of Blithbury Central cutting to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-206, E9 to D9).

2.2.30 This section of the route of the Proposed Scheme will include one emergency access point, at the southern end of the Pipe Ridware embankment, and four maintenance access points allowing vehicle access to the route. There will also be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.31 Construction of this section will be managed from the Pipe Ridware embankment satellite compound and the Blithbury Central cutting satellite compound, which are described in Section 2.3 and shown on Map CT-05-204, D4 and D5 and CT-05-206, C4 in the Volume 2: CA1 Map Book.

Blithbury West drop inlet culvert to the junction of High Street/Newlands Lane

- 2.2.32 This section of the route will run from the Blithbury West drop inlet culvert to the junction of High Street and Newlands Lane. The route will continue within the Blithbury Central cutting past Blithbury towards Stockwell Heath and Colton, continuing on to the Stockwell Heath embankment until reaching High Street/Newlands Lane.
- 2.2.33 This section of route is illustrated on maps CT-06-206, CT-06-207 and CT-06-208 in the Volume 2: CA1 Map Book.
- 2.2.34 Key features of this 2.3km section will include:
- continuation of Blithbury Central cutting, 1.4km in length, up to 8m in depth and 61m in width in this section, and continuation of a landscape bund, 5m in height, and landscape mitigation planting on the northern side of the cutting to provide visual and acoustic screening for residents in Blithbury which will also support the integration of the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-206, E5 to A5 and Map CT-06-207, J6 to E5);
 - two balancing ponds for highway drainage within an area of grassland habitat creation, one pond 250m to the southern side of the route of the Proposed Scheme, adjacent to the diverted Stonyford Lane. Access will be provided from Stonyford Lane. The second one, to the northern side of the route of the Proposed Scheme, adjacent to the junction of Hadley Gate Lane diversion and Blithbury Road. Access will be provided from Hadley Gate Lane (see Volume 2: Map CT-06-206, C7, C3);
 - realignment of Blithbury Road, 250m south of its existing alignment, for 1.5km in length, to pass over the route of the Proposed Scheme on the Blithbury Road overbridge. The overbridge will be 2m in height above existing ground level and 9m above track level. The realignment will increase the length of journey by 55m. A section of the existing Blithbury Road will be maintained for access to properties on Blithbury Road, on the southern side of the route of the Proposed Scheme (see Volume 2: Map CT-06-206, D3 to A8);
 - four ecological mitigation ponds to the southern side of the route of the Proposed Scheme, to provide replacement habitat for reptiles and amphibians, within an area of grassland and woodland habitat creation to provide ecological connectivity between habitats, to both the northern and southern sides of the realigned Blithbury Road (see Volume 2: Map CT-06-206, C7 to B6);
 - diversion of Hadley Gate Lane, 450m to the north-east of its existing junction with Blithbury Road, for 800m in length to join the diverted Blithbury Road, increasing the length of journey by 250m (see Volume 2: Map CT-06-206, B1 to C3);

- diversion of an unnamed watercourse to the west of its existing alignment for 200m, adjacent to the diverted Stonyford Lane (see Volume 2: Map CT-06-206, C7 to B7);
- closure of the Colton Byway Open to All Traffic (BOAT) 16. Users will be diverted via the realigned Blithbury Road and the Hadley Gate Lane diversion, which will reduce journey length by 100m (see Volume 2: Map CT-06-206, A2 to B7);
- diversion of Colton Footpath 17, to the south-east of its existing alignment, to join the diverted Hadley Gate Lane, reducing the length of journey to Blithbury Road by 200m (see Volume 2: Map CT-06-206, B2 and CT-06-207, I2);
- landscape mitigation planting to provide visual screening of the route of the Proposed Scheme from residential properties on Hadley Gate Lane (see Volume 2: CT-06-206, C4 to B4);
- ten ecological mitigation ponds, to provide replacement habitat for great crested newt, within supporting areas of woodland and grassland habitat creation, with six ecological mitigation ponds on the southern side of the route of the Proposed Scheme, 300m to the north of Hollow Lane, and four ecological mitigation ponds on to the northern side of the route, 400m north-west of Hadley Gate Lane (see Volume 2: Map CT-06-207, H6 to F7 and G4 to G5);
- a balancing pond for highway drainage, to the southern side of the route of the Proposed Scheme, adjacent to the junction of Blithbury Road and Hollow Lane. Access will be provided from Blithbury Road (see Volume 2: Map CT-06-206, G9);
- realignment of Colton Footpath 73, for 125m in length, 10m south of its existing alignment, to cross over the route of the Proposed Scheme on the Colton Footpath 73 overbridge, increasing the length of journey by 20m. The overbridge will be 2.1m in height above existing ground level and 9m in height above track level (see Volume 2: Map CT-06-207, G5 to G6);
- Hurstwood drop inlet culvert, 320m north-west of the Colton Footpath 73 overbridge, for surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-207, E5 to E6);
- Blithbury North cutting, 895m in length, up to 12m in depth and 87m in width. A noise fence barrier, 5m in height, will be located on the southern side of the cutting and provide acoustic screening for the residents of Colton (see Volume 2: Map CT-06-207, E5 to A5 and Map CT-06-208, J6 to H5);
- Newlands Lane auto-transformer feeder station, 200m by 135m, 150m south-east of Newlands Lane, with access from Newlands Lane. There will be areas of landscape mitigation planting around the auto-transformer feeder station on both sides of the route of the Proposed Scheme (see Volume 2: Map CT-06-207, E4 to D5, F46 to C6);

- a balancing pond for railway drainage, within an area of mitigation grassland habitat creation, to the southern side of the route of the Proposed Scheme, adjacent to the junction between Colton Bridleway 31, Colton Bridleway 32 and Colton Bridleway 33. Access will be provided from Colton Bridleway 33 (see Volume 2: Map CT-06-207, E7 to E9);
- realignment of Newlands Lane, 150m to the north of its existing alignment, for 700m in length, to cross over the route of the Proposed Scheme on the Newlands Lane overbridge. The overbridge will be 1m in height above existing ground level and 11m in above track level, reducing the length of journey by 20m (see Volume 2: Map CT-06-207, D3 to C7);
- diversion of Colton Footpath 34, 300m to the east of its existing alignment, for 900m in length, to meet the realigned Newlands Lane. The diversion will increase the length of journey to Newlands Lane to the north by 330m, and reduce the length of journey to Newlands Lane to the south via Newlands Lane overbridge by 110m (see Volume 2: Map CT-06-207, B4 to C4);
- a landscape bund, 200m in length and 5m in height, on the southern side of the route of the Proposed Scheme, beginning 200m north of Newlands Lane overbridge. The bund will provide noise and visual screening for residents in Colton (see Volume 2: Map CT-06-208, J6 to I6);
- an area of woodland habitat creation on the southern side of the route of the Proposed Scheme, adjacent to Newlands Lane, to provide replacement woodland habitat (see Volume 2: CT-06-208, I6 to H6); and
- diversion of Colton Footpath 36, 250m to the north of its existing alignment, to run along the northern side of the route of the Proposed Scheme for 600m, and to join Newlands Lane near Stockwell Heath, increasing the length of journey by 510m (see Volume 2: Map CT-06-208, H5 to G5).

2.2.35 This section of the route of the Proposed Scheme will include two emergency access points adjacent to Blithbury Road on the southern and northern sides of the route of the Proposed Scheme, and two maintenance access point allowing vehicle access to the route. There will also be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.36 Construction of this section will be managed from the Blithbury Central cutting satellite compound, the Blithbury North cutting satellite compound and the Newlands Lane auto-transformer feeder station satellite compound, which are described in Section 2.3, and shown on maps CT-05-206, CT-05-207, CT-05-207 in the Volume 2: CA1 Map Book.

High Street/Newlands Lane to Moreton Brook

2.2.37 This section of the route of the Proposed Scheme will continue from the junction of High Street and Newlands Lane to Moreton Brook (the start of the Colwich to Yarlet area (CA2)). The route will proceed on the Stockwell Heath embankment, past Stockwell Heath and Colton. The route will then continue north, into the Stockwell

Heath cutting and on to the Moreton South embankment to cross Moreton Brook on the Moreton Brook viaduct.

2.2.38 This section of route is illustrated on maps CT-06-208 and CT-06-209 in the Volume 2: CA1 Map Book.

2.2.39 Key features of this 2.9km section will include:

- Stockwell Heath embankment, 825m in length and up to 12m in height. Landscape earthworks, landscape mitigation planting and areas of woodland habitat creation on both sides of the route of the Proposed Scheme will provide visual screening for residents of Stockwell Heath and Colton and help integrate the Proposed Scheme into the landscape. A noise fence barrier, 5m in height, will continue from the Blithbury North cutting along the southern side of the route of the Proposed Scheme to provide acoustic screening for properties in Colton. To the northern side of the route, a noise fence barrier, 5m in height, will provide acoustic screening for residents of Stockwell Heath (see Volume 2: Map CT-06-208, H5 to D5);
- an area of woodland and grassland habitat creation on the northern side of the route of the Proposed Scheme, adjacent to the south-east of Newlands Lane, to provide habitat connectivity (see Volume 2: Map CT-06-208, H5 to G5);
- Finners culvert, 75m east of the junction between Newlands Lane and Narrow Lane, for surface water drainage under the route of the Proposed Scheme (see Volume 2: Map CT-06-208, H5 to H6);
- widening of Newlands Lane to 5.5m, for 200m in length, to pass under the route of the Proposed Scheme via Newlands Lane underbridge, 100m north of the junction between Narrow Lane and Newlands Lane (see Volume 2: Map CT-06-208, G5 to G6);
- diversion of Moor Lane, 500m south of its existing alignment, to meet Newlands Lane to the southern side of the route of the Proposed Scheme, increasing the length of journey by 170m. Moor Lane will be closed where it crosses the route of the Proposed Scheme, with a section of Moor Lane to the northern side of the route retained to allow access to properties (see Volume 2: Map CT-06-208, G6 to E7);
- diversion of Colton Footpath 76, 20m east of its existing alignment, for 20m along the northern side of the Stockwell Heath embankment and joining Newlands Lane, with no overall increase in length of the journey (see Volume 2: Map CT-06-208, G5);
- Stockwell Heath culvert, 150m north-west of the Newlands Lane underbridge, for the realignment of a tributary of Moreton Brook under the route of the Proposed Scheme (see Volume 2: Map CT-06-208, G5 to F6);
- closure of Colton Footpath 52, on the east of the diverted Moor Lane to the west of Stockwell Heath. Users will be diverted via Newlands Lane underbridge and the diverted Moor Lane, increasing the length of journey by 75m (see Volume 2: Map CT-06-208, F5 to F6);

- two balancing ponds, within areas of mitigation grassland habitat creation; one for highway drainage and one for railway drainage, to the southern side of the route of the Proposed Scheme, adjacent to and with access from the diverted Moor Lane (see Volume 2: Map CT-06-208, E6 to E7 and F6);
- Stockwell Heath cutting, 555m in length, up to 8m in depth and 59m in width, with landscape mitigation planting along the southern side. Noise fence barriers 2m in height, and two landscape bunds 3m in height, will be located along the southern side of the route of the Proposed Scheme, at the southern and northern extents of the Stockwell Heath cutting. The landscape bunds and noise fence barriers will provide acoustic and visual screening for properties at Hamley Heath (see Volume 2: Map CT-06-208, D5 to A6 and CT-06-209, J5 and I5);
- realignment of the B5013 Uttoxeter Road, 75m south-east of its existing alignment, for 1km in length, to pass under the route of the Proposed Scheme via the B5013 Uttoxeter Road underbridge. This realignment will increase the length of journey by 10m (see Volume 2: Map CT-06-208, A3 to B10 and CT-06-209, I2 to J10);
- an area of woodland habitat creation to the east of the realigned B5013 Uttoxeter Road, on the northern side of the route of the Proposed Scheme, to provide replacement habitat. To the southern side of the route, there will be areas of grassland habitat creation around existing ponds to the west of the realigned B5013 Uttoxeter Road to provide replacement terrestrial habitat for great crested newt (see Volume 2: Map CT-06-208, A4 to A8);
- a balancing pond for railway drainage, within an area of grassland habitat creation, 200m north-east of the route of the Proposed Scheme. Access will be provided from the realigned B5013 Uttoxeter Road (see Volume 2: Map CT-06-208, A3 to A4);
- an accommodation access track for Lea Hall Farm providing access to agricultural land from the realigned B5013 Uttoxeter Road, to the northern side of the route of the Proposed Scheme (see Volume 2: Map CT-06-208, C4 to A4);
- Moreton South embankment, 1.2km in length and up to 7m in height (see Volume 2: Map CT-06-209, H5 to C5);
- a landscape bund, 225m in length and up to 3m in height, on the southern side of the route of the Proposed Scheme, extending north-west from the B5013 Uttoxeter Road underbridge. The bund, which will be graded to allow the area to return to agricultural use, will provide visual and acoustic screening for properties at Hamley Heath (see Volume 2: Map CT-06-209, I6 to H6);
- widening of Jonghams Lane by 0.4m and provision of passing bays for 1.2km in length. Jonghams Lane will also be extended by 35m to the south-east, to meet the realigned B5013 Uttoxeter Road (see Volume 2: Map CT-06-209, J8 to F6);

- Hamley (South) culvert, 250m west of the realigned B5013 Uttoxeter Road, for the diversion of a tributary of Moreton Brook under the route of the Proposed Scheme (see Volume 2: Map CT-06-209, I3 to H6);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, with an area of grassland habitat creation, to the northern side of the route of the Proposed Scheme, 425m west of B5013 Uttoxeter Road (see Volume 2: Map CT-06-209, G4 to F3);
- an area of woodland habitat creation, to the northern side of the route of the Proposed Scheme, adjacent to the Hamley (North) drop inlet culvert, to provide habitat connectivity (see Volume 2: Map CT-06-209, F4 to E5);
- Hamley (North) drop inlet culvert, located 650m west of the B5013 Uttoxeter Road realignment, for the realignment of a tributary of Moreton Brook under the route of the Proposed Scheme (see Volume 2: Map CT-06-209, F5 to F6);
- a balancing pond for railway drainage, with an area of woodland and grassland habitat creation, on the south side of the route of the Proposed Scheme, 150m west of the Hamley (North) drop inlet culvert. Access will be provided from Jonghams Lane (see Volume 2: Map CT-06-209, F5 to D5);
- an area of woodland habitat creation, to the north of the route of the Proposed Scheme, 50m north-east of the Moreton Brook viaduct, to provide replacement habitat (see Volume 2: Map CT-06-209, C4 to C5);
- a replacement floodplain storage area, to the southern side of the route of the Proposed Scheme, adjacent to Jonghams Lane. Following excavation the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-209, D6);
- Moreton Brook viaduct, 195m in length and up to 9m in height (see Volume 2: Map CT-06-209, C5 to B5);
- realignment of Moreton Brook, 20m to the east of its existing alignment, around the piers of the Moreton Brook viaduct (see Volume 2: Map CT-06-209, B5 to C5);
- an accommodation access to agricultural land for Lea Hall Farm beneath the Moreton Brook viaduct from the northern end of Jonghams Lane (see Volume 2: Map CT-06-209, C5 to C6);
- an area of wetland habitat creation under the Moreton Brook viaduct, extending 900m in length south-west of the route along the west of Moreton Brook (see Volume 2: Map CT-06-209, G10 to B5);
- underground diversion of Western Power Distribution 132kV overhead power line for 1km, to pass under the route of the Proposed Scheme at Moreton Brook viaduct (see Volume 2: Map CT-06-209, C6 to B4); and
- a balancing pond for railway drainage, with an area of mitigation woodland and grassland habitat creation, to the west of the route of the Proposed Scheme, 150m south-west of the Moreton Brook viaduct. Access will be

provided from Colton Bridleway 58, which is located within the Colwich to Yarlet area (CA2) (see Volume 2: Map CT-06-209, B6 to B7).

- 2.2.40 This section of the route of the Proposed Scheme will include four emergency access points. One emergency access point will be located adjacent to the Newlands Lane underbridge. Two will be located either side of the route adjacent to the Stockwell Heath cutting and the realigned B5013 Uttoxeter Road, and a further point will be located to the north of the Moreton South embankment. There will be one maintenance access point, allowing vehicle access to the route. There will also be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.
- 2.2.41 Construction of this section will be managed from the Blithbury North cutting satellite compound, Stockwell Heath cutting satellite compound, Moreton Brook viaduct satellite compound and Trent South embankment main compound within Colwich to Yarlet area (CA2), which are described in Section 2.3 and shown on maps CT-05-207, CT-05-208 and CT-05-209 in the Volume 2: CA1 Map Book.

Connection from grid supply point at National Grid Rugeley substation to Newlands Lane auto-transformer feeder station

- 2.2.42 The Proposed Scheme will require power to be provided from the National Grid and distribution network. Power will be provided from an existing substation at the Rugeley Power Station via a three circuit power line 4km in length, of which 1.7km will be underground and 2.3km will be on overhead line, connecting into the Newlands Lane auto-transformer feeder station. The Newlands Lane auto-transformer feeder station will provide power directly to the overhead line equipment and to a number of auto-transformer stations along the route of the Proposed Scheme.
- 2.2.43 The key features of this connection will include:
- a connection to the grid supply point at National Grid Rugeley substation, where the existing 400kV power line will be transformed down to 132kV (see Volume 2: Map CT-06-207-L3, G2);
 - the 132kV power line will be ducted underground, using horizontal directional drilling, for 670m under the Lakeside golf course at Rugeley Power Station, the River Trent and the West Coast Main Line (WCML) (see Volume 2: Map CT-06-207-L3, F2 to E1 and Map CT-06-207 L2, H10 to F7);
 - a cable sealing end compound¹⁷, 80m by 40m, will be located adjacent to Cawarden Springs LWS to allow the transition of the ducted cables to overhead power line, 120m north of the WCML. Access to the cable sealing end compound will be via a new access from the existing access track to Cawarden Springs Farm, which connects to Blithbury Road to the north and will be upgraded (see Volume 2: Map CT-06-207-L2, F7 to E7);

¹⁷ A cable sealing end compound is required at the interface between overhead line and buried cables.

- two ecological mitigation ponds, within an area of grassland habitat creation, two areas of woodland habitat creation to provide replacement habitat, and an area of grassland habitat creation, to the east of the overhead power lines, extending from 270m north-east of the WCML (see Volume 2: Map CT-06-207-L2, F6 to E3);
- three sets of wooden poles 15m in height, with 100m span between poles, will carry the power line overhead for 2.3km north to a second cable sealing end compound. There will be an offset of 18m between each of the three parallel pole line (see Volume 2: Map CT-06-207-L2, F7 to C1 and Map CT-06-207-L1, H10 to D3);
- four ecological mitigation ponds, within an area of grassland habitat creation, and areas of woodland habitat creation to provide replacement habitat and provide habitat connectivity around an existing pond, extending from 300m south-west of Hollow Lane (see Volume 2: Map CT-06-207-L1, D4 to C6);
- a cable sealing end compound, 80m by 40m, 100m south-west of Hollow Lane within an area of landscape mitigation planting to provide visual screening at the sealing end compound for views from Hollow Lane and adjacent properties and grassland habitat creation. The cable sealing end compound will be accessed from Hollow Lane. This compound will allow the transition of the overhead power line to buried cables (see Volume 2: Map CT-06-207-L1, D2 and D3); and
- the buried power lines will continue for 1km to the north-east towards the route of the Proposed Scheme where they will be ducted beneath the route. The ducted lines will then pass around the perimeter of the Newlands Lane auto-transformer feeder station, under an area of grassland habitat creation, and connect into transformers on the northern side of the auto-transformer feeder station (see Volume 2: Map CT-06-207-L1, D2 and D1 and Map CT-06-207, E10 to E4).

2.2.44 This section of the route of the Proposed Scheme will include maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

Demolitions

2.2.45 Demolition of three existing residential properties, three commercial/ business properties (including farm outbuildings) and three other structures will be required to construct the permanent features in the Fradley to Colton area. Demolitions will be managed from the same construction compounds as the permanent features with which they are associated. The identified demolitions are listed in Section 2.3 under the relevant construction compounds.

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the key construction activities that are envisaged to build the Proposed Scheme in the Fradley to Colton area. It includes:

- an overview of the construction process;
- a description of the advance works;
- a description of the engineering works to build the Proposed Scheme;
- information on construction waste and material resources;
- a description of how the Proposed Scheme will be commissioned;
- an indicative construction programme; and
- monitoring arrangements during the construction period.

2.3.2 The construction arrangements described in this section provide the basis for the assessment presented in this ES.

2.3.3 Land used only for construction purposes will be restored as agreed with the owner of the land and the relevant planning authority once the construction works in that area are complete.

2.3.4 Land will be required permanently for the key features of the Proposed Scheme described in Section 2.2.

2.3.5 During the construction phase, public roads and PRow routes will remain open for public use, wherever reasonably practicable. Where such routes cross the Proposed Scheme and require diversion, the alternative road or PRow crossing the Proposed Scheme will be constructed prior to any closure of existing roads or PRow, wherever reasonably practicable. Where they cross the Proposed Scheme in proximity to their existing alignment, a temporary alternative alignment may be required. In some instances, diverted or realigned roads or PRow may need to pass through areas required for construction of the Proposed Scheme. Routes through these areas will be provided where it is safe and reasonably practicable to do so.

2.3.6 Volume 1, Section 5 and Section 6 provide details of the typical construction techniques. For the purposes of the environmental assessment, standard construction techniques as provided in Volume 1, Section 6 have been assumed.

Code of Construction Practice

2.3.7 All contractors will be required to comply with a Code of Construction Practice (CoCP). In addition, Local Environmental Management Plans (LEMPs) will be produced for each local authority area. The CoCP and LEMPs will be the means of controlling the construction works associated with the Proposed Scheme, and will set out monitoring requirements, with the objective of ensuring that the effects of the works on people and the natural environment are reduced insofar as reasonably practicable. The CoCP will contain general control measures and standards to be implemented throughout the construction process.

2.3.8 A draft CoCP has been prepared and is published as part of this ES, in Volume 5: Appendix CT-003-000. The CoCP will remain a draft document through the parliamentary process and will be finalised at Royal Assent. The CoCP sets out measures to be implemented by the nominated undertaker.

Overview of the construction process

- 2.3.9 Building and preparing the Proposed Scheme for operation will comprise the following general stages:
- advance works including: site investigations further to those already undertaken and preliminary mitigation works;
 - civil engineering works including: extraction of sand and gravel from borrow pits; establishment of construction compounds; haul road, site preparation and enabling works; main earthworks and structure works; site restoration; removal of construction compounds where the compound is not required for railway installation works; and associated utility diversions;
 - railway installation works including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and removal of construction compounds and site restoration;
 - site finalisation works; and
 - systems testing and commissioning.
- 2.3.10 General information about the construction process is set out in more detail in Volume 1, Section 6, and the following sections of the draft CoCP (Volume 5: Appendix CT-003-000) including:
- the approach to environmental management during construction and the role of the CoCP (Section 2);
 - working hours (Section 5);
 - management of construction traffic (Section 14); and
 - handling of construction materials (Section 15).

Advance works

- 2.3.11 General information about advance works can be found in Volume 1, Section 6. Advance works will be required before the main construction works commence and typically include:
- further detailed site investigations and surveys;
 - further detailed environmental surveys;
 - advance mitigation works including, where appropriate, contamination remediation, habitat creation and translocation, landscape planting and built heritage survey and investigation;
 - advance site access works; and
 - site establishment with temporary fence construction; along with soil stripping and vegetation removal.

Engineering works

Introduction

- 2.3.12 Construction of the Proposed Scheme will require the following broad types of engineering works along the entire length of the route, and within land adjacent to the route:
- civil engineering works, including earthworks such as embankments and cuttings, erection of bridges and viaducts and works to public roads; and
 - works to install, test and commission railway systems, including track, overhead line equipment, communications and signalling equipment and traction power supply.
- 2.3.13 The construction of track and railway systems works in open areas will include the installation of track form, rails, infill material, minor drainage works, and installation of electrification, signalling and communication equipment.
- 2.3.14 The construction of the Proposed Scheme will be divided into sections, each of which will be managed from compounds. The compounds will act as the main interface between the construction work sites and public roads, as well as performing other functions as described below. Compounds will either be main compounds or satellite compounds. Satellite compounds are generally smaller. Compounds will either be used for civil engineering works, for railway installation works, or for both.
- 2.3.15 Nine civil engineering satellite compounds will be located within the Fradley to Colton area. Two of these will continue to be used as satellite compounds for railway systems works following the completion of civil engineering works at those compounds. Two additional compounds will be used for railway systems works only.
- 2.3.16 There will be no main civil engineering compound within the Fradley to Colton area. Satellite compounds for civil engineering works will be managed from the Trent South embankment main compound in the Colwich to Yarlet area (CA2), shown on Map CT-05-212 in the Volume 2: CA2 Map Book.
- 2.3.17 Satellite compounds for railway systems works will be managed from the Stone railhead main compound in the Stone and Swynnerton area (CA3), shown on Map CT-05-223 in the Volume 2: CA3 Map Book.
- 2.3.18 Figure 4 shows the management relationship for civil engineering works compounds and Figure 5 for the railway installation works. Details about the works associated with individual compounds are provided in subsequent sections of this report.
- 2.3.19 Figure 6 provides a programme of works which will be managed from each construction compound. All dates and durations of activities set out in this section are indicative.

General overview of construction compounds

- 2.3.20 Main compounds will be used by core project management staff (i.e. engineering, planning and construction delivery) and commercial and administrative staff. These teams will directly manage some works and coordinate the works at the satellite compounds. In general, a main compound will include:

- space for the storage of bulk materials;
- space for the receipt, storage and loading and unloading of excavated material;
- an area for the fabrication of temporary works equipment and finished goods;
- fuel storage;
- plant and equipment storage including plant maintenance facilities; and
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities.

2.3.21 Satellite compounds will be used as the base to manage specific works along a section of the route. Depending on the nature and extent of the works to be managed, these satellite compounds could include office accommodation for staff, local storage for plant and materials, car parking for staff and site operatives, and welfare facilities.

2.3.22 The storage of soil, stripped as part of the works prior to it being re-used when the land is reinstated, requires land for the duration of construction. The location of soil storage areas will generally be within and adjacent to compounds and areas of construction activity. These areas are referred to as material stockpiles and those adjacent to compounds are shown on maps CT-05-201 to CT-05-209, in the Volume 2: CA1 Map Book.

2.3.23 Further information on the function of compounds is provided in Section 6 of Volume 1 and Section 5 of the draft CoCP. This includes general provisions for the operation of compounds, such as security fencing, lighting, utilities supply, site drainage and codes of worker behaviour.

Construction traffic routes, site haul routes and transfer nodes

2.3.24 The movement of construction vehicles, whether to carry materials, plant, other equipment and workforce, or moving empty, will take place within the construction compounds, on public roads and between the compounds and working areas. Where reasonably practicable, movements between the construction compounds and the working areas will be on designated haul routes within the site, often along the line of the route of the Proposed Scheme or running parallel to it.

2.3.25 The proposed railhead near Stone (in the Stone and Swynnerton area (CA3)) will connect with the existing railway network for the delivery of major materials required for the construction of the railway systems and the movement of excavated materials. This will reduce the volume of construction vehicles using the public road network.

2.3.26 The construction compounds will provide the interface between the construction works and the public road or railway network. The likely road routes to access compounds in the Fradley to Colton area are described in the subsequent sections of this report.

2.3.27 It may be necessary to undertake minor works including a number of minor highways and junction improvements along public roads that will be used as construction traffic routes but are at a distance from the route of Proposed Scheme. These minor works are reported in Volume 4: Off-route effects. Areas of land are also required for the

storage, loading and unloading of bulk earthworks materials that are moved to and from the site on public roads. These will allow transfer of material between road vehicles and site vehicles during construction to balance traffic movements on the road network. These areas are referred to as transfer nodes and are shown on Map CT-05-202 and Map CT-05-203 in the Volume 2: CA1 Map Book.

Use of borrow pits

- 2.3.28 The Proposed Scheme will require high quality aggregate for construction. This will be provided, in part, through excavation of cuttings and other earthworks, however it is unlikely that excavation across the Proposed Scheme will generate sufficient volume of suitable quality materials. As a result, it would be necessary to import material, either from further distances across the Proposed Scheme or from other sources. In some locations, this would be likely to result in significant adverse transport effects during construction on minor roads used by local communities. Therefore, to reduce significant effects, six borrow pits in proximity to the route of the Proposed Scheme are proposed along the length of the route, of which four will be located in the Fradley to Colton area.
- 2.3.29 A borrow pit is an area where material, usually sand and gravel, is excavated for use in the construction of nearby infrastructure projects. In most cases the sand and gravel is used for road or rail earthworks. The use of borrow pits is intended to reduce the need for longer distance transport and import of materials, therefore reducing the volume and impact of road traffic on local roads and communities.
- 2.3.30 For the purpose of this assessment, it has been assumed that borrow pit sites will be restored to existing ground level and land use once excavation has been completed. It is anticipated that borrow pits will be restored with materials generated from construction of the Proposed Scheme, typically clay, which does not have suitable characteristics for use as construction or engineering fill. Further information on the need, use and restoration strategy for borrow pits is provided in Volume 1, Section 6.
- 2.3.31 In the Fradley to Colton area, four borrow pits will be used to extract sand and gravel for construction, as follows (all dimensions and durations are approximate):
- Kings Bromley South, located either side of Crawley Lane and to the south of Ashby Sitch, both sides of the route of the Proposed Scheme (see Volume 2: Maps CT-05-201, E5 to A1 and CT-05-201-R1, D10 to B9), which will:
 - be excavated to an assumed average depth of 4.1m, comprising 0.8m of topsoil and subsoils and 3.3m of sand and gravel extraction, across an area of up to 35ha (based on this assumed average mineral depth). Topsoils and subsoils will be stored and used in restoration of the borrow pit;
 - be accessed initially during site set up from the A515 Lichfield Road. The main access will then be via site haul routes, along the route of the Proposed Scheme; and
 - for this borrow pit, a maximum mineral depth of up to 12m, derived from geotechnical desk study of mineral resources, has also been assessed for relevant topics. Excavation of sand and gravels to this maximum depth, to avoid

sterilisation of mineral resources for example, would mean excavation across the full 35ha area would not be required.

- Kings Bromley North, located adjacent to the realigned A515 Lichfield Road (see Volume 2: Maps CT-05-202, E5 to B2), which will:
 - be excavated to an assumed average depth of 4.1m, comprising 0.8m of topsoil and subsoils and 3.3m of sand and gravel extraction, across an area of up to 12ha (based on this assumed average mineral depth). Topsoils and subsoils will be stored and used in restoration of the borrow pit;
 - be accessed initially during site set up from the A515 Lichfield Road. The main access will then be via site haul routes, along the route of the Proposed Scheme; and
 - for this borrow pit, a maximum mineral depth of up to 8m, derived from geotechnical desk study of mineral resources, has also been assessed for relevant topics. Excavation of sand and gravels to this maximum depth, to avoid sterilisation of mineral resources for example, would mean excavation across the full 12ha area would not be required.
- Kings Bromley North, located adjacent to the realigned Shaw Lane (see Volume 2: Maps CT-05-202, C7 to A6 and CT-05-203, J7 to F8), which will:
 - be excavated to an assumed average depth of 4.3m, comprising 0.8m of topsoil and subsoils and 3.5m of sand and gravel extraction, across an area of up to 19ha (based on this assumed average mineral depth). Topsoils and subsoils will be stored and used in restoration of the borrow pit;
 - be accessed initially during site set up from the A515 Lichfield Road and Shaw Lane. The main access will then be via site haul routes, along the route of the Proposed Scheme; and
 - for this borrow pit, a maximum mineral depth of up to 8m, derived from geotechnical desk study of mineral resources, has also been assessed for relevant topics. Excavation of sand and gravels to this maximum depth, to avoid sterilisation of mineral resources for example, would mean excavation across the full 19ha area would not be required.
- Blithbury, located to the north of the River Trent viaduct (see Volume 2: Maps CT-05-204, H2 to E5), which will:
 - be excavated to an assumed average depth of 11.1m, comprising 0.8m of topsoil and subsoils and 10.3m of sand and gravel extraction, across an area of up to 20ha (based on this assumed average mineral depth). Topsoils and subsoils will be stored and used in restoration of the borrow pit;
 - be accessed initially during site set up from the A513 Rugeley Road, the A515 Lichfield Road and Pipe Lane. The main access will then be via site haul routes, along the route of the Proposed Scheme; and
 - for this borrow pit, a maximum mineral depth of up to 15m, derived from geotechnical desk study of mineral resources, has also been assessed for

relevant topics. Excavation of sand and gravels to this maximum depth, to avoid sterilisation of mineral resources for example, would mean excavation across the full zoha area would not be required.

- 2.3.32 These borrow pits will be excavated over a period of four years and will be progressively backfilled during this period. During the period of operation of the borrow pit, processes such as dewatering, crushing and materials blending may be carried out on the site. The borrow pit sites will be restored to a condition suitable for a return to its existing land use.
- 2.3.33 The majority of material being excavated from the borrow pits will be used within the Fradley to Colton area and transported along the route of the Proposed Scheme via site haul routes insofar as reasonably practicable. It may also be transported to construct parts of the Proposed Scheme in the Colwich to Yarlet area (CA2) and the Stone and Swynnerton area (CA3). The material to infill the borrow pit for restoration (which will be material excavated from cuttings and other earthworks to construct the Proposed Scheme) will be provided from more distant locations across the route, as such it may be necessary to transport some material along public roads.

Figure 4: Construction compounds showing key civil engineering works within the Fradley to Colton area

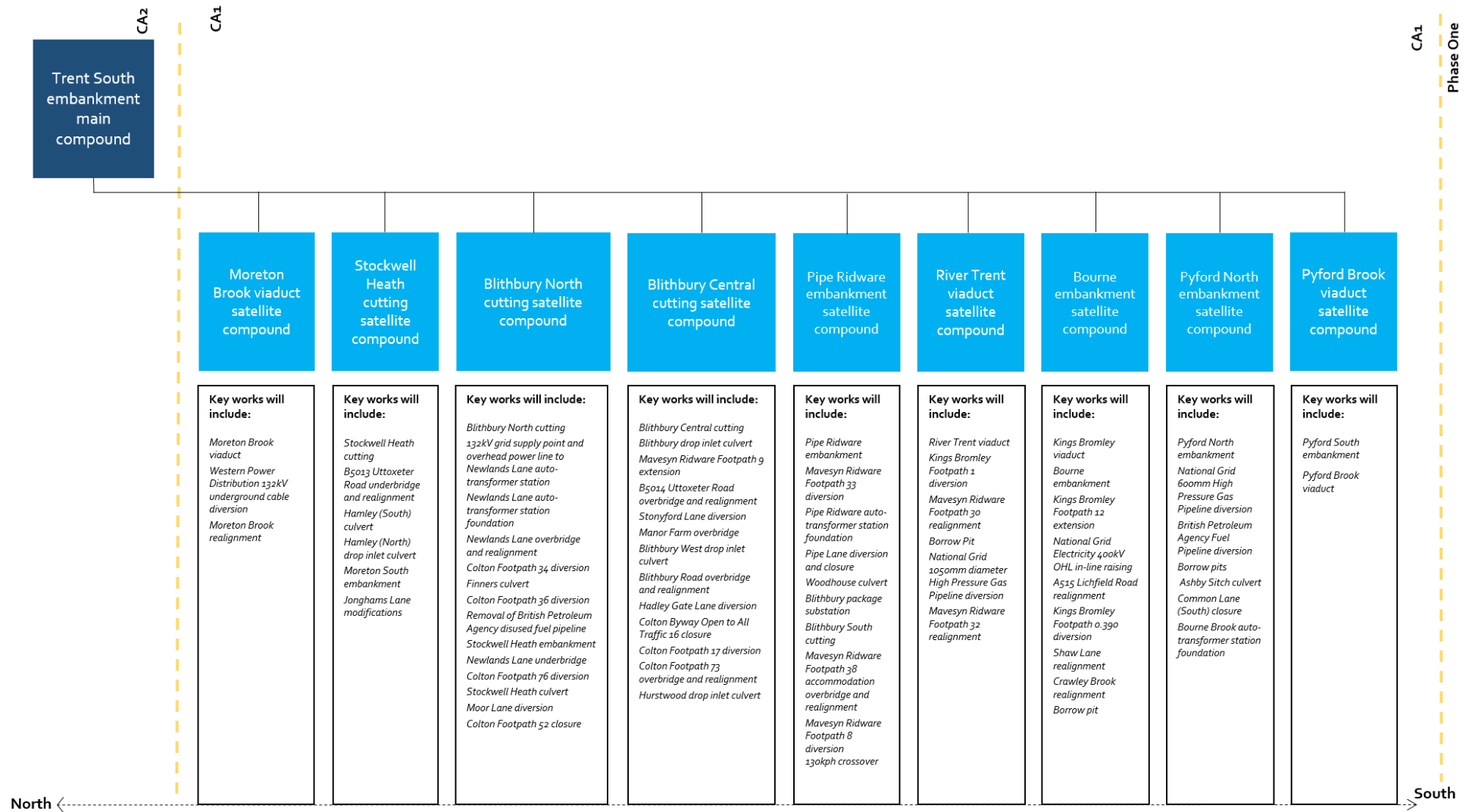
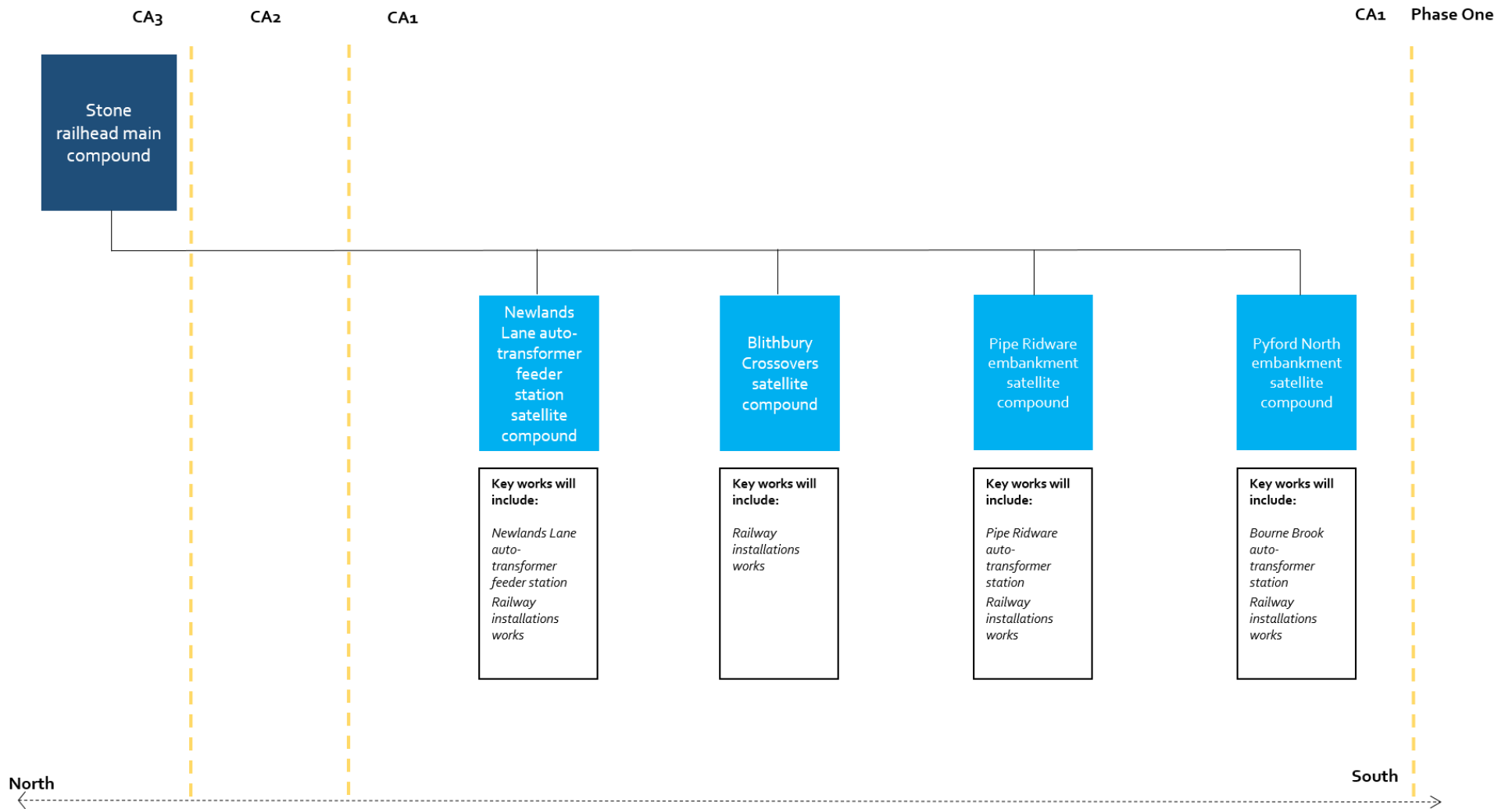


Figure 5: Construction compounds for railway installation works showing key works within the Fradley to Colton area



2.3.34 This section provides details of the works to be managed from the construction compounds in the Fradley to Colton area, including duration of works, number of workers and a summary of the works to be undertaken. All dates and durations of activities and number of workers are indicative.

Pyford Brook viaduct satellite compound

2.3.35 This compound (Volume 2: Map CT-05-201, F6) will provide for civil engineering works and will:

- be operational for a total of three years and six months, commencing during 2021;
- support 10 civil engineering workers per day (15 workers at peak times);
- be accessed from a site haul route to the west of the route of the Proposed Scheme, connecting to the A515 Lichfield Road and Common Lane (South); and
- provide two temporary material stockpile areas (see Volume 2: Map CT-05-201).

2.3.36 There will be no worker accommodation associated with this compound.

2.3.37 Demolition of a building associated with one property will be required as a result of the works to be managed from this compound, described in Table 1.

Table 1: Demolitions to be managed from the Pyford Brook viaduct satellite compound

Description	Location	Feature resulting in the demolition
Commercial		
Demolition of the Cranberry disused barn ¹⁸ , part of Alrewas Hayes wedding venue	250m south-east of Pyford Brook	Pyford South embankment

2.3.38 The compound will be used to manage the construction of the Pyford Brook viaduct, which will take two years and three months to complete.

2.3.39 The compound will additionally be used to manage construction of the Pyford South embankment, which will take one year and three months to complete. Material for the Pyford South embankment will be received from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.40 The works to be managed from this compound will require Kings Bromley Footpath 0.392(a) to be temporarily diverted for a period of three years during construction. This will divert users for 900m, 200m east of the existing alignment around the construction area required for the borrow pit located either side of Crawley Lane.

2.3.41 Finalisation works will include site reinstatement, landscaping and planting

¹⁸ Referred to as cottage at Cranberry (as its asset name) in Section 7, Cultural heritage.

Pyford North embankment satellite compound

- 2.3.42 This compound (Volume 2: Map CT-05-202, G6) will provide for civil engineering and railway system works and will:
- be operational for a total of five years, commencing during 2021. Civil engineering works will be managed from this compound for a period of three years and nine months, followed by railway installation works for a period of one year and three months;
 - support 25 civil engineering workers per day (35 workers at peak times);
 - support 30 railway systems workers per day (45 workers at peak times);
 - be accessed via the A515 Lichfield Road and Common Lane (South);
 - provide a transfer node, accessed from the A515 Lichfield Road (Volume 2: Map CT-05-202, F6 to G6) for the storage and loading and unloading of bulk earthworks materials, which will be moved to and from the site on public roads for five years; and
 - provide nine temporary material stockpile areas (see Volume 2: Map CT-05-202, J5 to F7).
- 2.3.43 There will be no worker accommodation associated with this compound.
- 2.3.44 The works to be managed from this compound will not require demolition of any buildings.
- 2.3.45 This compound will be used to manage the works associated with the excavation, material extraction and backfilling of a borrow pit located at Kings Bromley South, either side of the route of the Proposed Scheme and Crawley Lane on the east and to the south of Ashby Sitch over a period of approximately four years. Access to the borrow pit will be primarily along the site haul routes, with a main access from the A515 Lichfield Road.
- 2.3.46 The compound will be used to manage the construction of the Pyford North embankment, which will take two years and three months to complete. Material for the Pyford North embankment will be received from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.
- 2.3.47 The works to be managed from this compound will require Common Lane (South) to be permanently closed where it intersects with the route of the Proposed Scheme. Users will be diverted via the A515 Lichfield Road from the A515 Lichfield Road/Shaw Lane junction.
- 2.3.48 The works to be managed from this compound will require the following watercourse diversions:
- diversion of an unnamed watercourse, for 350m along the west edge of the Pyford North embankment to Pyford Brook; and

- realignment of Ashby Sitch under the route of the Proposed Scheme will be required as a result of the works to be managed from this compound. It will be realigned via Ashby Sitch culvert, which will take six months to complete.

2.3.49 The works to be managed from this compound will require the following works to utilities:

- diversion of a National Grid 600mm diameter high pressure gas pipeline, which will take one year to complete; and
- diversion of a British Pipeline Agency 10 inch diameter fuel line, which will take one year to complete.

2.3.50 Construction of the Bourne Brook auto-transformer station will be managed from this compound. Civil engineering works to construct the foundations will take six months to complete and installation of the railway systems equipment associated with the Bourne Brook auto-transformer station will take a further one year and three months to complete. A new access road will be provided from A515 Lichfield Road to the Bourne Brook auto-transformer station, which will take three months to complete. Initially the access road will be used during the construction of the auto-transformer station foundations. Following construction, it will be retained as a permanent maintenance access for the auto-transformer station.

2.3.51 Finalisation works will include site reinstatement, landscaping and planting.

Bourne embankment satellite compound

2.3.52 This compound (Volume 2: Map CT-05-203, H5 to G5) will provide for civil engineering works and will:

- be operational for four years and three months, commencing during 2021;
- support 40 civil engineering workers per day (60 workers at peak times);
- be accessed via the A513 Rugeley Road; and
- provide a transfer node, accessed from the A513 Rugeley Road (Volume 2: Map CT-05-003, H5 to G5) for the storage and loading and unloading of bulk earthworks materials which will be moved to and from the site on public roads.

2.3.53 There will be no worker accommodation associated with this compound.

2.3.54 The works to be managed from this compound will require demolition of the following buildings and structures, as described in Table 2.

Table 2: Demolitions to be managed from the Bourne embankment satellite compound

Description	Location	Feature resulting in the demolition
Residential		
The Byre at Shaw Lane Farm	Shaw Lane Farm	Kings Bromley viaduct
Commercial		
Two warehouse/storage	Shaw Lane Farm	Kings Bromley viaduct

Other		
Two National Grid 400kV overhead line towers	Overhead power line, adjacent to the Bourne Brook	Kings Bromley viaduct
Container	Shaw Lane Farm	Kings Bromley viaduct

2.3.55 This compound will be used to manage the works associated with the excavation, material extraction and backfilling of the following borrow pits over a period of approximately four years:

- borrow pit at Kings Bromley North, adjacent to the realigned A515 Lichfield Road, which will be accessed primarily via the site haul route connecting to the A515 Lichfield Road; and
- borrow pit at Kings Bromley North, adjacent to the realigned Shaw Lane, which will be accessed primarily via the site haul route connecting to the A515 Lichfield Road and the A513 Rugeley Road.

2.3.56 A pre-cast yard and pre-cast laydown area to manufacture and store concrete elements, such as viaduct beams, and facilitate the construction of the Kings Bromley and River Trent viaducts will be located at the Bourne embankment satellite compound for a period of three years and six months, accessed from the A513 Rugeley Road (Volume 2: Map CT-05-203, G8 to F6).

2.3.57 The compound will be used to manage the construction of the Kings Bromley viaduct, which will take three years and three months to complete.

2.3.58 The compound will be used to manage the construction of the Bourne embankment, which will take one year and three months to complete. Material for the Bourne embankment will be received from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.59 The works to be managed from this compound will require the following works to public roads:

- permanent realignment of the A515 Lichfield Road, 200m to the west of its existing alignment, which will take one year and three months to complete and will be constructed offline¹⁹. On completion of construction, temporary lane restrictions and traffic management measures will be implemented for three months to enable connection between the realigned road and the existing road;
- temporary closure of 1.4km of Shaw Lane during construction for a period of one year and six months, with diversions along the A515 Lichfield Road and A513 Rugeley Road. During this time, the permanent realignment of Shaw Lane will be constructed, which will take six months to complete. Following the construction period, Shaw Lane will be permanently realigned by 50m to the north-west of its existing alignment.

¹⁹ Offline works are works which are generally constructed along or nearby existing routes, which will remain open during construction.

2.3.60 The works to be managed from this compound will require the following works to PRoW:

- temporary diversion of the Kings Bromley Footpath 12 to the west of the area required for construction for a period of one year and six months. On completion of construction, Kings Bromley Footpath 12 will be permanently extended by 240m beneath the Kings Bromley viaduct to meet the A515 Lichfield Road the south of the route of the Proposed Scheme; and
- temporary diversion of Kings Bromley Footpath 0.390 for a period of three years, users will be diverted to the west of the area required for construction. On completion of construction, the Kings Bromley Footpath 0.390 will be permanently realigned by 10m in length around a pier of the Kings Bromley viaduct and realigned to meet the realigned A515 Lichfield Road.

2.3.61 The works to be managed from this compound will require the permanent realignment of two sections of Crawley Brook. One section will be realigned for 50m around a pier of the Kings Bromley viaduct, and the second for 75m beneath the realigned Shaw Lane, which will take nine months to complete.

2.3.62 The compound will be used to manage the works to raise a 400kV National Grid overhead power line along its existing alignment to cross the route of the Proposed Scheme, which will take nine months to complete.

2.3.63 There will also be minor utilities works managed from this compound.

2.3.64 Finalisation works will include site reinstatement, landscaping and planting.

River Trent viaduct satellite compound

2.3.65 This compound (Volume 2: Map CT-05-203, B7 to B6) will provide for civil engineering works and will:

- be operational for four years and three months, commencing during 2021;
- support 60 civil engineering workers per day (80 workers at peak times); and
- be accessed via the A513 Rugeley Road.

2.3.66 There will be no worker accommodation associated with this compound.

2.3.67 The works to be managed from this compound will not require demolition of any buildings.

2.3.68 This compound will be used to manage the works associated with the excavation, material extraction and backfilling of a borrow pit located to the north-east of the River Trent viaduct, between the River Trent and Pipe Lane over a period of approximately four years. Access to the borrow pit will be primarily be via site haul routes, connecting to the A513 Rugeley Road and the A515 Lichfield Road.

2.3.69 The compound will be used to manage the construction of the River Trent viaduct, which will take three years and six months to complete.

2.3.70 The works to be managed from this compound will require the following works to PRoW:

- temporary diversion of Kings Bromley Footpath 1 for three years during the construction period. Users will be diverted to the north passing under the River Trent viaduct and joining the A513 Rugeley Road increasing the journey length by 725m. On completion of construction, Kings Bromley Footpath 1 will be permanently diverted for 725m to the north of its existing alignment, around the northern end of the Bourne embankment to meet the A513 Rugeley Road;
- temporary diversion of Mavesyn Ridware Footpath 30 in two places during the construction period. Users will be diverted 500m south of the existing alignment around the extent of the borrow pit for a period of three years and nine months. There will be an alternative diversion of 40m to the south, around a pier of the River Trent viaduct, for one year and six months. On completion of construction, this footpath will be permanently realigned 10m to the north of its existing alignment, around a pier of the River Trent viaduct; and
- temporary diversion of Mavesyn Ridware Footpath 32 for two years. Users will be diverted to the east of the area required for construction, adjacent to Pipe Lane, during the construction period. On completion of construction, this footpath will be permanently realigned 10m to the east of its existing alignment, around a pier of the River Trent viaduct.

2.3.71 The compound will be used to manage the diversion of a National Grid high pressure 1,050mm gas pipeline, which will take nine months to complete.

2.3.72 Finalisation works will include site reinstatement, landscaping and planting.

Pipe Ridware embankment satellite compound

2.3.73 This compound (Volume 2: Map CT-05-204, D5 to C4) will provide for civil engineering works and railway system works and will:

- be operational for a total of five years, commencing during 2021. Civil engineering works will be managed from this compound for a period of three years and nine months, followed by railway installation works for a period of one year and three months;
- support 30 civil engineering workers per day (45 workers at peak times);
- support 30 railway systems workers per day (45 workers at peak times);
- be accessed via the diverted Pipe Lane; and
- provide 11 temporary material stockpile areas (see Volume 2: Map CT-05-205 and -05-206).

2.3.74 There will be no worker accommodation associated with this compound.

2.3.75 The works to be managed from this compound will not require demolition of any buildings.

2.3.76 The compound will be used to manage the construction of the Mavesyn Ridware Footpath 38 accommodation overbridge, which will take six months to complete.

- 2.3.77 The compound will be used to manage construction of the following earthworks:
- Pipe Ridware embankment, which will take one year and six months to complete; and
 - Blithbury South cutting, which will take one year and three months to complete.
- 2.3.78 Material for the Pipe Ridware embankment will be received from Blithbury South cutting, from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.
- 2.3.79 The works to be managed from this compound will require the following works to public roads:
- permanent diversion of Pipe Lane for 1.1km north-east of its existing alignment. Temporary lane closures and diversions will be implemented during the construction of the diversion, which will take six months to complete; and
 - permanent closure of a 300m section of Dawson Lane where it intersects with the route of the Proposed Scheme.
- 2.3.80 The works to be managed from this compound will require the following works to PRow:
- temporary diversion of Mavesyn Ridware Footpath 33 to the east of the area required for construction of the Proposed Scheme for three years during the construction period. On completion of construction, this footpath will be permanently diverted for 500m in length, 100m to the east of its existing alignment;
 - temporary diversion of Mavesyn Ridware Footpath 38 for one year and six months during the construction period. On completion of construction, this footpath will be permanently realigned for 400m, 10m north-west of its existing alignment, to cross over the route of the Proposed Scheme on the Mavesyn Ridware Footpath 38 accommodation overbridge; and
 - temporary diversion of Mavesyn Ridware Footpath 8 for one year and six months during the construction period, with users diverted along Pipe Lane to the east and around the area required for construction to the west. On completion of construction, this footpath will be permanently diverted for 1km, 500m south-east of its existing alignment.
- 2.3.81 This compound will be used to manage construction of the Woodhouse culvert to provide surface water drainage, which will take six months to complete.
- 2.3.82 The compound will be used to manage the construction of the foundations and installation of the railway system works for the Blithbury package substation which will take nine months to complete.
- 2.3.83 Construction of the Pipe Ridware auto-transformer station will be managed from this compound. Civil engineering works to construct the foundations will take six months to complete and installation of the railway systems equipment will take a further one year and three months to complete. A new access road will be provided from Pipe Lane to the Pipe Ridware embankment satellite compound, which will take three

months to complete. Initially the access road will be used during the construction of the auto-transformer station foundations. Following construction, it will be retained as a permanent maintenance access for the auto-transformer station.

2.3.84 Finalisation works will include site reinstatement, landscaping and planting.

Blithbury Crossovers satellite compound

2.3.85 This compound (Volume 2: Map CT-05-205, D5) will provide site clearance and enabling works, and manage railway systems installation and track works. This compound will:

- be operational for nine months, commencing during 2025;
- support 10 railway systems workers per day (15 workers at peak times); and
- be accessed via an access road from Pipe Lane.

2.3.86 There will be no worker accommodation associated with this compound.

2.3.87 The works to be managed from this compound will not require demolition of any buildings.

2.3.88 Finalisation works will include site reinstatement, landscaping and planting.

Blithbury Central cutting satellite compound

2.3.89 This compound (Volume 2: Map CT-05-206, C4) will provide for civil engineering works and will:

- be operational for three years and six months, commencing during 2021;
- support 30 civil engineering workers per day (45 workers at peak times);
- be accessed via site haul routes connecting to Blithbury Road and the B5014 Uttoxeter Road; and
- provide nine temporary material stockpile areas (see Volume 2: Map CT-05-206).

2.3.90 There will be no worker accommodation associated with this compound.

2.3.91 Demolition of buildings associated with two properties will be required as a result of the works to be managed from this compound, as described in Table 3.

Table 3: Demolitions to be managed from the Blithbury Central cutting satellite compound

Description	Location	Feature resulting in the demolition
Residential		
Edlyn Cottage	Hadley Gate Lane	Blithbury Central cutting
Hadley Gate Cottage	Hadley Gate Lane	Blithbury Central cutting

2.3.92 The compound will be used to manage the construction of the following bridges:

- B5014 Uttoxeter Road overbridge, which will take one year and eight months to complete;

- Manor Farm overbridge, which will take one year and three months to complete;
- Blithbury Road overbridge, which will take one year and three months to complete; and
- Colton Footpath 73 overbridge, which will take one year and three months to complete.

2.3.93 The compound will be used to manage construction of the Blithbury Central cutting, which will take two years and three months to complete. Material from the Blithbury Central cutting will be used as engineering material for construction locally within the Fradley to Colton area, where possible.

2.3.94 The works to be managed from this compound will require the following works to public roads:

- permanent realignment of B5014 Uttoxeter Road to the west of its existing alignment, which will take one year and three months to complete. Temporary lane restrictions and traffic management measures will be implemented for three months during the construction period to enable connection between the realigned road and the existing road alignment. There will also be works to the B5014 Uttoxeter Road at the junction with Blithbury Road. These are described and assessed in Volume 4, Off-route effects;
- permanent diversion of two sections of Stonyford Lane, one section where it joins the B5014 Uttoxeter Road and one section where it joins Blithbury Road, which will take nine months to complete;
- permanent realignment of Blithbury Road, which will take nine months to complete. Temporary lane restrictions and traffic management measures will be implemented for up to six months during the construction period to enable construction of the new section of road and connection between the realigned road and the existing road alignment; and
- permanent diversion of Hadley Gate Lane, north-east of its existing alignment, which will take six months to complete.

2.3.95 The works to be managed from this compound will require the following works to PRoW:

- Mavesyn Ridware Footpath 7 will be temporarily diverted in two places, one for 1.3km to the west of its existing alignment, for one year and six months during the construction period, and one local diversion for 300m for six months;
- extension of Mavesyn Ridware Footpath 9 by 120m to join the new alignment of B5014 Uttoxeter Road, which will take one month to complete;
- a 300m section of the Colton Footpath 17 will be permanently closed and diverted via Hadley Gate Lane to Blithbury Road;
- temporary diversion of Colton Footpath 73 for 300m to the east for one year and six months during the construction period. On completion of construction,

Colton Footpath 73 will be permanently realigned for 125m in length, to cross over the route of the Proposed Scheme on the Colton Footpath 73 overbridge; and

- closure of the Colton BOAT 16, with users diverted via the realigned Blithbury Road and Hadley Gate Lane.

2.3.96 The works to be managed from this compound will require the following drainage works and watercourse diversions:

- construction of Blithbury drop inlet culvert for the realignment of a tributary of Bentley Brook, which will take nine months to complete;
- construction of Blithbury West drop inlet culvert for the diversion of a tributary of Bentley Brook, which will take nine months to complete; and
- construction of Hurstwood drop inlet culvert for surface water drainage, which will take nine months to complete.

2.3.97 Finalisation works will include site reinstatement, landscaping and planting.

Blithbury North cutting satellite compound

2.3.98 This compound (Volume 2: Map CT-05-207, D6 to E7) will provide for civil engineering works and will:

- be operational for four years, commencing during 2021;
- support 70 civil engineering workers per day (100 workers at peak times);
- be accessed via site haul routes, connecting to Newlands Lane; and
- provide three temporary material stockpile areas (see Volume 2: Map CT-05-008, J5, I5 and E5 to D5).

2.3.99 There will be no worker accommodation associated with this compound.

2.3.100 The works to be managed from this compound will not require demolition of any buildings.

2.3.101 The compound will be used to manage the construction of the following bridges:

- Newlands Lane overbridge, which will take one year to complete; and
- Newlands Lane underbridge, which will take one year to complete.

2.3.102 The compound will be used to manage construction of the following earthworks:

- Blithbury North cutting, which will take three years to complete; and
- Stockwell Heath embankment, which will take one year and nine months to complete.

2.3.103 Material for Stockwell Heath embankment will be received from cuttings within the Fradley to Colton area where possible, and additionally, if required, from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.104 The works to be managed from this compound will require the following works to public roads:

- permanent realignment of Newlands Lane over the Newland Lane overbridge. Temporary lane restrictions and traffic management measures will be implemented for three months during the construction of the Newlands Lane overbridge to enable connection between the existing Newlands Lane and the overbridge;
- widening of a section of Newlands Lane, which will pass under the route of the Proposed Scheme via Newlands Lane underbridge. During construction of the Newlands Lane underbridge, a section of Newlands Lane will be closed with traffic diverted via alternative routes for one year; and
- permanent diversion of Moor Lane, which will take six months to complete.

2.3.105 The works to be managed from this compound will require the following works to PRoW:

- temporary diversion of Colton Bridleway 32 for three months, with users diverted 200m to the north-east of the existing alignment;
- temporary diversion of Colton Footpath 19 for one year, with users diverted 25m to the north of the existing footpath alignment;
- temporary diversion of Colton Footpath 23 for one year, with users diverted 200m to the north of the existing footpath alignment;
- temporary diversion of Colton Bridleway 31 for one year and six months, with users diverted 25m to the west of the existing bridleway alignment. On completion of construction, the Colton Bridleway 31 will be permanently widened;
- temporary diversion of Colton Bridleway 33 for one year and six months, with users diverted 25m to the west of the existing bridleway alignment. On completion of construction, the Colton Bridleway 33 will be permanently widened;
- temporary diversion of Colton Footpaths 20 and 13 for one year and six months, with users diverted 25m to the south of the existing footpath alignments. On completion of construction, the footpaths will be permanently widened;
- there will be a temporary diversion of Colton Footpath 34 for one year and six months, with users diverted 200m to the east of the existing alignment. On completion of construction, the footpath will be permanently diverted 300m to the east of its existing alignment, for 900m in length, to meet the realigned Newlands Lane;
- temporary diversion of Colton Footpath 36 for one year and six months, with users diverted for 575m to the north. On completion of construction, Colton Footpath 36 will be permanently diverted, 250m to the north of its existing

alignment, to run along the east side of the route of the Proposed Scheme for 600m to join Newlands Lane to the east of the route of the Proposed Scheme;

- a section of Colton Footpath 76 will be permanently diverted 20m east of its existing alignment to join Newlands Lane; and
- there will be a temporary diversion of Colton Footpath 52, 300m to the south adjacent to Moor Lane, for one year and six months. On completion of construction, a section of Colton Footpath 52 will be permanently closed with the remainder being permanently realigned to join the newly diverted Moor Lane.

2.3.106 The works to be managed from this compound will require the following drainage works and watercourse diversions:

- construction of Finners culvert to provide surface water drainage, which will take nine months to complete; and
- construction of Stockwell Heath culvert for the realignment of a tributary of Moreton Brook, which will take nine months to complete.

2.3.107 The works to be managed from this compound will require the following utilities works:

- permanent removal of a section of an out of use British Pipeline Agency 6-inch fuel line, which will take one year to complete;
- construction of a grid supply point at National Grid Rugeley substation and installation of a 132kV power line, connecting from Rugeley substation to the Newlands Lane auto-transformer feeder station, which will take two years to complete.

2.3.108 The compound will be used to manage the construction of the foundations and building for the Newlands Lane auto-transformer feeder station, which will take one year to complete. A new access road will be provided from Newlands Lane to the Newlands Lane auto-transformer feeder station, which will take nine months to complete. Initially the access road will be used during the construction of the auto-transformer station foundations. Following construction, it will be retained as a permanent maintenance access for the auto-transformer station.

2.3.109 Finalisation works will include site reinstatement, landscaping and planting.

Newlands Lane auto-transformer feeder station satellite compound

2.3.110 This compound (Volume 2: Map CT-05-207, E4 to E5) will manage the railway systems and equipment installation at the Newlands Lane auto-transformer feeder station and will:

- be operational for two years, commencing during 2024;
- support 45 railway systems workers per day (90 workers at peak times); and
- be accessed via Newlands Lane.

2.3.111 There will be no worker accommodation associated with this compound.

- 2.3.112 The works to be managed from this compound will not require demolition of any buildings.
- 2.3.113 Other works that will be managed from this compound include site clearance, enabling works, and finalisation works including site reinstatement, fencing, planting, and landscaping.

Stockwell Heath cutting satellite compound

- 2.3.114 This compound (Volume 2: Map CT-05-208, B4 to B5) will provide for civil engineering works and will:
- be operational for four years and three months, commencing during 2021;
 - support 25 civil engineering workers per day (35 workers at peak times);
 - be accessed via the B5013 Uttoxeter Road; and
 - provide two temporary material stockpile areas (see Volume 2: Map CT-05-208, C5, A4 and CT-05-209, H6 to F6); and
 - be managed from the Trent South embankment main compound (in the Colwich to Yarlet area) for civil engineering works.
- 2.3.115 There will be no worker accommodation associated with this compound.
- 2.3.116 The works to be managed from this compound will not require demolition of any buildings.
- 2.3.117 The compound will be used to manage the construction of the B5013 Uttoxeter Road underbridge, which will take one year and nine months to complete.
- 2.3.118 The compound will be used to manage construction of the following earthworks:
- Stockwell Heath cutting, which will take one year and three months to complete; and
 - Moreton South embankment, which will take one year and six months to complete.
- 2.3.119 Material for Moreton South embankment will be received from cuttings within the Fradley to Colton area, from elsewhere along the Proposed Scheme and/or from borrow pits.
- 2.3.120 The works to be managed from this compound will not require the following works to public roads:
- there will be a permanent realignment of the B5013 Uttoxeter Road, which will take one year and nine months to complete. Temporary lane closures will be implemented for three months during the construction period to enable connection between the realigned road and the existing road alignment; and
 - widening of Jonghams Lane, which will take six months to complete. Temporary lane restrictions and traffic management measures will be implemented for three months during the construction period.

- 2.3.121 The works to be managed from this compound will require the following watercourse diversions:
- construction of Hamley (South) culvert for the realignment of a tributary of Moreton Brook, which will take nine months to complete; and
 - construction of Hamley (North) drop inlet culvert for the diversion of a tributary of Moreton Brook, which will take nine months to complete.
- 2.3.122 Finalisation works will include site reinstatement, landscaping and planting.

Moreton Brook viaduct satellite compound

- 2.3.123 This compound (Volume 2: Map CT-05-209a C5 to B4) will provide for civil engineering works and will:
- be operational for four years and three months, commencing during 2021;
 - support five civil engineering workers per day (10 workers at peak times);
 - be accessed via site haul routes along the north of the route of the Proposed Scheme connecting to the B5013 Uttoxeter Road; and
 - provide three temporary material stockpile areas (see Volume 2: Map CT-05-209a).
- 2.3.124 There will be no worker accommodation associated with this compound.
- 2.3.125 The works to be managed from this compound will not require demolition of any buildings.
- 2.3.126 The compound will be used to manage the construction of the Moreton Brook viaduct, which will take two years and six months to complete.
- 2.3.127 The works to be managed from this compound will require the permanent realignment of Moreton Brook around the piers of the Moreton Brook viaduct.
- 2.3.128 Permanent diversion of a Western Power Distribution 132kV underground cable will be required as a result of the works to be managed from this compound, which will take one year and three months to complete.
- 2.3.129 Finalisation works will include site reinstatement, landscaping and planting.

Construction waste and material resources

- 2.3.130 Excavated material generated across the Proposed Scheme will be reused as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme, where reasonably practicable.
- 2.3.131 Forecasts of the amount of construction, demolition and excavation waste that will be produced during construction of the Proposed Scheme are reported in Volume 3, Route-wide effects.
- 2.3.132 Local excess or shortfall of excavated material within the Fradley to Colton area will be managed through the mitigation earthworks design adopted for the Proposed Scheme, as well as the use of borrow pits, with the aim of contributing to an overall

balance of excavated material on a route-wide basis and help to reduce the amount of material to be transported on public roads. The overall balance of excavated material is presented in Volume 3, Section 14.

Commissioning of the railway

- 2.3.133 Commissioning is the process of testing the infrastructure to ensure that it operates as expected. It will be carried out in the period prior to opening. Further details are provided in Volume 1, Section 6.

Construction programme

- 2.3.134 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in Figure 5.

Monitoring during construction

- 2.3.135 The appointed contractor will be required to undertake the necessary monitoring for each environmental topic to comply with the requirements of the CoCP, the relevant LEMP and any additional consent requirements. Any actions that may be necessary for compliance will be reported to the nominated undertaker and remedial action identified.
- 2.3.136 The CoCP will set out inspection and monitoring procedures to assess the effectiveness of measures to prevent or reduce environmental effects during construction. Relevant local authorities and consenting authorities, such as the Environment Agency, will be consulted on the monitoring procedures to be implemented prior to construction commencement, as appropriate.

Fradley to Colton	2020 Quarters				2021 Quarters				2022 Quarters				2023 Quarters				2024 Quarters				2025 Quarters				2026 Quarters				2027 Quarters							
Construction Activity	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Blithbury North cutting satellite compound																																				
Site preparation and set-up																																				
Utilities																																				
Blithbury North cutting																																				
Finners culvert																																				
Moor Lane diversion																																				
Newlands Lane overbridge																																				
Newlands Lane underbridge																																				
Moor Lane closure																																				
Stockwell Heath culvert																																				
Stockwell Heath embankment																																				
Newlands Lane auto-transformer feeder station foundation																																				
132kV Grid supply point and overhead power line																																				
Site reinstatement																																				
Newlands Lane auto-transformer feeder station satellite compound																																				
Site preparation and set-up																																				
Newlands Lane auto-transformer feeder station installation																																				
Site reinstatement																																				
Stockwell Heath cutting compound																																				
Site preparation and set-up																																				
Hamley (South) culvert																																				
Hamley (North) drop inlet culvert																																				
B5013 Uttoxeter Road underbridge and realignment																																				
Utilities																																				
Moreton South embankment																																				
Jonghams Lane widening																																				
Stockwell Heath cutting																																				
Site reinstatement																																				
Moreton Brook satellite compound																																				
Site preparation and set-up																																				
Utilities																																				
Moreton Brook viaduct																																				
Site reinstatement																																				
Railway Systems																																				
Track installation																																				
Overhead line electrification, communications and traction power																																				
Testing and commissioning																																				

Construction works
 Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

Introduction

- 2.4.1 Volume 1, Section 4 describes the envisaged operational characteristics of the Proposed Scheme and how they may change when Phase Two, as a whole, is operational.

HS2 services

- 2.4.2 It is anticipated that there will be up to six trains per hour in each direction upon opening in 2027, increasing to up to 12 trains per hour each way passing through the Fradley to Colton area when, from 2033, the full Phase Two route is operational. Services are expected to operate between 05:00 and 24:00 from Monday to Saturday and 08:00 and 24:00 on Sunday.
- 2.4.3 In this area, trains will run at speeds of up to 225mph (360kph). The trains will be either single 200m trains or two 200m trains coupled together (i.e. 400m), depending on demand and time of day.

Maintenance

- 2.4.4 Volume 1, Section 4 describes the maintenance regime for the Proposed Scheme.
- 2.4.5 Asset performance and condition monitoring will be undertaken using asset condition monitoring and unattended measurement systems fitted to the HS2 passenger rolling stock. Intrusive inspections will be carried out during the maintenance period. The maintenance approach will be a combination of risk based, preventative and reactive maintenance.
- 2.4.6 Provision for railway maintenance vehicles will be made at the HS2 Infrastructure Maintenance Base - Rail (IMB-R) near Stone in the Stone and Swynnerton area (CA3). Further information on the Stone IMB-R can be found in Volume 2: Community area 3, Stone and Swynnerton.

Operational waste and material resources

- 2.4.7 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the Proposed Scheme as a whole in Volume 3, Section 15.
- 2.4.8 Forecasts of the amount of waste arising from track maintenance and ancillary infrastructure and the associated likely significant environmental effects are provided in Volume 5: Appendix WM-001-000.

Monitoring during operation

- 2.4.9 The nominated undertaker will be responsible for monitoring during operation of the Proposed Scheme. General monitoring measures during operation are set out in Volume 1, Section 9. Monitoring requirements and proposed monitoring measures relevant to the Fradley to Colton area are presented in Sections 4 to 15 of this report.

2.5 Route section alternatives

Introduction

- 2.5.1 Since November 2015, as part of the design development process, a series of potentially feasible amendments to the Proposed Scheme have been identified and reviewed within workshops attended by engineering, construction, planning and environmental specialists. During the workshops, a comparison was conducted of each design option, which included consideration of:
- engineering requirements: the degree of design complexity of the alternatives and the impact this would have on construction durations and construction and operational costs;
 - cost: whether the alternatives would be more cost effective or incur additional costs; and
 - potential environmental impact: whether the alternatives would have more or less environmental impact (e.g. sound, noise and vibration and landscape and visual).
- 2.5.2 The comparison also considered, as appropriate, feedback provided through stakeholder engagement and responses to the consultation between September and November 2016 on the working draft EIA Report and the Design Refinement Consultation.
- 2.5.3 The following sections detail the reasonable local alternatives studied and the main reasons for selecting the option to be taken forward into the Proposed Scheme. The environmental impacts of the option selected (the Proposed Scheme) are then presented, followed by the environmental impacts of the alternative options compared to those of the Proposed Scheme. Other considerations are also noted including engineering requirements and cost. In some cases a preliminary appraisal of options has been undertaken, whereby options have been considered in terms of whether they are reasonable against environmental, technical and design criteria, and should, therefore, be progressed for further consideration.
- 2.5.4 In considering the environmental impacts, all EIA topics have been taken into account, however, only those topics where there is a potential impact are reported. During the preparation of the EIA, alternatives were appraised against the baseline scheme, however in accordance with the new Environmental Impact Assessment (EIA) Directive (2014/52/EU) that was implemented by the Town and Country Planning (Environmental Impact Assessment) Regulations that came into force on 16 May 2017, the comparison is presented below against the Proposed Scheme.

Review of the vertical alignment at Kings Bromley, Pipe Ridware and Blithbury

- 2.5.5 During the design development process since the announcement of the preferred route to Crewe in November 2015, and following the publication of the working draft EIA Report, design development of the Proposed Scheme has led to the relocation of the permanent maintenance facility from Crewe, in the South Cheshire area (CA5), to near Stone, in the Stone and Swynnerton area (CA3).

- 2.5.6 The relocation of the permanent maintenance facility means that maintenance loops at Pipe Ridware will no longer be required²⁰, therefore presenting an opportunity to consider a lower vertical alignment of a section of the route of the Proposed Scheme at Kings Bromley, Pipe Ridware and Blithbury. The sensitivity of this location, particularly the proximity of the route to residential properties at Pipe Ridware and Blithbury and the impact on local heritage settings have been key considerations in the development of these alternatives.
- 2.5.7 The following two options were taken forward to a detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:
- Option SSo: the route would remain on the same vertical alignment as assessed in the working draft EIA Report but with the removal of the maintenance loops at Pipe Ridware. The height of the Pipe Ridware embankment being up to 16m, the Blithbury South cutting up to 4m in depth, the Blithbury Central cutting up to 12m in depth, and the Blithbury North cutting up to 12m in height. The Kings Bromley viaduct would be up to 13m, the Bourne embankment up to 14m, and the River Trent viaduct up to 17m; and
 - the vertical alignment of the route presented in Option SS1b²¹: the vertical alignment of this route would generate an embankment of up to 8m at Pipe Ridware and depths of up to 3m at Blithbury South cutting, up to 8m at Blithbury Central cutting and up to 11m at Blithbury North cutting. The height of the Kings Bromley viaduct and Bourne embankment would both be up to 15.5m. The height of the River Trent viaduct would be up to 15m.
- 2.5.8 The vertical alignment of the route presented in Option SS1b was taken forward into the Proposed Scheme as on balance it presented the most favourable environmental outcome. Option SSo in comparison would present an increase in environmental impacts most notably an impact on local groundwater resources and an increase in visual and noise impacts for residences at Pipe Ridware. Option SSo would also be significantly more expensive to construct than the Proposed Scheme. The analysis of engineering, cost and potential environmental impacts associated with both options is set out below, with the impacts of the option selected presented first.

Option SS1b

- 2.5.9 Option SS1b would result in noise impacts on the residents of Blithbury including the pupils and residents of Rugeley School. The lowered alignment would significantly decrease the height of the Pipe Ridware embankment minimising visual and noise impacts on the amenity of residences at Pipe Ridware, the Grade II listed Woodhouse

²⁰ At the time that alternatives were being considered, maintenance loops were proposed as part of the scheme. These were to be located at Pipe Ridware due to the IMD then proposed to be located towards the northern end of the route at Crewe. They were intended to enable maintenance trains to be stabled temporarily during the day when maintenance activities would be undertaken over a number of nights, without having to return to the IMD. However, the maintenance facility (the IMB-R) will now be located more centrally, near Stone, in the Stone and Swynnerton area. This will enable better positioning of maintenance trains for efficient dispatch for maintenance works across the route in both directions, avoiding the need for maintenance loops.

²¹ Option SS1b includes a low vertical alignment and the route crossing the River Trent and Bourne Brook via two viaducts, with a central embankment. This option deals only with the vertical alignment component of the option. The viaduct and embankment component of the option are dealt with under the 'Review of the Bourne Brook and River Trent crossings (via one viaduct or two shorter viaducts)' alternative.

Farmhouse and Bentley Hall Farmhouse. It would also decrease the height of the River Trent viaduct minimising visual impacts. The reduced cutting depth of the Proposed Scheme near Blithbury would require two drop inlet culverts. This would allow groundwater resources to flow efficiently and would minimise the impact on biodiversity and potential flood risk.

- 2.5.10 Option SS1b does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option SSo

- 2.5.11 In comparison to Option SS1b (the Proposed Scheme), Option SSo would result in a slight decrease in localised noise impacts for the residents of Blithbury and pupils of Rugeley School due to the increased cutting depths at Blithbury. The visual and noise impacts on residences at Pipe Ridware and the Grade II listed Woodhouse Farmhouse and Bentley Hall Farmhouse however would be greater than those associated with the Proposed Scheme. Two inverted siphons would be required to allow the existing watercourse to continue to flow downstream. The use of inverted siphons could increase the risk of material build up causing blockages and therefore flooding upstream. Inverted siphons also have the potential to impact local groundwater resources as part of the watercourse would be covered and light would be prevented from reaching existing sections of open channel. This could potentially impact the water quality, biodiversity and have implications on achieving the required Water Framework Directive (WFD) status.
- 2.5.12 Option SSo also does not introduce any technical, construction complexities or risk of safety hazards or lengthening of the construction programme. This option would, however, be significantly more expensive to construct than Option SS1b.

Embankment at Stockwell Heath and Colton

- 2.5.13 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration was given to how the route of the Proposed Scheme would pass the villages of Stockwell Heath and Colton.
- 2.5.14 The following four options were taken forward to a more detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:
- Option A3.0: the route would pass between the villages of Stockwell Heath and Colton on an embankment of approximately 900m in length and up to 10m in height. The realignment of Newlands Lane and diversion Moor Lane would be required. Moreton Brook would be diverted beneath the embankment;
 - Option A3.1a: the route would pass between the villages of Stockwell Heath and Colton on a multi-span viaduct of approximately 540m in length and up to 11m in height removing the need to realign Newlands Lane and divert Moor Lane and removing the need to culvert Moreton Brook. Moor Lane would however be lowered to allow for a lower viaduct height;
 - Option A3.1b: the route would pass between the villages of Stockwell Heath

and Colton on a multi-span viaduct of approximately 540m in length and up to 13m in height removing the need to realign Newlands Lane and divert Moor Lane; and

- Option A3.2: the route would pass between the villages of Stockwell Heath and Colton on an embankment of approximately 580m in length and up to 8m in height. The realignment of Newlands Lane and the diversion of Moor Lane would be required. Moreton Brook would be diverted beneath the embankment.

2.5.15 Option A3.0 was taken forward into the Proposed Scheme. In comparison, Option A3.1a and Option A3.2 would provide greater environmental benefits. However, all presented significant increases in cost compared to Option A3.0, and Option A3.1a and Option A3.1b introduced significant technical complexities. The analysis of engineering, cost and potential environmental impacts associated with the options is set out below, with the impacts of the option selected presented first.

Option A3.0

2.5.16 Option A3.0 would introduce a physical and visual barrier between Colton and Stockwell Heath and would be likely to result in permanent isolation for residential properties. This option would result in noise impacts on the residents of Stockwell Heath, sever the historic landscape and result in the loss of agricultural land and loss and fragmentation of habitats. The culverts required for this option (required to divert Moreton Brook beneath the embankment) would result in hydraulic and hydro-geomorphology impacts and there would be an impact on an upstream tributary of the Moreton Brook.

2.5.17 Option A3.0 would not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option A3.1a

2.5.18 In comparison to Option A3.0 (the Proposed Scheme), Option A3.1a would require the lowering of Moor Lane resulting in severance and a reduction in accessibility during construction. It would result in significant temporary landscape and visual and noise effects during construction compared to Option A3.0. This option would reduce the loss of agricultural land and also reduce severance of the historic landscape. The need to realign Newlands Lane and to divert Moor Lane would reduce the impact on the local highway network.

2.5.19 This option would be significantly more expensive and complex to construct than the Proposed Scheme due to the length of the viaduct. There would also be a slight increase to the construction programme due to viaduct construction works and would be more hazardous during operation due to maintenance.

Option A3.1b

2.5.20 In comparison to Option A3.0 (the Proposed Scheme), Option A3.1b would increase the height of the embankments on the approach to the viaduct due to the height of the viaduct. This increase in height would require a greater portion of land therefore increasing the loss of agricultural land and would have a greater visual impact during construction when compared to Option A3.0.

- 2.5.21 This option would be significantly more expensive and complex to construct than the Proposed Scheme due to the inclusion of a viaduct. There would be a slight increase to the programme due to viaduct construction works and would be more hazardous during operation due to maintenance.

Option A3.2

- 2.5.22 In comparison to Option A3.0 (the Proposed Scheme), Option A3.2 would reduce the length and height of the embankment however the lower alignment in this option would increase the requirement for noise barriers. This lower alignment would result in improved visual impacts compared to Option 3.0.
- 2.5.23 Option A3.2 would be more expensive to construct due to the additional cut material required for transportation but would not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Review of the Bourne Brook and River Trent crossings (via one viaduct, or two shorter viaducts)

- 2.5.24 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration was given to how the route of the Proposed Scheme would cross the Bourne Brook and River Trent and their associated floodplains. The sensitivity of this location, particularly the visual impacts and proximity of the route to the River Trent and Bourne Brook and Tomlinson's Spinney local wildlife site (LWS) have been key considerations in the development of these alternatives.
- 2.5.25 As part of design for the working draft EIA Report the following four options were taken forward to a detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:
- Option A1.0 (the route announced in November 2015 and presented in the working draft EIA Report) included the Bourne Brook viaduct (renamed as the Kings Bromley viaduct) and the River Trent viaduct, approximately 730m and 1.9km in length, respectively, with the Bourne embankment, approximately 800m in length, between the two viaducts;
 - Option A1.1a included a single viaduct of approximately 2.8km in length, with a 230kph crossover, which would remove the Bourne embankment with the viaduct spanning across the Bourne Brook and the River Trent and their associated floodplains. A 230kph rail crossover would be relocated to an extended embankment to the north near Pipe Ridware which would itself extend further to the south. Due to the extension of the embankment into the River Trent floodplain, this option would increase flood levels in this location and a replacement floodplain storage area would need to be provided. Therefore this option was not taken forward for further consideration;
 - Option A1.1b was developed as a minor variation to Option A1.1a and included a single viaduct of approximately 2.8km in length, with a 130kph crossover. The 130kph rail crossover would be relocated to an embankment to the north near Pipe Ridware which would extend slightly further to the south and would require additional land for earthworks. The extended embankment for this

option was slightly lower than Option A1.1a due to the requirements of the lower design speed. This option was considered the preferred environmental option because of its benefits to ecology and landscape, and its reduction in the loss of floodplain when compared with Option A1.0. The single viaduct would reduce the land required at Tomlinson's Spinney reducing habitat fragmentation and severance and improve visual permeability beneath the viaduct when compared to Option A1.0. However, on balance, it was not considered that these environmental benefits were sufficient to justify the disproportionately higher cost; and

- Option A1.2 was developed as a minor variation to Option A1.0 reducing the length of both viaducts. The length of the Bourne Brook viaduct would be reduced from 730m to 720m and the River Trent viaduct from 1.9km to 895m. This change would increase the embankment length on either side of the respective viaducts. The visual impact of this option would increase due to the introduction of a series of embankments with bridges and culverts rather than the two longer viaducts spans in Option A1.0. Additional habitat loss and fragmentation at Little Spinney and the adjacent watercourse due to the extension of the embankments would result in increased impacts on ecological habitats and the construction works in the floodplain would increase the impact watercourses. This option was not taken forward for further consideration due to impact on the floodplain, habitat fragmentation and increased visual impacts on neighbouring communities.

2.5.26 Following the publication of the working draft EIA Report, design development of the Proposed Scheme was undertaken through detailed hydraulic modelling of the Bourne Brook and the River Trent to better define the flood zone and the potential impacts and to reduce the loss of floodplain. This resulted in the lengths of the Kings Bromley and River Trent viaducts being increased from approximately 730m to 980m and 1.9km to 1.92km respectively to avoid impacts on the floodplain.

2.5.27 Lengthening of the viaducts resulted in a reduction in the length of the Bourne embankment from the design presented in the working draft EIA Report, from approximately 800m to 505m. This therefore presented an opportunity to reconsider how the route of the Proposed Scheme would cross the Bourne Brook, the River Trent and the associated floodplains. This also allowed an opportunity to reduce the disruption to the local road network, including keeping Shaw Lane open (which was closed in the scheme assessed in the working draft EIA Report)²².

2.5.28 Given this opportunity, two options, presented as new to those assessed for the working draft EIA Report, were taken forward to a more detailed appraisal where engineering, construction feasibility, cost and environmental impacts were considered:

- Option SS1: a single viaduct, approximately 3.3km in length, crossing the Bourne Brook, River Trent and associated floodplains. This option allowed the

²² Refer to the HS2 Ltd., (2016), West Midlands- Crewe Working Draft Environmental Impact Assessment Report – Volume 2, Community Area 1: Fradley to Colton for further information regarding the previous options considered. Available online at: <https://www.gov.uk/government/publications/hs2-phase-2a-west-midlands-to-crewe-working-draft-environmental-impact-assessment-report-volume-2-community-area-reports-and-map-books>

retention of Shaw Lane; and

- Option SS1b: two viaducts, approximately 980m and 1.92km in length, crossing the Bourne Brook and the River Trent respectively. These viaducts would be separated by a central embankment approximately 505m in length. This option would also retain Shaw Lane (which will be realigned). The high pressure gas main would also be retained.

Option SS1b was taken forward into the Proposed Scheme. Whilst Option SS1 would provide greater environmental benefits, when compared to Option SS1b the benefits were not considered sufficient to justify the additional safety risk associated with the requirement to have an emergency access point on the viaduct. The analysis of engineering, cost and potential environmental impacts associated with both options is set out below, with the impacts of the option selected presented first.

Option SS1b

- 2.5.29 The construction of the Bourne embankment between the two viaducts would result in the partial loss of Tomlinson's Spinney LWS introducing habitat fragmentation by creating a barrier to wildlife movement across the route of the Proposed Scheme. The embankment would also introduce the potential for collision risk of trains with certain fauna groups e.g. bats attempting to cross the route. The Bourne embankment would result in a loss of agricultural land and sever farmland to form a prominent visual horizon feature, breaking up open space and impacting the landscape character of the area. This option would also impact the historic setting and have a visual impact on historic buildings in Kings Bromley.
- 2.5.30 Option SS1b does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme and allows the provision of an emergency access point on the Bourne embankment, which would represent a safe form of evacuation.

Option SS1

- 2.5.31 In comparison to Option SS1b (the Proposed Scheme), Option SS1 would reduce impacts on the Tomlinson's Spinney LWS, reduce barrier effects on wildlife and species collision risk due to the removal of the Bourne embankment. A single viaduct would reduce the impact on agricultural land and the open nature of the landscape by retaining visual permeability. This visual permeability would also reduce the visual impact on the historic buildings in Kings Bromley and upon the remains of the former landscape park to the south of the former Kings Bromley Manor.
- 2.5.32 Option SS1 introduces an additional safety risk as the emergency access point would be a stairwell from track walkway level down to ground level which would be approximately 15m high. Therefore de-trained passengers could be required to climb down to a muster point at ground level in the event of an evacuation, making this option less desirable. This option does not introduce any new construction complexities or lengthening of the construction programme.

Auto-transformer feeder station at Newlands Lane

- 2.5.33 Following publication of the working draft EIA Report, consideration has been given to the location of the auto-transformer feeder station at Newlands Lane. The auto-transformer feeder station will house the electrical equipment that will protect and control the power supply to the Proposed Scheme. The auto-transformer feeder station is required to be located at the start of a neutral section²³ along the route at a location with a potential grid connection to existing electrical infrastructure (see Section below on grid connection from Rugeley sub-station to the auto-transformer feeder station at Newlands Lane).
- 2.5.34 The sensitivity of this location, particularly the historic landscape and the proximity of the route of the Proposed Scheme to residential properties at Colton and Stockwell Heath, have been key considerations in the development of these alternatives.
- 2.5.35 The following four options were taken forward to a detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:
- Option 0 (presented in the working draft EIA Report): the auto-transformer feeder station would be located to the north of Newlands Lane, on the southern side of the route of the Proposed Scheme, approximately 500m to the east of Colton with the western edge of the auto-transformer feeder station within a 4m cutting;
 - Option 1: the auto-transformer feeder station would be located to the south of Newlands Lane, on the southern side of the route of the Proposed Scheme approximately 800m east of Colton. The auto-transformer feeder station at this location would be within a cutting of 10m at its north-eastern corner, however a large portion of the south-western side of the facility would be located on embankment up to 8m in height;
 - Option 2: the auto-transformer feeder station would be located to the south of Newlands Lane, on the west side of the route of the Proposed Scheme, approximately 600m east of Colton. The auto-transformer feeder station at this location would be within a cutting at its north eastern corner, however a large portion of the south western side of the facility would be located on embankment. The embankment would be up to 5m in height; and
 - Option 3: the auto-transformer feeder station would be located south of Newlands Lane on the northern side of the route of the Proposed Scheme, approximately 900m to the north-east of Colton within the Blithbury North cutting approximately 14m deep at its north-east corner.
- 2.5.36 Option 3 was taken forward into the Proposed Scheme as on balance it presented the most favourable environmental outcome. Option 0 and Option 1 were not taken forward as there would be an increase in environmental impacts most notably in relation to visual and noise impacts on the amenity of residents at Colton and

²³ A neutral section is an insulated section that prevents two differing electrical from touching, by introducing an electrical clearance (an earth section).

Stockwell Heath. Option 1 also presented an increase to land required permanently from two farm holdings. Option 2 was not taken forward as there would be an increase in environmental impacts, most notably in relation to landscape and visual, noise, and ecological habitats.

- 2.5.37 The analysis of engineering, cost and potential environmental impacts associated with all four options are set out below, with the impacts of the option selected presented first.

Option 3

- 2.5.38 Option 3 would generate an impact on the landscape character of the area due to partial severance of an ancient field pattern at the southern tip of the auto-transformer feeder station. The land required permanently for this option would extend the land required for construction of the Proposed Scheme resulting in the loss of agricultural land at Manor Farm and impact species through the potential loss of woodland and pond habitat. No views of the auto-transformer feeder station are anticipated from Stockwell Heath, due to intervening landform, and no views from Colton are anticipated due to the auto-transformer feeder station being located on the opposite side of the Blithbury North cutting. Both Colton and Stockwell Heath would be far enough away to receive minimal noise impacts.
- 2.5.39 Option 3 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option o

- 2.5.40 In comparison to Option 3 (the Proposed Scheme), with Option o, the auto-transformer feeder station would be visible from Colton and Stockwell Heath leading to an increase in visual impacts on built-heritage assets and residents within both communities. Noise impacts on the community of Colton would be potentially worse due to the auto-transformer feeder station being closer to the community. This option would slightly reduce the impact on agricultural land as the land required permanently would be located within a small parcel of land at Manor Farm. This would cause the farm to be isolated by the route of the Proposed Scheme and make it difficult to farm commercially. This option would potentially reduce the impact on ecological habitat as it does not extend the land required for construction.
- 2.5.41 Option o does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option 1

- 2.5.42 In comparison to Option 3 (the Proposed Scheme), with Option 1, the south eastern corner of the auto-transformer feeder station would be located on embankment forming a highly visible feature. This option would also increase the visual impacts on users of Colton bridleways 31, 32 and 33 and residents on Hollow Lane and Blithbury Road. The potential noise impacts on residents within these communities would be greater as this option is closer to Colton and Stockwell Heath. This option would increase the impact on agriculture as land farmed by Manor Farm and Town End Farm would be required permanently. This option would potentially reduce the impact on ecological habitat as it does not extend the land required for construction.

- 2.5.43 Option 1 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option 2

- 2.5.44 In comparison to Option 3 (the Proposed Scheme), with Option 2, the auto-transformer feeder station would form a highly visible feature within the surrounding landscape visible from Colton and Stockwell Heath increasing the visual impact on these communities. Noise impacts on the community of Colton and properties on Blithbury Road, Hollow Lane and Hurst Wood Farm would be potentially greater due to the auto-transformer feeder station being closer to these residences. This option would increase the impact on agriculture as land owned by Manor Farm and Town End Farm would be required permanently. The additional land required in this option would also increase the impact on species habitat through the removal of mature trees.

Option 2 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Grid connection from Rugeley sub-station to the auto-transformer feeder station at Newlands Lane

- 2.5.45 During the design development process since the announcement of the preferred route to Crewe in November 2015, consideration has been given to the alignment of a power line required to provide traction power²⁴ to operate the trains. The power supply required to operate the Proposed Scheme will come from the Rugeley sub-station and connect to the Proposed Scheme via the Newlands Lane auto-transformer feeder station. The auto-transformer feeder station will provide power to a number of auto-transformer stations across the route of the Proposed Scheme, which will supply the overhead line equipment.
- 2.5.46 The sensitivity of this location, particularly the historic landscape and the proximity of the power line to residential properties at Colton and Hill Ridware have been key considerations in the development of these alternatives.
- 2.5.47 The working draft EIA Report reported that two auto-transformer feeder stations would be located adjacent to the route of the Proposed Scheme, one within the Fradley to Colton area at Newlands Lane and the other within the South Cheshire area (CA5), south of Crewe. Following engagement with Scottish Power and National Grid it was deemed that providing power to the South Crewe auto-transformer feeder station would not be feasible due to constraints on capacity (see Section 2.5 in the Volume 2 CA5 South Cheshire). As such the power supply to the Newlands Lane auto-transformer feeder station will provide the full extent of traction power for the operation of the trains.
- 2.5.48 A preliminary options appraisal was undertaken of five options and three options were not taken forward for further consideration as they were not considered to be reasonable alternatives:

- Option 1 would include an overhead power line of approximately 7.8km,

²⁴ Traction power is that provided primarily for the purpose of moving trains.

connecting the Newlands Lane auto-transformer feeder station into an existing 400kV pylon near Rileyhill. The route of the power line would run adjacent to the route of the Proposed Scheme and would require construction of a new substation to reduce the power from 400kV to 132kV at the auto-transformer feeder station at Newlands Lane. This option would require pylons, approximately 50m in height, to accommodate the higher voltage. Option 1 was not taken forward for further consideration. This was due to risks associated with the close proximity of the works to the construction of the overhead power line and route of the Proposed Scheme and resultant lengthening of the construction programme. Residential receptors would experience significant cumulative visual impacts from the overhead power line in combination with other elements of the Proposed Scheme;

- Option 2 would include an overhead power line of approximately 3.6km, connecting the Newlands Lane auto-transformer feeder station into an existing 400kV pylon adjacent to Lawnmeadow Covert, north of Handsacre. Like Option 1 this option would require the construction of a new substation to reduce the power from 400kV to 132kV. Routing the 400kV overhead power line from the grid supply point at Lawnmeadow Covert, north of Handsacre to the auto-transformer feeder station at Newlands Lane would require pylons, approximately 50m in height, to accommodate the higher voltage. During consultation in September 2016, National Grid confirmed that the construction of a substation in the required location was unviable therefore Option 2 was not taken forward for further consideration; and
- Option 5 would include an underground route of approximately 4.2km connecting the Newlands Lane auto-transformer feeder station to a grid supply point at the Rugeley sub-station where the power would be reduced from 400kV to 132kV. As the route would leave the Rugeley sub-station approximately 450m of horizontal directional drilling would be required to duct the power line beneath the River Trent and the WCML. The remaining 3.7km of the underground route would follow the alignment of Blithbury Road and Hollow Lane and connect to the Newlands Lane auto-transformer feeder station. Option 5 was not taken forward as whilst this option would result in reduced visual impacts once constructed, due to the power line being buried, there would be the potential for significant disruption to local highways during construction, to Blithbury Road and Hollow Lane associated with additional length of the route and the land required. This option would also be complex and costly due to the length of buried cables and the measures required to manage the dissipation of heat generated by the cables.

2.5.49 The following two options were taken forward to a more detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:

- Option 3 would include an underground route of approximately 4km connecting the Newlands Land auto-transformer station to a grid supply point at the Rugeley sub-station where the current would be stepped-down from 400kV to 132kV. As the route leaves the Rugeley sub-station approximately

640m of horizontal directional drilling would be required to duct the power line beneath the River Trent and the WCML. The underground route would then proceed north beneath predominantly agricultural land for approximately 2.9km and connect to the Newlands Lane auto-transformer feeder station; and

- Option 4 would include an overhead line of approximately 4km (with approximately 30m high pylons) and underground route connecting the Newlands Lane auto-transformer feeder station to a grid supply point at the Rugeley sub-station where the power would be reduced from 400kV to 132kV at a substation located at Rugeley Power Station. As the route leaves the Rugeley sub-station approximately 640m of horizontal directional drilling would be required to duct the power line beneath the River Trent and the WCML. The underground route would then transition to a 132kV overhead power line via a cable sealing end compound located adjacent to the Cawarden Springs Wood Local Wildlife Site (LWS). The route would proceed north as an overhead line for approximately 2.3km to a second cable sealing end compound located to the south-west of Hollow Lane where it would then proceed as an underground route for 1km and ducted beneath the route of the Proposed Scheme to connect directly into the Newlands Lane auto-transformer feeder station.

2.5.50 Option 4 was taken forward into the Proposed Scheme. Whilst Option 3 would provide greater environmental benefits during operation, the effects during construction would be greater and on balance the benefits expected during operation were not considered sufficient to justify the additional complexity and significant increase in cost associated with managing the heat dissipation from larger cables.

2.5.51 The analysis of engineering, cost and potential environmental impacts associated with both options is set out below, with the impacts of the option selected presented first.

Option 4

2.5.52 The visual impact of this option would impact the setting of residential properties and locally listed buildings in close proximity to the route and within the villages of Colton, Rake End and Hill Ridware. It would also impact the setting of the former Colton Hall Farm, a 19th century farmstead and the landscape character as it transverses a deer park and assumed parkland. The land required permanently would result in a minor loss of agricultural land required for the footprint of the pylons.

2.5.53 This option could also potentially indirectly impact the River Trent as the 450m drilled section would involve stripping and excavation in the vicinity of the upper catchment channels of the Moreton Brook. The underground section of the route would cross an historic landfill and would present a risk of contamination. Additionally, there would be impacts on a Principal aquifer and the route would cross a Mineral Safeguarding Area, and would result in a severance of mineral. The construction corridor would impact upon Cawarden Springs Wood LWS which is a deciduous woodland however the overhead power line could be designed to avoid most features of ecological value, including the LWS woodland. There would be a potential risk of bird collision with the overhead power lines.

- 2.5.54 The final section of this option includes burying approximately 1km of the power line beneath the route of the Proposed Scheme, to minimise the landscape and visual impact of this option.
- 2.5.55 The works associated with the underground section of the route introduces hazards such as working with high tension cables, breaking ground, directional drilling and an interface with existing underground cables. .

Option 3

- 2.5.56 In comparison to Option 4 (the Proposed Scheme), once constructed Option 3 would reduce the visual impacts on residential properties and the impact on landscape character. The impacts on the setting of the listed buildings would be avoided and the risk of bird collision with the overhead power lines would be removed.
- 2.5.57 With this option the burying of cables would increase the loss of agricultural land and the impact on farm holdings construction during construction, although land would be restored during operation of the Proposed Scheme. An area of Cawarden Brick and Tile Company would be impacted which could result in a disruption to the business operations. The impact of directional drilling on water resources are comparable to the Proposed Scheme. The removal of woodland within Cawarden Springs Wood LWS and hedgerows would be required during construction presenting a greater impact on biodiversity compared to the Proposed Scheme.
- 2.5.58 Option 3 would be significantly more complex and costly than the Proposed Scheme due to the increased length of larger buried cables required to manage the heat dissipation.

Pylons vs wooden poles

- 2.5.59 Following the decision to take Option 4 forward into the Proposed Scheme, consideration was given to the form of the structure that would carry the overhead power line in order to reduce the visual impact associated with the route. The options included, wooden poles, approximately 15m in height, and steel pylons, approximately 26m in height.
- 2.5.60 Wooden poles would better integrate into the landscape than steel pylons, due to their size, colour and material. This would result in a lower visual impact on nearby residential receptors and reduce the setting impact on heritage assets, such as Colton Hall Farm (ruins of a 14th century manor house). There would, however, be an increase in the impact on one farm holding, due to reduced spacing between the wooden poles making it more difficult to manoeuvre machinery.
- 2.5.61 The wooden pole option has been taken forward into the Proposed Scheme as it provides greater environmental benefits when compared with the steel pylons.

Borrow pits

- 2.5.62 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration has been given to the way in which the Proposed Scheme would acquire high quality material (usually comprising sand and gravel) to construct embankments. This material will be provided, in part, through excavation of cuttings and other earthworks along the route of the Proposed

Scheme, where the quality is appropriate. However, at some locations along the route there is insufficient high quality material for use in railway embankment construction. The use of borrow pits close to the route of the Proposed Scheme would enable high quality material and aggregate to be extracted and processed and backfilled locally and transported largely on site haul routes, lowering HGV movements and reducing impacts on the local road network and communities. Section 6.10 of Volume 1 of this ES presents an overview of the alternatives to using borrow pits.

- 2.5.63 Three areas proposed for potential borrow pits within the Fradley to Colton area were initially identified using plans showing suitable geology combined with requirements for excavated material where the largest shortfalls of material occurred along the route of the Proposed Scheme. Selection criteria also included areas of mineral resource identified by Staffordshire County Council (SCC) and avoidance, where reasonably practicable, of residential properties, environmentally sensitive receptors, major services and diversions. The sensitivity of the River Trent valley, particularly the historic landscape, local water resources and the proximity of the borrow pits to residential properties have been key considerations in the development of these alternatives.

Area One: Kings Bromley South

- 2.5.64 A detailed appraisal was undertaken for two options, where engineering and construction feasibility, and environmental impacts were considered:

- Option A-1: the borrow pit would be located to the south side of the route of the Proposed Scheme, approximately 350m south of Common Lane; and
- Option A-2: the borrow pit would be located to the north side of the route of the Proposed Scheme, approximately 300m south of Common Lane.

- 2.5.65 Option A-2 has been taken forward into the Proposed Scheme as on balance it presented the most favourable environmental outcome. Option A-1 in comparison would present an increase in environmental impacts most notably to Ashby Sitch, Rice's Spinney and noise and visual amenity impacts to local residents.

- 2.5.66 Option A-2 was subsequently modified following further analysis of volume requirements and due to uncertainties around material depth and quantity. This also, included further avoidance of environmental sensitivities and construction complexities. The modified Option A-2 incorporated a portion of the footprint from Option A-1. The analysis of engineering and potential environmental impacts associated with both options is set out below, with the impacts of the option selected presented first.

Option A-2

- 2.5.67 The first iteration of Option A-2 would have an impact on buried archaeological remains and the amenity of residents of Barn Farm, Common Lane Farm and recreational receptors using Kings Bromley Footpath 0.392 would be impacted due to associated noise and visual intrusion. Following analysis of the excavated material required, this option did not fully meet the volume requirements that are expected to be required based on estimates of suitability and depth of material at this location.

2.5.68 The footprint of this option was subsequently modified to meet volume requirements and to consider avoidance of environmental sensitivities. The refined option represents an improvement for local residents by moving the borrow pit further from Barn Farm, and a reduction in the number of buried archaeological assets to be removed. The increase in land associated with the extended footprint included a portion of the land contained in Option A-1 therefore extending the borrow pit either side of the route of the Proposed Scheme. This change would generate an increase in impacts on the landscape character, the removal of landscape features and an increase in visual receptors affected.

Option A-1

2.5.69 In comparison to Option A-2 (the Proposed Scheme), Option A-1 presents an increase in environmental impacts. This option would result in the diversion of Ashby Sitch, a watercourse which flows through the site. Construction noise impacts would be anticipated on residents of properties in Rileyhill and visual amenity impacts on the users of Common Lane Farm, Barn Farm and residents of Common Farm. There would be temporary impacts on the archaeological setting of the Trent and Mersey Canal Conservation Area due to associated construction traffic movements, and a further loss of woodland habitat at Rice's Spinney. The landform in this area is flat therefore further removal of the woodland would reduce screening.

Area Two: Kings Bromley North

2.5.70 A detailed appraisal was undertaken for two options, where engineering and construction feasibility, cost and environmental impacts were considered:

- Option B-1: the borrow pit would be located on the south side of the route of the Proposed Scheme, approximately 1.4km west of Kings Bromley; and
- Option B-2: the borrow pit would be located on the north side of the route of the Proposed Scheme, approximately 600m west of Kings Bromley.

2.5.71 Following further analysis of volume requirements and due to uncertainties around material depth and quantity at this stage, both options have been taken forward and included into the Proposed Scheme. The analysis of engineering and potential environmental impacts associated with both options is set out below.

Option B-1

2.5.72 Option B-1 would result in impacts on ecology, the residential amenity of properties on Shaw Lane, and buried archaeological remains. This option would increase flood risk as part of the borrow pit is within the floodplain associated with Bourne Brook and may affect the base flow of this watercourse. There would also be impacts on the amenity of residents of Echills Farm, located approximately 200m to the north, due to isolation, visual intrusion and cumulative effects associated with construction of the route of the Proposed Scheme.

2.5.73 As a result of design refinement to this option an offset of approximately 150m was introduced to reduce impacts on Echills Farm. A 25m buffer was also applied to reduce potential impacts on bat species using the woodland located to the north-west of the option.

Option B-2

- 2.5.74 This option would increase flood risk as the borrow pit is located within the floodplain associated with the Bourne Brook. There would also be amenity impacts on the residents of Kings Bromley due to noise and visual impacts during construction. This option would also have the potential to impact on buried archaeological remains. The Trent Valley, where the majority of fluvioglacial sands and gravels required for embankment fill are found, has a greater potential to contain protected archaeological and palaeoenvironmental remains as these areas are likely to have originated as seasonal outwash deposits at the edge of the late-Devensian ice-sheet. By excavating this material there is a higher risk of impacting archaeological assets.
- 2.5.75 As a result of design refinement to this option an offset was introduced to reduce impacts on grazing land used by Pipe Hall Farm.

Area Three: Blithbury

- 2.5.76 A detailed appraisal was undertaken of three options, where engineering and construction feasibility, cost and environmental impacts were considered:
- Option C-1: the borrow pit would be located on the south side of the route of the Proposed Scheme, located adjacent to Quintons Orchard Farm and Bentley Hall Farm;
 - Option C-2: the borrow pit would be located on the south side of the route of the Proposed Scheme, approximately 50m north of Bentley Fall Farm; and
 - Option C-3: the borrow pit would be located on the north side of the route of the Proposed Scheme, approximately 400m north-east of Pipe Ridware.
- 2.5.77 Option C-3 has been taken forward into the Proposed Scheme as on balance it presented the most favourable environmental outcome. Option C-1 and Option C-2 in comparison would both present an increase in environmental impacts, most notably in relation to amenity impacts on Bentley Hall Farm, Bentley Hall Cottage and Quintons Orchard Farm. The analysis of engineering, cost and potential environmental impacts associated with all three options is set out below, with the impacts of the option selected presented first.

Option C-3

- 2.5.78 Option C-3 is located within the River Trent floodplain and would therefore present impacts on flood risk and cultural heritage in this location. This option also has the potential to impact on the amenity of residents of Nethertown relating to noise and visual intrusion and would result in the loss of agricultural land currently used for grazing.
- 2.5.79 Data obtained through ground investigation provided more certainty about the suitability and location of the resource available within this option. This information significantly reduced the risk associated with finding better quality material and therefore the footprint of this option was reduced and the depth increased. This design development further increased the distance between the borrow pit and Nethertown therefore reducing impacts on amenity. The loss of agricultural land was also reduced by moving the boundary of the borrow pit out of a key grazing field.

Option C-1

- 2.5.80 Option C-1 would impact the surface water flow and would increase the risk of flooding in the area. It would also impact the historical setting of two Grade II listed buildings, Bentley Hall Farm and Bentley Hall Cottage. The proximity of these residences and Quintons Orchard Farm would result in amenity impacts on these residences relating to noise, visual intrusion and isolation.

Option C-2

- 2.5.81 Option C-2 would require the diversion of an unnamed watercourse increasing the impact on water resources and would have an impact on ecology by reducing ecological connectivity. The two Grade II listed buildings, Bentley Hall Farm and Bentley Hall Cottage would be impacted through changes in their setting due to noise, visual intrusion and isolation.

3 Stakeholder engagement and consultation

3.1 Introduction

3.1.1 HS2 Ltd’s approach to stakeholder engagement and consultation on the Proposed Scheme is set out in Volume 1, Section 3.

3.1.2 Since the route announcement in November 2015, HS2 Ltd has carried out a programme of stakeholder engagement and formal consultation with a broad range of stakeholders.

3.1.3 A variety of mechanisms have been used to ensure an open and inclusive approach to engagement and consultation, reflecting the differing requirements and expectations of stakeholders.

3.2 Key stages of Phase 2a engagement and consultation

Summary of engagement

3.2.1 A summary of engagement undertaken or underway since the route announcement in November 2015 is provided in Table 4.

Table 4: Mechanisms and timeline of stakeholder engagement and consultation since the route announcement in November 2015

Date	Engagement and consultation activity and mechanisms	Stakeholders engaged/consulted
November 2015	Local authority briefings	Local authority officers along the line of route.
November 2015 – February 2016	Consultation on schemes to assist property owners from 30 November 2015 to 25 February 2016	National consultation with information published on the HS2 Ltd website. Direct engagement with communities and their representatives through public events and documents being made available at a range of community locations along the route.
December 2015 – September 2016	Direct engagement to develop the Proposed Scheme, the Environmental Impact Assessment (EIA) and Equality Impact Assessment (EQIA)	Local authorities, parish councils and technical and specialist stakeholders.
January 2016 - ongoing	Site visits and meetings to observe and discuss possible impacts and understand people’s concerns	Residents, landowners, businesses, community interest groups and other directly affected stakeholders and their representatives along the route.
March 2016 - May 2016	Consultations on the draft EIA and EQIA Scope and Methodology Reports (SMR) from 8 March to 13 May 2016	National consultation with information published on the HS2 website. Technical and specialist stakeholders, local authorities and parish councils on the line of route directly invited to participate.
September – November 2016	Consultations on the working draft EIA Report; working draft EQIA Report; and Design Refinements from 13 September to 7 November 2016	National consultation with information published on the HS2 Ltd website. Direct engagement with communities and their representatives through public events and documents being made available at a range of community locations along the route.

Date	Engagement and consultation activity and mechanisms	Stakeholders engaged/consulted
November 2015	Local authority briefings	Local authority officers along the line of route.
November 2016 - ongoing	Ongoing discussions, meetings and site visits in response to issues raised during consultation and through broader stakeholder engagement.	Residents, landowners, businesses, community interest groups and other directly affected stakeholders and their representatives along the route.

Property consultation

- 3.2.2 Property consultation focused on those individuals and landowners potentially directly affected by the Proposed Scheme. Consultation took place between 30 November 2015 and 25 February 2016. Its purpose was to inform the Government’s decision on whether to implement the same compensation and assistance schemes as for Phase One, taking into consideration the views of those individuals and organisations who expressed their opinions on the proposals.
- 3.2.3 Within the Fradley to Colton area, a property consultation event was held at Kings Bromley Village Hall on 15 January 2016.
- 3.2.4 Consultation responses were analysed, and reported on 26 May 2016 in the Government’s report entitled “HS2 Phase Two: West Midlands to Crewe Property Consultation 2015”²⁵ and the Government’s response was issued in the Decision Document HS2 Phase Two: West Midlands to Crewe Property Consultation 2015²⁶.

EIA SMR consultation

- 3.2.5 The draft EIA Scope and Methodology Report (SMR) was formally consulted on from 8 March to 13 May 2016 and was issued to statutory bodies, non-government organisations and local authorities. It was also available on the Government’s website, allowing comment by local interest groups and the public. Twenty-six responses to the draft EIA SMR were received, as a result of which changes were made to the EIA SMR, which was published in September 2016. The changes between the draft EIA SMR and the publication of the EIA SMR were set out in the EIA SMR Consultation Report²⁷, also published in September 2016.
- 3.2.6 The assessment set out in this ES follows the scope and methodology in the EIA SMR and SMR Addendum (Volume 5: Appendix CT-001-001 and Appendix CT-001-002).

Working draft EIA Report consultation

- 3.2.7 The working draft EIA Report was formally consulted upon between 13 September and 7 November 2016. Parallel consultations on the working draft EQIA and Design Refinements were also undertaken during this period. As part of the process of consultation, stakeholders were invited to comment on the Proposed Scheme and the

²⁵ UK Government: HS2 Phase 2a: HS2 Phase Two: West Midlands to Crewe Property Consultation 2015. Available online at: <https://www.gov.uk/government/consultations/hs2-phase-two-west-midlands-to-crewe-property-consultation-2015>

²⁶ UK Government: HS2 Phase 2a: HS2 Phase Two West Midlands to Crewe property consultation 2015: government decision. Available online at: <https://www.gov.uk/government/publications/hs2-phase-two-west-midlands-to-crewe-property-consultation-2015-government-decision>

²⁷ UK Government: HS2 Phase 2a: West Midlands to Crewe Draft Environmental Impact Assessment Scope and Methodology Report consultation. Available online at: <https://www.gov.uk/government/consultations/hs2-phase-two-west-midlands-to-crewe-draft-environmental-impact-assessment-scope-and-methodology-report-consultation>

working draft EIA and EQIA Reports that informed it as well as the key design refinements to the Proposed Scheme which were being considered at the time.

3.2.8 Four hundred and seventy-five responses to the working draft EIA Report consultation were received in total.

3.2.9 These responses were analysed and the following themes and issues relevant to the Fradley to Colton area included:

- noise and visual impacts associated with the construction and operation of the Proposed Scheme, in particular those associated with the River Trent viaduct;
- the cumulative impact of HS2 Phase One and HS2 Phase 2a construction works at the interface of the two schemes;
- impacts of use of local roads during the construction periods;
- Impacts of construction traffic on businesses at Common Lane;
- maintaining access to properties and agricultural land;
- impacts of the maintenance loops at Pipe Ridware;
- ecological impacts in the Fradley to Colton area; and
- impacts on the community at Stockwell Heath.

3.2.10 These consultations and wider feedback from ongoing stakeholder engagement have been considered as part of the ongoing design of the Proposed Scheme and the assessment and identification of mitigation for the Fradley to Colton area.

3.2.11 A Working Draft Environmental Impact Assessment Report: Consultation Summary Report²⁸ has been published alongside this ES summarising how the responses to the working draft EIA Report have been taken into consideration in the design and assessment of the Proposed Scheme. A separate consultation summary report has been prepared for the working draft EQIA Report²⁹.

3.2.12 Section 2 of this report describes the key changes made to the design in the Fradley to Colton area since the working draft EIA Report.

3.3 Engagement and consultation with stakeholder groups

Technical and specialist groups

3.3.1 Engagement has been undertaken with technical and specialist organisations to provide appropriate specialist input to inform the design and assessment of the Proposed Scheme. This includes engagement with statutory bodies, local councils and utility companies operational within the Fradley to Colton area.

3.3.2 Direct engagement with county and district councils within the Fradley to Colton area has been undertaken in order to collate local baseline information, identify and

²⁸ Volume 5: Appendix CT-008-000, Working Draft Environmental Impact Assessment Report: Consultation Summary Report.
²⁹ Working Draft Equality Impact Assessment Report: Consultation Summary Report. Available online at: www.gov.uk/hs2

understand issues and concerns, and provide a mechanism for ongoing dialogue and discussion on the assessment and design development.

- 3.3.3 Engagement has focused on the technical areas that inform the assessment, including, landscape and visual, sound, noise and vibration and traffic and transport, among other topics. It has also informed the design of the Proposed Scheme, as summarised in Table 5.
- 3.3.4 Briefings were offered to specialist and technical stakeholders along the route of the Proposed Scheme during the period of consultation on the working draft EIA Report to provide information on the evolving design and assessment of the Proposed Scheme in their respective areas.
- 3.3.5 Table 5 includes engagement undertaken with technical and specialist groups and how this has informed the design and assessment of the Proposed Scheme in the Fradley to Colton area.

Table 5: Engagement to date with technical and specialist groups

Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
Statutory		
Department for Environment, Food and Rural Affairs (Defra)	Agricultural and land quality issues	Identifying local agricultural and land quality issues, including sites of particular interest such as foot and mouth burial sites.
Canal & River Trust	The landscape and visual assessment methodology with specific reference to the selection and location of representative viewpoints for the assessment and for photomontages.	A number of additional viewpoints were identified for assessment notably at Woodend Lock, to reinforce those already selected for Fradley Lock and to better understand the visual interface of Phase 2a with the Lichfield spur of Phase One. This has led to the identification of a number of sensitive visual receptors that would be significantly impacted by the construction and operation of the Proposed Scheme and which has informed the development of the mitigation landscape design.
Environment Agency	Water and flood risk issues	Providing information on water and flood risk issues along the line of route.
Food and Environment Research Agency (FERA)	Land contamination issues	Identification of local land quality issues.
Forestry Commission	Ecology and landscape related issues	Informing understanding of methodological approach and detailed local conditions and factors to be taken into consideration in the assessment.
Highways England	Traffic and transport assessment	Informing the assessment of road network capacity and identification of proposed future works.
Historic England	Nationally designated heritage assets and the heritage assessment methodology.	Informing the methodology for assessing setting and impacts on historic landscape at national and regional level. Identification and assessment methodology of designated and non-designated heritage assets.
Natural England	Ecology and landscape and visual related issues	Providing further information regarding potential ancient woodland sites. Understanding of methodological approach and detailed local

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Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
	Agricultural land quality and land restoration issues	conditions and factors to be taken into consideration in the assessment.
Local authorities		
Staffordshire County Council	Cultural heritage issues	Identifying heritage assets to protect these assets and their settings.
	Water and flood risk issues	Understanding local infrastructure and conditions, including flood risks.
	Ecology and biodiversity assessment	Understanding sensitive ecological sites and appropriate mitigations and compensation for habitat loss associated with the Proposed Scheme.
	Traffic and transport in relation to the construction of the Proposed Scheme	Understanding the local road network, its current use and levels of traffic and congestion to inform construction traffic routes.
	Landscape and visual effects of the Proposed Scheme	Identifying representative viewpoint and photomontages locations.
	Potential health effects of the Proposed Scheme on local communities	Understanding local demographic and determinants of health and wellbeing.
	Air quality assessment	Understanding local conditions and factors to inform scheme design and EIA.
	Sound noise and vibration assessment	Understanding local conditions and factors to inform scheme design and EIA.
Lichfield District Council	Local planning developments	Identifying local plans, policy and committed developments, to inform Scheme development
	Potential health effects of the Proposed Scheme on local communities.	Understanding local demographic and determinants of health and wellbeing.
	Land quality and land contamination.	Identifying local areas of land contamination.
Utilities		
National Grid	Utilities, gas and electricity networks	Informing route-wide considerations around utilities network and factors to be considered in the design and assessment of the Proposed Scheme.
Severn Trent Water	Potential connections and proximity of the Proposed Scheme to Severn Trent Water's assets.	Understanding of local utilities and factors to consider in the design, construction and operation of the Proposed Scheme.
Other Specialist stakeholders		
Central Association of Agricultural Valuers (CAAV)	Potential impacts of the Proposed Scheme on agricultural businesses.	Understanding the concerns of the agricultural industry in relation to the Proposed Scheme.
County Land and Business Association (CLA)	Potential impacts of the Proposed Scheme on agricultural businesses	Understanding the concerns of the agricultural industry in relation to the Proposed Scheme.

Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
National Farmers Union (NFU)	Potential impact of the Proposed Scheme on farmers and agricultural businesses	Understanding the concerns of farmers affected by the Proposed Scheme.
Royal Society for the Protection of Birds (RSPB)	Ecology and biodiversity issues	Informing the ecology survey programme, and strategic mitigation opportunities.
Staffordshire Wildlife Trust	Local and regional ecology and biodiversity issues	Understanding of local wildlife assets and informing potential off-site and strategic mitigation.
Woodland Trust	The route and associated effects to local woodland habitats	Informing understanding of local woodland habitats and how to mitigate and offset impacts to these.

3.3.6 Further information about topic-specific engagement with technical and specialist groups is provided in Sections 4 to 15, where relevant.

Communities

3.3.7 Community stakeholders in the Fradley to Colton area include a range of local community interest groups, local facility and service providers and schools, as well as members of the public. The purpose of this engagement has been to give affected communities the opportunity to raise issues during the development of the design and assessment of the Proposed Scheme.

3.3.8 As part of the formal consultation on the working draft EIA Report, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the working draft EIA Report and the development of the Proposed Scheme design. Details of local consultation events were provided on the HS2 Ltd website, via social media, on posters at local venues, through regional advertising and by direct mail out to properties within 1km of the Proposed Scheme.

3.3.9 In the Fradley to Colton area a consultation event on the working draft EIA Report, working draft EQIA Report and on key design refinements was held at Kings Bromley Village Hall on 5 October 2016. HS2 Ltd staff and consultants attended the events, including engineers, environmental and property specialists, for members of the public to speak to.

3.3.10 An overview of how these responses have been taken into consideration in the ES is contained in the Working Draft Environmental Impact Assessment Report: Consultation Summary Report.

3.3.11 Engagement has also been undertaken with members of the community via the local parish councils and residents, as outlined in Table 4. Engagement with parish councils and residents has been used to understand local community concerns and issues in relation to the Proposed Scheme. Table 6 sets out meetings undertaken with community stakeholders in the Fradley to Colton area.

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Table 6: Meetings held with communities and community stakeholders

Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Alrewas Parish Council	To provide an update on the Proposed Scheme and discuss the working draft EIA, EQIA and Design Refinement Consultation documents and understand the local conditions and factors to inform scheme design and EIA	Understanding local conditions and factors to inform scheme design and EIA.
Abbots Bromley Parish Council		
Armitage with Handsacre Parish Council		
Colton Parish Council		
Fradley and Streethay Parish Council		
Hamstall Ridware Parish Council		
Mavesyn Ridware Parish Council		
Kings Bromley, Colton, and The Ridwares Community Group	To provide an update on the Proposed Scheme and understand the local conditions and factors to inform scheme design and EIA.	Understanding local conditions and factors to inform scheme design and EIA.
Rugeley School ³⁰		
Stockwell Heath residents		
Sir Henry Chadwick Primary School		

Directly affected individuals, landowners and businesses

- 3.3.12 Engagement was undertaken with landowners, whose operations, land and/or property will be directly affected by the Proposed Scheme whether permanently or temporarily. This included individual property and landowners, commercial and educational entities, and farmers and growers, including through the land and property consultation and ongoing dialogue.
- 3.3.13 Key commercial and educational landowners engaged within the Fradley to Colton area include: Conservation, Horticulture, Agriculture for the Disabled Society (CHADS); Blithbury Reindeer Lodge; and the Border Collie Trust. Ongoing dialogue continues with these stakeholders to understand their specific issues in relation to the Proposed Scheme.
- 3.3.14 Thirty-one visits were undertaken to farmers and growers in this area during the assessment and design development. Engagement was also carried out with key representatives of the farmers and growers' industry.
- 3.3.15 Key areas of focus for the engagement with landowners and their representatives were: the refinement of locations of balancing ponds, access roads and environmental mitigation; the design of access and accommodation bridges; and maintaining operational access to land and businesses.

³⁰ The facilities at Rugeley School also extend to the Mayfield Children's Home, the residential arm of the school, located in the Colwich to Yarlet area (CA2).

4 Agriculture, forestry and soils

4.1 Introduction

- 4.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and the likely impacts and significant effects of the construction and operation of the Proposed Scheme within the Fradley to Colton area. Consideration is given to the extent and quality of the soil and land resources underpinning the primary land use activities of farming and forestry, and the physical and operational characteristics of enterprises engaged in these activities. Consideration is also given to diversification associated with the primary land uses, and to related land-based enterprises, notably equestrian activities.
- 4.1.2 Engagement with farmers and landowners has been undertaken. The purpose of the engagement has been to obtain baseline information on the scale and nature of the farm and forestry operations and related farm-based uses, and to provide farmers and landowners with the opportunity to raise issues and discuss mitigation in relation to the Proposed Scheme. Engagement undertaken with farmers and landowners will be documented in a farm pack for each farm holding³¹.
- 4.1.3 Details of published and publicly available information used in the assessment, and the results of surveys undertaken within this area, are contained in Volume 5: Appendix AG-001-001 and shown on Map Series AG-01 (Agricultural Holdings), AG-02 (Soil Associations) and AG-04 (Agricultural Land Classification) (Volume 5: Agriculture, forestry and soils Map Book).
- 4.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.

4.2 Scope, assumptions and limitations

- 4.2.1 The assessment scope, key assumptions and limitations for the agriculture, forestry and soils assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)³², and the SMR Addendum³³.
- 4.2.2 The study area for the agriculture, forestry and soils assessment covers all land required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land, forestry land and soils, together with farm and rural holdings. The assessments of the impacts on agricultural land quality and forestry land are made with reference to the prevalence of best and most versatile (BMV) land and forestry land in the general locality, taken as a 4km corridor centred on the route of the Proposed Scheme.
- 4.2.3 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC)³⁴ system, which classifies agricultural land into

³¹ Part 3 of the HS2 Phase 2a Guide for Farmers and Growers, Available online at: www.gov.uk/hs2

³² Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

³³ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

³⁴ Ministry of Agriculture, Fisheries and Food (1988), Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land.

five grades from excellent quality Grade 1 land to very poor quality Grade 5 land. Grade 3 is subdivided into Subgrades 3a and 3b. The main issue in the assessment of the impacts on agricultural land is the extent to which land of BMV agricultural quality (Grades 1, 2 and 3a) is affected by the route of the Proposed Scheme.

- 4.2.4 Forestry is considered as a land use feature, and the impacts have been calculated quantitatively. The qualitative effects on forestry land and woodland are addressed principally in Section 8, Ecology and biodiversity, and Section 11, Landscape and visual.
- 4.2.5 Soil attributes, other than for food and biomass production, are identified in this section, but the resulting function or service provided is assessed in other sections, notably Section 7, Cultural heritage; Section 8, Ecology and biodiversity; Section 11, Landscape and visual; and Section 15, Water resources and flood risk. The function of soil as a carbon store is described in Volume 3: Route-wide effects (Section 4).
- 4.2.6 The main issue for farm holdings is disruption by the Proposed Scheme of the physical structure of agricultural holdings and the operations taking place upon them, during both construction and operational phases.
- 4.2.7 Common assumptions that have been used in assessing the effects of the Proposed Scheme are set out in Volume 1 (Section 8). These assumptions include the restoration of agricultural land that is required temporarily for construction to agricultural use, and the handing back of land used temporarily to the original landowner. It is also assumed that capital items demolished will not be replaced as replacement assets are not included in the Proposed Scheme and will ultimately be at the discretion of the landowner. In the majority of cases, the details of land use have been obtained from face-to-face interviews. Where this has not been possible, holding data has been obtained from publicly available sources.
- 4.2.8 In the case of those holdings that will be affected only by the 132kv power line from the grid supply point at Rugeley Power Station to Newlands Lane auto-transformer feeder station, the assumption has been made, for the purpose of this assessment, that all the land required temporarily for the Proposed Scheme will be used. However, this is a worst case assumption as it is likely that most of the land can remain in agricultural use. The land shown within the power line corridor will only be required for the erection of new pylons, the re-stringing of cables and to provide an access route to the works.

4.3 Environmental baseline

Existing baseline

- 4.3.1 This section sets out the main baseline features that influence the agricultural and forestry use of land within the Fradley to Colton area. These include the underlying soil resources that are used for food and biomass production, as well as providing other services and functions for society, and the associated pattern of agricultural and other rural land uses.

Soil and land resources

Geology and soil parent materials

- 4.3.2 A full description of the geological characteristics of the Fradley to Colton area is provided in Section 10, Land quality and Section 15, Water resources and flood risk, and shown on Map WR-02-201 (Volume 5: Water resources and flood risk Map Book). The bedrock geology mapped by the British Geological Survey (BGS)³⁵ mostly comprises the Mercia Mudstone Group, which consists of mudstone with subordinate siltstone, with some halite-bearing units and sandstone. The Helsby Formation of the Sherwood Sandstone Group is present at Rugeley and is aligned roughly south-east to north-west, and eastwards to Hill Ridware and Blithbury. The Helsby Formation comprises pebbly sandstone interbedded with siltstone and mudstone.
- 4.3.3 In the south of the study area, between Fradley and Rileyhill, the mudstone is overlain by Quaternary Glaciofluvial Sheet Deposits, which comprise elongated spreads of sand and gravel.
- 4.3.4 There are extensive River Terrace Deposits of sand and gravel over the mudstone within the Trent Valley, north-west of Rileyhill and continuing to the north-east of Hill Ridware. These deposits are dissected by watercourses with associated deposits of Alluvium, which are aligned east to west between Kings Bromley and Mavesyn Ridware. Alluvium is also present to the north of Curborough and west of Rileyhill associated with tributaries of the River Trent; and to the north-west of Colton on low-lying land associated with the Moreton Brook. The Alluvium deposits typically comprise consolidated silty clay, but may also contain silt, sand, peat and gravel. Superficial deposits of Glacial Till are present on higher land between Hamstall Ridware and Blithbury, and to the east of Colton. These deposits comprise unsorted material ranging in size from clay to boulders (hence, it is also commonly referred to as Boulder Clay).

Topography and drainage

- 4.3.5 The main topographical and drainage feature within this area is the River Trent and its valley and river terraces, with the River Blithe feeding into the River Trent from the north at Kings Bromley. The River Trent flows in a south-east direction through this area. Two flooded former gravel pits are located close to the confluence of the two rivers.
- 4.3.6 Between Fradley and Hill Ridware, the land is predominantly within the valley and terraces of the River Trent, with shallow gradients, at around 60-70m above Ordnance Datum (AOD). Between Hill Ridware and Colton the landform is characterised by a series of irregular outcrops and valleys, which feed into the River Trent to the west. Most of the land is characterised by moderate gradients, with some steeper land at Colton, reaching elevations of around 100m AOD. In the north of the study area, to the south of Admaston, altitudes within the Moreton Brook valley fall from 100m to 80m AOD.

³⁵ British Geological Survey (2017). Geology of Britain viewer. Available online at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

- 4.3.7 Within the study area, the land at greatest risk of flooding is between Rileyhill and Pipe Ridware, across the low-lying floodplain of the River Trent and also in association with the Bourne Brook. Most of the land at risk of flooding from these water courses is classified as Flood Zone 3, in which there is a 1 in 100 or greater annual probability of flooding. A relatively narrow strip of land to the west of Colton is also in Flood Zone 3, aligned roughly north-west to south-east in conjunction with the Moreton Brook.
- 4.3.8 Flood Zone 2 is defined as land having between a 1 in 100 and 1 in 1,000 annual probability of flooding by a river. Land immediately surrounding the flooded gravel pits at Kings Bromley is classified as Flood Zone 2, which is also mapped in conjunction with a small watercourse to the north-east of Handsacre. Further details are provided in Section 15, Water resources and flood risk.

Description and distribution of soil types

- 4.3.9 The characteristics of the soils are described by the Soil Survey of England and Wales³⁶ and shown on the National Soil Map³⁷. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5: Appendix AG-001-001 and their distribution is shown on Map AG-02-101 (Volume 5: Agriculture, forestry and soils Map Book).
- 4.3.10 There are three groups of soil associations mapped in this study area. The presence of each group has been confirmed by detailed soil survey data obtained from published survey records and surveys undertaken for the purpose of this assessment.
- 4.3.11 The first soil group comprises coarse-textured soils derived from the sandstones and from glaciofluvial drift and River Terrace Deposits. This group includes coarse loamy and sandy soil profiles of the Newport 1, Wick 1, Blackwood and Wigton Moor associations. The topsoil textures in these associations include loamy sand, sandy loam and sandy clay loam. Subsoil textures are similar, but also include sand. The Newport 1 and Wick 1 associations are freely drained, such that the profiles are affected by soil droughtiness³⁸, whereas the Blackwood and Wigton Moor associations are variably affected by groundwater and may be of Wetness Classes³⁹ (WC) III to IV.
- 4.3.12 Surveys undertaken at Fradley, Ravenshaw, Handsacre, Kings Bromley, Colton, Rugeley and to the south-east of Rugeley have identified soils of this first group developed primarily on the River Terrace Deposits that include medium sandy loam topsoils with moderately high stone contents over stony loamy sand, sand and sandy clay loam subsoils.
- 4.3.13 The second group of soil associations is developed in Triassic mudstone and siltstone, and comprises clay loam or sandy clay loam topsoils over clay loam or clay subsoils. This group includes the Salwick, Brockhurst 1, Flint and Salop associations, which have imperfectly to poorly drained soil profiles of WC III or IV. Profiles similar to Salwick,

³⁶ Soil Survey of England and Wales (1984), *Soils and their use in Midland and Western England*, Soil Survey of England and Wales, Bulletin No. 12, Harpenden.

³⁷ Cranfield University (2001), *The National Soil Map*.

³⁸ A measure of the likely moisture stress in a crop arising from the crop's requirement for water exceeding the available water capacity in the soil

³⁹ The Wetness Class of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six categories from WCI which is well drained to WCVI which is very poorly drained.

Brockhurst, and Flint soils have been identified in the detailed surveys undertaken around Colton and Stockwell Heath.

- 4.3.14 The third group is also developed in Triassic mudstone and siltstone, but comprises soil profiles that are clayey throughout, or comprise clay over Peat. This group includes the Fladbury 2, Middelney and Whimple 3 associations. These soils are found predominantly on floodplains and low lying land, and are typically of WC IV, although the Whimple 3 soils can occur on moderate slopes and are consequently slightly better drained.
- 4.3.15 Surveys at Kings Bromley and Colton identified heavy clay soils on riverine Alluvium, and black medium clay loam topsoils overlying malodorous, greenish grey clay subsoils. Soil profiles observed in the Trent Valley to the north-west of Alrewas comprised clay and clay loam, with humose clay loam at depth.

Soil and land use interactions

Agricultural land quality

- 4.3.16 The principal soil/land use interaction is the quality of the agricultural land resource. The ALC is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the study area.
- 4.3.17 The main soil properties that affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility.
- 4.3.18 Climate within this study area does not in itself place any limitation on agricultural land quality. However, the interactions of climate with soil characteristics are important in determining the wetness and droughtiness⁴⁰ limitations of the land.
- 4.3.19 The local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point dataset⁴¹ for three points within the area and are set out in Volume 5: Appendix AG-001-001. The data show climate in the area to be moderately cool and moderately moist. The number of Field Capacity Days (FCDs), when the soil moisture deficit⁴² is zero, ranges from 161 to 172 days per annum. This is higher than average for lowland England (150 days) and generally constrains agricultural cultivation and soil handling for relatively long periods over winter. Soil moisture deficits, which give an indication of the liability of soils to droughtiness in summer, are moderate.
- 4.3.20 Site factors include gradient and microrelief, which limit agricultural land quality in the north of this area, particularly around Colton, where slopes steeper than 7 degrees occur.
- 4.3.21 Flooding of low-lying land is a limitation to agricultural land quality in the south of the study area, particularly in the vicinity of Rileyhill, Kings Bromley and Handsacre where flood risk limits agricultural land quality to Subgrade 3b and Grade 4. Much of this land

⁴⁰ A measure of the likely moisture stress in a crop arising from the crop's requirement for water exceeding the available water capacity in the soil.

⁴¹ Meteorological Office (1989), *Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations*.

⁴² The moisture deficit is a crop-related meteorological variable which represents the balance between rainfall and potential evapotranspiration calculated over a critical portion of the growing season.

represents the floodplain of the River Trent and is classified as Flood Zone 3, relating to a greater than 1 in 100 annual probability of flooding. Further details are provided in Section 15, Water resources and flood risk.

- 4.3.22 The main physical limitations that result from interactions between soil, climate and site factors are soil wetness, soil droughtiness and a localised susceptibility to erosion. For soil wetness, each soil can be allocated a Wetness Class based on soil structure, evidence of waterlogging and the number of FCDs. The topsoil texture then determines its ALC grade. Soil droughtiness is determined by the soil textures and thickness of each soil horizon present, together with the crop moisture deficits.
- 4.3.23 The first group of soil associations, comprising well drained, coarse loamy and sandy soils (the Newport 1, Wick 1, Blackwood and Wigton Moor associations) is affected mostly by soil droughtiness, the severity of which is determined by factors such as stone content and depth to the sandstone bedrock.
- 4.3.24 The river terrace soils at Echills Farm, Kings Bromley have been classified mostly as Subgrade 3b due to soil droughtiness associated with a sandy and moderately to very stony subsoil encountered at shallow depth. Elsewhere at Kings Bromley and around Rugeley, the river terrace soils have been classified as mostly Subgrade 3a due to soil droughtiness, and those soils with higher sand and stone contents are classified as Subgrade 3b. Other profiles surveyed at Stockwell Heath contain permeable sandy clay loam or clay loam subsoils, which are moderately well drained (WC II) and these are classified as Grade 2.
- 4.3.25 Some coarse-textured soil profiles within this first group are affected by groundwater (particularly the Blackwood and Wigton Moor associations). The profiles identified during survey at Stockwell Heath have sandy clay loam or medium clay loam topsoils over coarse subsoils, but are often gleyed⁴³, indicating waterlogging of the subsoil. They are limited to Grade 2 on soil wetness and workability.
- 4.3.26 The second and third groups of soil associations are limited mostly by soil wetness. These comprise the medium clay loams and sandy clay loams over clay loams and clays in the Salwick, Brockhurst 1, Flint and Salop associations, and the clay soils in the Fladbury 2, Middelney and Whimple 3 associations. Imperfectly drained profiles of WC III with medium loamy topsoils are limited to Subgrade 3a (as shown by surveys at Colton and Stockwell Heath), whilst those with heavier loamy topsoils are limited to Subgrade 3b. All profiles of WC IV are limited to Subgrade 3b (as shown by surveys at Colton and Rugeley).
- 4.3.27 The heavy clay soils of the floodplain Alluvium on part of the land at Echills Farm, Kings Bromley have been classified as Grade 4 due to prolonged waterlogging and regular winter flooding. Other land in Flood Zone 3 around Kings Bromley is likely to be similarly limited by flood risk.
- 4.3.28 As set out in the SMR, the sensitivity of BMV land in the study area is determined relative to the abundance of such land in the area, set as a 4km corridor centred on the

⁴³ Conditions of poor aeration resulting in chemical reduction of iron and other elements and in grey colours and ochreous or rusty mottles, usually caused by poor or imperfect drainage.

route of the Proposed Scheme. Department for the Environment, Food and Rural Affairs (Defra) mapping⁴⁴ shows that there is a high likelihood of encountering BMV agricultural land in the locality, which makes such land a resource of low sensitivity in this study area.

- 4.3.29 The distribution of agricultural land quality in the study area is described in more detail in Volume 5: AG-001-001 and shown on Map AG-04-101 to Map AG-04-105a (Volume 5: Agriculture, forestry and soils Map Book).

Other soil interactions

- 4.3.30 Soil fulfils a number of functions and services for society in addition to those of food and biomass production, which are central to social, economic and environmental sustainability. These are outlined in sources such as the Soil Strategy for England⁴⁵ and the Government's White Paper, *The Natural Choice: securing the value of nature*⁴⁶, and include:

- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
- the support of ecological habitats, biodiversity and gene pools;
- support for the landscape;
- the protection of cultural heritage;
- the provision of raw materials; and
- the provision of a platform for human activities, such as construction and recreation.

- 4.3.31 Forestry resources represent a potentially multifunctional source of productive timber, landscape amenity, biodiversity and carbon storage capacity. An assessment of the value and sensitivity of woodland resources is reported in Section 8, Ecology and biodiversity.

- 4.3.32 The floodplains of the River Trent and its tributaries occupy land where water has to flow or be stored in times of flood, as set out in Section 15, Water resources and flood risk. The soils and floodplains in these areas function as water stores for flood attenuation, as well as providing ecological habitat.

Land use

Land use description

- 4.3.33 At the southern end of the study area, agricultural land is divided between large blocks of arable cropping and pasture, with pasture near the Bourne Brook and the River Trent used to graze dairy and beef cattle. Field-scale protected horticulture⁴⁷ is also a major land use in this area. On the rising land between Pipe Ridware and

⁴⁴ Defra (2005), Likelihood of Best and Most Versatile Agricultural Land.

⁴⁵ Defra (2009), *Soil Strategy for England*.

⁴⁶ HM Government (2011), *The Natural Choice: securing the value of nature*.

⁴⁷ Protected horticulture refers to cultivating fruit and vegetables in a sheltered or enclosed environment to improve plant growth; on a field-scale, this protection is normally provided by open-sided (Spanish) polytunnels.

Blithbury the land is used almost exclusively for arable agriculture, including combinable crops and potatoes. Between Blithbury and Moreton Brook, the land is predominantly in grassland and used mostly for dairying and cattle rearing.

- 4.3.34 Most of the fields in the Fradley to Colton area are large, reflecting larger scale arable agriculture. However, in the vicinity of Stockwell Heath there is a much smaller field pattern reflecting the low intensity of agriculture and other rural land uses.
- 4.3.35 Woodland is sparse within the area, and found mainly in the south, around and to the north of Lichfield where woodland blocks include Brokendown Wood, Ravenshaw Wood and Rice's Spinney. Further north, the woodlands are generally smaller and include Tomlinson's Spinney, Hurst Wood and Hurst Wood Pit. A full description of woodland in the Fradley to Colton area is set out in Section 8, Ecology and biodiversity.
- 4.3.36 The proportion of woodland as a land use in the general locality, taken as a 4km corridor centred on the route of the Proposed Scheme, is relatively low at 5.6% compared to the national average of 10%, such that woodland as a land use is a resource of high sensitivity in this study area.
- 4.3.37 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone, where statutory land management measures apply that seek to reduce nitrogen losses from agricultural sources to water.
- 4.3.38 Some agricultural land is also subject to agri-environment management prescriptions that seek to retain and enhance the landscape and biodiversity qualities and features of farmland. These are associated with the Environmental Stewardship Scheme (the Entry Level Scheme (ELS) or Higher Level Scheme (HLS)), or the Countryside Stewardship Scheme (CSS), which from 2015 is the main agri-environment scheme in England. The CSS incorporates elements of Environmental Stewardship, the English Woodlands Grant scheme and Catchment Sensitive Farming grants.
- 4.3.39 Most Environmental Stewardship agreements, which were extensive and covered approximately 70% of agricultural land in England, have now ended, although existing agreements will run their course. The CSS is more focused than Environmental Stewardship, with applications for funding being competitive and the area covered by the scheme less than that covered under Environmental Stewardship. Holdings that have land entered into an agri-environment scheme are identified in Table 7.

Number, type and size of holdings

- 4.3.40 Table 7 sets out the main farm holdings within this study area.
- 4.3.41 The arable and mixed holdings range from 15ha to almost 1,700ha. Generally, the arable holdings are approximately 100ha, with the mixed farms being larger at approximately 200ha to 450ha, although two holdings each farm over 1,600ha, mostly in arable production. The mixed holdings usually combine arable agriculture with dairy or beef production, often with the harvested grains used on-farm for cattle feed.
- 4.3.42 There are 11 dairy farms in the area, with herds generally being small to medium scale. Four of the dairy farms, with the smallest herds, are tenanted farms on land owned by Staffordshire County Council (SCC). There is one organic dairy farm producing all of its

own feed. Six holdings are dedicated beef farms, all of which farm an area of approximately 50ha or less. Twenty-one holdings in the area are 5ha or less and are generally in equestrian or grassland uses. The boundaries of the holdings are shown on Maps AG-01-101 to AG-01-105a (Volume 5: Agriculture, forestry and soils Map Book) along with the location of the main farm buildings. Field drainage is common throughout the study area.

- 4.3.43 Table 7 also sets out the sensitivity of individual holdings to change. This is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can better absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Non-commercial land uses and units, such as pony paddocks associated with residential properties, have a low sensitivity. The holding reference provides a unique identifier and relates to Maps AG-01-101 to AG-01-105a (Volume 5: Agriculture, forestry and soils Map Book) and Volume 5: Appendix AG-001-001.

Table 7: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA1/1 Land farmed by J T L Estate (CFA22/10)†	Arable, pigs, beef cattle and sheep	1,620	Commercial property, shipping containers, equipment scrappage contracts	None	Medium
CA1/2 Woodend Farm (CFA22/11)†	Arable	97	Residential let, forestry operations, floristry	None	Medium
CA1/3* Alrewas Hayes Farm	Arable	15	Wedding and event venue	ELS	Medium
CA1/4 Common Farm	Arable	101	Commercial forestry (Rice's Spinney), Bed and Breakfast, buildings let for office and retail uses	None	Medium
CA1/5 Common Lane Farm (CFA22/19)†	Dairy and beef cattle	385	Commercial, industrial and residential lets	None	Medium (affected land not part of grazing block)
CA1/6 Barn Farm	Beef cattle	43	None	None	Medium
CA1/7* Land at Common Lane	Grassland	1	Not known	None	Low

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA1/8* Land east of A515 Lichfield Road	Grassland	1	Not known	None	Low
CA1/9* Woodshoot Nurseries	Horticulture	32	Not known	None	High
CA1/10* Longcroft Farm	Dairy and arable	49	Not known	ELS	Medium
CA1/11* Land at New Buildings Farm (Kings Bromley)	Arable and grassland	5	Commercial and industrial lets	None	Medium
CA1/12 Hunts Farm (CFA22/17)†	Mixed arable and livestock	32	None	HLS and ELS	Medium
CA1/13 Tuppenhurst Farm (CFA22/21)†	Arable	304	Agricultural contracting	ELS	Medium
CA1/14 Shaw Lane Farm	Let grassland	5	Industrial lets	None	Low
CA1/15 Echills Farm	Arable	160	Birdseed producer, DIY livery	None	Medium
CA1/16 Trentside Meadows	Beef cattle	39	Care farm, nature conservation	ELS and HLS	Medium
CA1/17* Bromley Lane Farm	Let grassland	15	Not known	None	Low
CA1/18 Pipe Hall Farm	Dairy, arable, beef cattle	405	None	ELS	High
CA1/19* Land at Littleton House Farm	Grassland	1	Not known	None	Low
CA1/20 Church Farm	Beef cattle	12	None	None	Medium
CA1/21 Woodhouse Farm	Arable, potatoes (irrigated), beef cattle, sheep	1,680	Potato marketing companies, agricultural chemical and fertiliser supplier	HLS	Medium

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA1/22* Land at Luthbur	Equestrian (non-commercial)	1	Not known	None	Low
CA1/23* Land at Pipe Lane	Grassland	1.5	Not known	None	Low
CA1/24 Blythe House Farm	Arable	49	Caravan site/rallies, 16 commercial units, on-farm shoot	HLS	Medium
CA1/25 Quinton's Orchard Farm	Arable, beef cattle, sheep, equestrian, fishery	316	Shoot, forestry plantation	ELS and HLS	Medium
CA1/26 Bentley Hall Farm	Arable	134	On-farm shoot	Mid-tier Countryside Stewardship	Medium
CA1/27 Manor Farm, Blithbury	Dairy, arable, beef cattle (organic)	225	None	Organic Countryside Stewardship	High
CA1/28 Blithbury Reindeer Lodge	Reindeer, sheep, donkeys, goats	12	Christmas attraction, animal hire for film and TV, café and shop, reindeer workshops	None	High
CA1/29* Land south of Blithbury Road	Grassland	3	Not known	None	Low
CA1/30 Land east of Hadley Gate Lane	Equestrian (non-commercial)	4	None	None	Low
CA1/31 Hadley Gate Field Farm	Pigs and arable	33	Public weighbridge	None	Medium
CA1/32 Stoneyford	Let grassland	9	None	None	Low
CA1/33* Hadley Gate Farm	Grassland	2	Not known	None	Low
CA1/34 Blackflatts Farm	Dairy and arable	84	None	ELS	High
CA1/35* Land at Hadley Gate Cottage	Equestrian (non-commercial)	1	Not known	None	Low
CA1/36	Dairy	17	None	None	High

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
Holding No. 6 - Old Wood Estate					
CA1/37 Hurstwood Farm	Dairy and sheep	27	None	None	High
CA1/38 Town End Farm	Dairy, beef cattle and sheep (accommodation land only)	324	On-farm shoot	ELS	Medium
CA1/39* Holding No. 8 - Old Wood Farm	Dairy (accommodation land only)	21	Not known	ELS	Medium
CA1/40* Land north of Hollow Lane	Grassland	2.3	Not known	None	Low
CA1/41* Land at Bank Top Farm	Grassland	1	Not known	None	Low
CA1/42* Hurst Wood Meadow	Equestrian (non-commercial)	0.3	Not known	None	Low
CA1/43* Holding No. 2 - Old Wood Farm	Dairy	38	Not known	ELS	High
CA1/44* Land at New Barn	Grassland, equestrian (non-commercial)	6	Fishery	None	Low
CA1/45 Cawarden Springs Farm	Arable	121	Reclaimed building materials suppliers, industrial lets	HLS	Medium
CA1/46* Land south of Longley Lane	Grassland	1	Not known	None	Low
CA1/47 Crab Tree Farm	Beef cattle	36	Arboricultural contractors, biomass for energy production, plank manufacture	None	Low
CA1/48 Little Strongbrook Farm	Sheep	4	None	None	Low
CA1/49 Border Collie Trust (GB)	Grassland	2	Dog kennels	None	Medium
CA1/50* Land at Hamley Fields	Equestrian (non-commercial)	1	Not known	None	Low

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA1/51* Land at Stockwell Heath	Equestrian (non-commercial) and grassland	4	Not known	None	Low
CA1/52 Land at Rose Cottage	Grassland	1	Agricultural contracting	None	Low
CA1/53 Lea Hall Farm	Beef cattle and arable	182	Farm shoot run by a third party, farm cottage rented out	ELS	Medium
CA1/54 Hamley House Farm	Sheep	16	Barn conversion underway	None	Medium
CA1/55 Little Dunstal Farm	Dairy and sheep	87	Caravan site/rallies	Mid-tier Countryside Stewardship	Medium (affected land not part of grazing block)
CA1/56* Hamley Cottage Farm	Beef and sheep	20	Not known	None	Medium
CA1/57* Land at Jonghams Lane	Grassland	2	Not known	None	Low
CA1/58 Lount Farm	Beef cattle	52	None	ELS, HLS and WGS	Medium
CA1/59 Oakfields Farm	Arable, beef cattle and sheep	113	None	None	Medium
CA1/60* Hanch Hall Farm	Beef cattle	40	Not known	None	Medium

* No Farm Impact Assessment interview conducted; data estimated.

† High Speed Rail (London – West Midlands) Supplementary Environmental Statement and Additional Provision 2 Environmental Statement Volume 2: Community Forum Area report CFA22, Whittington to Handsacre.

Future baseline

Construction (2020)

- 4.3.44 Volume 5: Appendix CT-004-000 provides details of committed developments that are assumed to have been implemented by 2020.
- 4.3.45 HS2 Phase One will be under construction by 2020, which will alter the future baseline conditions for the Proposed Scheme. This has the potential to affect agricultural, forestry and soils receptors that fall within study area of the Proposed Scheme. This is considered in the cumulative assessment of the construction phase of the Proposed Scheme.
- 4.3.46 No committed developments, in addition to HS2 Phase One, have been identified in this study area that will materially alter the baseline conditions in 2020 for agriculture, forestry and soils.

Operation (2027)

- 4.3.47 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.
- 4.3.48 No further committed developments have been identified in this study area that will materially alter the baseline conditions in 2027 for agriculture, forestry and soils.

4.4 Effects arising during construction

Avoidance and mitigation measures

- 4.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate adverse impacts on agriculture, forestry or soils:
- agricultural access provided to severed land farmed by J T L Estate (CA1/1) at the southern end on the Pyford South embankment by joint use of the balancing pond access track;
 - agricultural access provided for Common Lane Farm (CA1/5) and Barn Farm (CA1/6) from the track at the northern end of the Pyford North embankment;
 - replacement agricultural access track provided to Echills Farm (CA1/15) from the realigned Shaw Lane;
 - agricultural crossing incorporated into Mavesyn Ridware Footpath 38 accommodation overbridge to replace existing access to Quinton's Orchard Farm (CA1/25);
 - agricultural access track provided from the retained section of B5014 Uttoxeter Road to severed land at Bentley Hall Farm (CA1/26);
 - agricultural access available to the severed grazing block for Manor Farm (CA1/27) via Manor Farm overbridge;
 - agricultural crossing incorporated into Colton Footpath 34 to access severed land at Town End Farm (CA1/38);
 - access track provided from B5013 Uttoxeter Road re-alignment to severed land at Hamley House Farm (CA1/54); and
 - access track provided at the northern and southern ends of Moreton Brook viaduct for use by Lea Hall Farm (CA1/53) and Land at Lount Farm (CA1/58).
- 4.4.2 The effect of severance of agricultural land for various holdings is also reduced by the ability of agricultural machinery to pass under the Pyford Brook, Kings Bromley, River Trent and Moreton Brook viaducts.
- 4.4.3 Other design refinements to reduce the impact of the Proposed Scheme on agriculture, forestry and soil resources have included:
- rationalisation of balancing ponds to seek to locate them in least sensitive agricultural locations;
 - locally slackened or steepened slopes to improve agricultural land use;

- rationalisation of road realignments to reduce the area of agricultural land required;
- incorporation of agricultural tracks to gain access to severed land; and
- rationalisation and relocation of mitigation planting to reduce the area of agricultural land required and reduce impacts on holdings.

4.4.4 In addition, there is a need to avoid or reduce environmental impacts to soils during construction. Soil resources from the areas required temporarily and permanently for the Proposed Scheme will be stripped and stored. This will enable agricultural land that is required temporarily for construction to be returned to agricultural use. It will also enable soils to be returned to other uses, such as to support landscape planting and biodiversity, and to a suitable condition whereby they will be able to fulfil the identified function.

4.4.5 Compliance with the Code of Construction Practice (CoCP) will avoid or reduce environmental impacts during construction. Those measures that are particularly relevant to agriculture, forestry and soils are set out in the draft CoCP⁴⁸ and relate to:

- the reinstatement of agricultural land that is used temporarily during construction to agriculture, where this is the agreed end use (Section 6);
- the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (Section 6);
- a requirement for contractors to monitor and manage flood risk and other extreme weather events, insofar as reasonably practicable, that may affect agriculture, forestry and soil resources during construction (Sections 5 and 16);
- arrangements for the maintenance of farm and field accesses affected by construction (Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (Sections 5, 6, 9 and 12);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (Section 7);
- the control of invasive and non-native species; and the prevention of the spread of weeds generally from the construction site to adjacent agricultural land (Section 9);

⁴⁸ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- the adoption of measures to prevent, insofar as reasonably practicable, the spread of soil-borne, tree, crop and animal diseases from the construction area (Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate (Sections 5 and 6).

4.4.6 Upon completion of construction, soils replaced for agricultural, forestry or landscape uses will be monitored to identify any unsatisfactory growing conditions during the five-year aftercare period.

4.4.7 Where agricultural uses are to be resumed on land disturbed during the construction of the Proposed Scheme, the design objective is to avoid any reduction in long term capability, which would downgrade the quality of the disturbed land, through the adoption of good practice techniques in handling, storing and reinstating soils on that land. This will include the separate storage of soils from land occupied by certified organic farms. Land with heavier textured soils (such as the Fladbury 2, Middelney and Whimple 3 association soils) may also require particularly careful management, such as the timing of cultivation and livestock grazing, during the aftercare period to ensure this outcome.

Assessment of impacts and effects

4.4.8 The acquisition and use of land for the Proposed Scheme will interfere with existing uses of that land and, in some locations, preclude existing land uses or sever and fragment individual fields and operational units of agricultural and forestry land. This could result in potential effects associated with the ability of affected agricultural interests to access and effectively use residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure such as drainage. The Proposed Scheme seeks to reduce this disruption and, where appropriate and reasonably practicable, incorporate inaccessible severed land as part of environmental mitigation works.

4.4.9 Land used to construct the Proposed Scheme will fall into the following main categories when work is complete:

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with aftercare management to ensure stabilisation of the soil structure);
- used for drainage or replacement floodplain storage areas, which may also retain some agricultural use; or
- used for ecological and/or landscape mitigation.

Temporary effects during construction

Impacts on agricultural land

4.4.10 During the construction phase, the total area of agricultural land used within the Fradley to Colton area will be approximately 585ha as shown in Table 8. Of this total, it is anticipated that approximately 402ha will be restored and available for agricultural use following construction.

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Table 8: Agricultural land required for the construction of the Proposed Scheme

Agricultural land quality	Area required (ha)	Percentage of agricultural land (%)	Area to be restored (ha)
Grade 1	0	0	0
Grade 2	104.0	17.8	70.8
Subgrade 3a	263.5	45.1	164.5
BMV subtotal	367.5	62.9	235.3
Subgrade 3b	212.8	36.4	165.4
Grade 4	4.3	0.7	0.9
Grade 5	0	0	0
Total agricultural land	584.6	100	401.6

4.4.11 The disturbance during construction to 368ha of BMV land is assessed as an impact of high magnitude, comprising 63% of the agricultural land requirement. BMV land is assessed as a receptor of low sensitivity because of its relevant abundance in this area. The effect of the Proposed Scheme on BMV land during the construction phase is therefore assessed as moderate adverse, which is significant.

4.4.12 Following completion of construction, temporary facilities will be removed and the topsoil and subsoil reinstated in accordance with the agreed end use for the land. Some permanently displaced soils may be used to restore land to agriculture or other uses with slightly deeper topsoil and subsoil layers, where appropriate. This could improve the quality of agricultural land locally, for example where droughty soils are limited by soil depth, subject to the soil resource plans to be prepared during the detailed design stage.

Nature of the soil to be disturbed

4.4.13 The sensitivity of the soils disturbed by construction activity reflects their textural characteristics, in the light of local rainfall conditions, as set out in the SMR. In areas of heaviest rainfall, and during the wettest times of the year, soils with high clay and silt fractions are most susceptible to the effects of handling during construction and the re-instatement of land; whereas soils with a high sand fraction in areas of lowest rainfall and during the driest times of the year are the least susceptible.

4.4.14 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils⁴⁹. These principles will be followed throughout the construction period.

4.4.15 The clayey and seasonally waterlogged Fladbury 2, Midelney and Whimple 3 associations are least able to remain structurally stable if moved in wet conditions or by inappropriate equipment. They are susceptible to compaction and smearing, which

⁴⁹ Defra (2009), *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.

could affect successful reinstatement. Implementation of the measures set out in the draft CoCP will ensure the magnitude of impact on soil will be low and the significance of the effect will be negligible and not significant.

- 4.4.16 The disturbance of peat soils has implications for carbon emissions and biodiversity. The Proposed Scheme seeks to reduce disturbance of any deep peat soils insofar as reasonably practicable. Where disturbance cannot be avoided, the peat soils will be handled with particular care to avoid compaction when wet and wind erosion when the soils are dry. When reinstated, opportunities will be taken to use peat soils to create habitats, enhance biodiversity and build carbon reserves.
- 4.4.17 The four borrow pits within the Fradley to Colton area will require land at Woodend Farm (CA1/2), Common Farm (CA1/4), Common Lane Farm (CA1/5), Barn Farm (CA1/6), Echills Farm (CA1/15) and Pipe Hall Farm (CA1/18). The borrow pits will be used to extract material that is suitable for engineering purposes, from beneath the topsoil and subsoil (i.e. the whole soil profile). It is anticipated that borrow pits will be restored with materials generated from construction of the Proposed Scheme, typically clay, which does not have suitable characteristics for use as construction or engineering fill.
- 4.4.18 The existing soil survey data indicates that the entire agricultural soil profile (i.e. the topsoil and subsoil) is likely to be available for agricultural restoration so that agricultural soils can be returned to the same condition as their pre-excavated state, as good practice techniques will be used to handle, store and reinstate soils. Given the permeable nature of the existing material beneath the agricultural soil profile, agricultural land drainage works will be required when restoring the borrow pits to achieve this condition and to ensure ongoing agricultural management of the restored land.

Impacts on holdings

- 4.4.19 Land may be required for the Proposed Scheme from holdings temporarily, during the construction period, or permanently. In most cases, the temporary and permanent land requirement will occur simultaneously at the start of the construction period and it is the combined effect of both that will have the most impact on the holding. During the construction period, some agricultural land will be restored and the impact on individual holdings will reduce.
- 4.4.20 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 9. This table shows the total area of land required from a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that could be returned to the holding following the construction period. The degree of impact is based on the proportion of the holding required rather than the absolute area of land.
- 4.4.21 The effects of severance during construction are judged on the ease and availability of access to severed land. With the implementation of the measures set out in the draft CoCP, these will generally be the same during and post construction. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Impacts on residential properties on farm holdings are assessed, as required, in Section 5, Air quality, Section 6, Community;

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and Section 13, Sound, noise and vibration. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-001.

- 4.4.22 Quinton's Orchard Farm (CA1/25) includes land affected by the Proposed Scheme in both the Fradley to Colton area and the Colwich to Yarlet area (CA2). As the main farm buildings are located in the Fradley to Colton area, the assessment of impacts and effects is presented in this report.
- 4.4.23 Upper Moreton Farm (CA2/1) and Moreton Farm (CA2/2) also include land affected by the Proposed Scheme in both the Fradley to Colton area and the Colwich to Yarlet area. As the main farm buildings are located in the Colwich to Yarlet area, the assessment of impacts on those holdings are reported in Volume 2: Community area 2, Colwich to Yarlet.

Table 9: Summary of effects on holdings during construction

Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA1/1 Land farmed by JTL Estate Medium sensitivity	19.2ha (1%) Negligible	Low	Low	Minor adverse	14.2ha
CA1/2 Woodend Farm Medium sensitivity	33.1ha (34%) High	Medium	Negligible	Major/moderate adverse due to the proportion of the farm required	16.5ha (10.3ha restored borrow pit)
CA1/3 Alrewas Hayes Farm Medium sensitivity	1.4ha (9%) Low	Negligible	Medium	Moderate adverse due to the disturbance on wedding venue	0.8ha
CA1/4 Common Farm Medium sensitivity	30.6ha (30%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the farm required	26.3ha (12ha restored borrow pit)
CA1/5 Common Lane Farm Medium sensitivity	41.8ha (11%) Medium	Medium	Medium	Moderate adverse due to the proportion of the farm required, severance and disruption during construction	36.7ha (13ha restored borrow pit)
CA1/6 Barn Farm Medium sensitivity	19.4ha (45%) High	Medium	Medium	Major/moderate adverse due to the proportion of the farm required	13.6ha (6.7ha restored borrow pit)
CA1/7 Land at Common Lane	0.1ha (10%) Low	Negligible	Negligible	Negligible	0.1ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
Low sensitivity					
CA1/8 Land east of A515 Lichfield Road Low sensitivity	0.1ha (10%) Low	Negligible	Negligible	Negligible	0.1ha
CA1/9 Woodshoot Nurseries High sensitivity	3.5ha (11%) Medium	Negligible	Negligible	Major/moderate adverse due to the proportion of the farm required	3.5ha
CA1/10 Longcroft Farm Medium sensitivity	4.1ha (8%) Low	Negligible	Negligible	Minor adverse	4.1ha
CA1/11 Land at New Buildings Farm (Kings Bromley) Medium sensitivity	2.5ha (49%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the farm required	2.5ha
CA1/12 Hunts Farm Medium sensitivity	8.7ha (27%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the farm required	8.7ha
CA1/13 Tuppenhurst Farm Medium sensitivity	2.0ha (1%) Negligible	Negligible	Negligible	Negligible	2.0ha
CA1/14 Shaw Lane Farm Low sensitivity	2.2ha (44%) High	High	Negligible	Moderate adverse due to the proportion of the farm required and severance during construction	1.3ha
CA1/15 Echills Farm Medium sensitivity	49.4ha (31%) High	Low	Medium	Major/moderate adverse due to the proportion of the farm required	35.9ha (19.4ha restored borrow pit)
CA1/16 Trentside Meadows Medium sensitivity	4.1ha (11%) Medium	Low	Medium	Moderate adverse due to the proportion of the farm required and disruption during construction	3.4ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA1/17 Bromley Lane Farm Low sensitivity	14.1ha (94%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	14.1ha
CA1/18 Pipe Hall Farm High sensitivity	57.3ha (14%) Medium	Low	Medium	Major/moderate adverse due to proportion of the farm required and disruption during construction	50.3ha (20ha restored borrow pit)
CA1/19 Land at Littleton House Farm Low sensitivity	0.1ha (10%) Low	Negligible	Negligible	Negligible	0.1ha
CA1/20 Church Farm Medium sensitivity	3.1ha (25%) High	High	Medium	Major/moderate adverse due to the proportion of the farm required and severance during construction	0.7ha
CA1/21 Woodhouse Farm Medium sensitivity	20.4ha (1%) Negligible	Medium	High	Major/moderate adverse due to disruption during construction	9.4ha
CA1/22 Land at Luthbur Low sensitivity	0.1ha (10%) Low	Negligible	Negligible	Negligible	0.1ha
CA1/23 Land at Pipe Lane Low sensitivity	1.5ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	1.4ha
CA1/24 Blythe House Farm Medium sensitivity	7.8ha (16%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	5.7ha
CA1/25 Quinton's Orchard Farm Medium sensitivity	14.6ha (5%) Negligible	Low	Medium	Moderate adverse due to disruption during construction	5.8ha
CA1/26 Bentley Hall Farm Medium sensitivity	12.0ha (9%) Low	High	Negligible	Major/moderate adverse due to severance during construction	6.2ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA1/27 Manor Farm, Blithbury High sensitivity	44.1ha (20%) Medium	High	Medium	Major adverse due to severance during construction	16.2ha
CA1/28 Blithbury Reindeer Lodge High sensitivity	1.0ha (8%) Low	Negligible	Low	Moderate adverse due to the proportion of the farm required and disruption during construction	0.1ha
CA1/29 Land south of Blithbury Road Low sensitivity	2.5ha (82%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.2ha
CA1/30 Land east of Hadley Gate Lane Low sensitivity	2.6ha (66%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	1.6ha
CA1/31 Hadley Gate Field Farm Medium sensitivity	2.5ha (8%) Low	Medium	Low	Moderate adverse due to severance during construction	0.2ha
CA1/32 Stoneyford Low sensitivity	7.9ha (88%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.1ha
CA1/33 Hadley Gate Farm Low sensitivity	0.2ha (11%) Medium	Negligible	Negligible	Minor adverse	0ha
CA1/34 Blackflatts Farm High sensitivity	7.3ha (9%) Low	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	6.4ha
CA1/35 Land at Hadley Gate Cottage Low sensitivity	0.1ha (10%) Low	Negligible	Negligible	Negligible	0.1ha
CA1/36 Holding No. 6 - Old Wood Estate High sensitivity	1.4ha (8%) Low	Medium	Negligible	Major/moderate adverse due to severance during construction	0.4ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA1/37 Hurstwood Farm High sensitivity	9.7ha (36%) High	Negligible	Negligible	Major adverse due to the proportion of the farm required	6.7ha
CA1/38 Town End Farm Medium sensitivity	28.0ha (9%) Low	High	Low	Major/moderate adverse due to severance during construction	14.0ha
CA1/39† Holding No. 8 - Old Wood Farm Medium sensitivity	4.4ha (21%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the farm required	2.8ha
CA1/40† Land north of Hollow Lane Low sensitivity	2.3ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	2.2ha
CA1/41† Land at Bank Top Farm Low sensitivity	0.3ha (30%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.3ha
CA1/42† Hurst Wood Meadow Low sensitivity	0.3ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.3ha
CA1/43† Holding No. 2 - Old Wood Farm High sensitivity	12.3ha (32%) High	Negligible	Negligible	Major adverse due to the proportion of the farm required	10.6ha
CA1/44† Land at New Barn Low sensitivity	0.7ha (10%) Low	Negligible	Negligible	Negligible	0.7ha
CA1/45† Cawarden Springs Farm Medium sensitivity	21.0ha (17%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	19.4ha
CA1/46 Land south of Longley Lane Low sensitivity	0.3ha (30%) High	High	Negligible	Moderate adverse due to the proportion of the farm required and severance during construction	0.2ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA1/47 Crab Tree Farm Low sensitivity	3.3ha (9%) Low	Negligible	Low	Negligible	0ha
CA1/48 Little Strongbrook Farm Low sensitivity	0.7ha (18%) Medium	Negligible	Negligible	Minor adverse	0.2ha
CA1/49 Border Collie Trust (GB) Medium sensitivity	0.7ha (33%) High	Negligible	Medium	Major/moderate adverse due to the proportion the of the holding required	0.5ha
CA1/50 Land at Hamley Fields Low sensitivity	0.3ha (30%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.1ha
CA1/51 Land at Stockwell Heath Low sensitivity	3.6ha (89%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0ha
CA1/52 Land at Rose Cottage Low sensitivity	1.0ha (96%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	0.6ha
CA1/53 Lea Hall Farm Medium sensitivity	44.7ha (25%) High	Medium	Low	Major/moderate adverse due to the proportion of the farm required	28.0ha
CA1/54 Hamley House Farm Medium sensitivity	5.0ha (31%) High	High	Low	Major/moderate adverse due to the proportion of the farm required and severance during construction	3.3ha
CA1/55 Little Dunstal Farm Medium sensitivity	3.9ha (5%) Negligible	High	Negligible	Major/moderate adverse due to severance during construction	1.0ha
CA1/56 Hamley Cottage Farm	0.9ha (5%) Negligible	Negligible	Negligible	Negligible	0.8ha

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Holding reference / name / sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
Medium sensitivity					
CA1/57 Land at Jonghams Lane Low sensitivity	1.0ha (50%) High	Low	Negligible	Moderate adverse due to the proportion of the farm required	1.0ha
CA1/58 Lount Farm Medium sensitivity	14.8ha (29%) High	Medium	Low	Major/moderate adverse due to the proportion of the farm required	5.7ha
CA1/59 Oakfields Farm Medium sensitivity	1.1ha (1%) Negligible	Negligible	Negligible	Negligible	1.1ha
CA1/60 Hanch Hall Farm Medium sensitivity	2.0ha (5%) Negligible	Negligible	Negligible	Negligible	2.0ha

†Holding affected by the proposed 132kV power line from the grid supply point at Rugeley Power Station to Newlands Lane auto-transformer feeder station only.

- 4.4.24 Overall, 60 holdings in the Fradley to Colton area will be affected during construction, of which 45 will experience moderate, major/moderate or major adverse effects, which are significant.
- 4.4.25 The temporary construction effect on Manor Farm, Blithbury (CA1/27) is assessed as major adverse due to the severance of the dairy grazing block of land and other parcels during construction. In addition, a high proportion of land that is used to grow organic forage for the milking herd will be required temporarily from the holding. As organic forage cannot easily be purchased, the effect on the holding associated with the loss of land is compounded.
- 4.4.26 Two other holdings: Hurstwood Farm (CA1/37) and Holding No.2 - Old Wood Farm (CA1/43) will also experience a major adverse effect during construction due to the proportion of land that is required temporarily. However, Holding No.2 - Old Wood Farm will only be affected by works required for the 132kv power line between Rugeley and the Newlands Lane auto-transformer station.
- 4.4.27 Nineteen holdings will experience major/moderate adverse effects during construction, principally due to the proportion of land required or severance of agricultural land. In general terms, agricultural severance has been limited through the use of small severed areas of land required for the Proposed Scheme and environmental mitigation.
- 4.4.28 Woodhouse Farm (CA1/21) will experience major/moderate adverse disruptive effects during construction as it is likely to have substantial disturbance to its regular potato and grain HGV deliveries.

- 4.4.29 Generally, the highest proportions of land required are from the smallest holdings. Land will be required from the entirety of the holdings at Bromley Lane Farm (CA1/17), Land at Pipe Lane (CA1/23), Stoneyford (CA1/32), Land north of Hollow Lane (CA1/40), Hurst Wood Meadow (CA1/42), Land at Stockwell Heath (CA1/51) and Land at Rose Cottage (CA1/52).

Permanent effects of construction

Impacts on agricultural land

- 4.4.30 Following construction and restoration, the area of agricultural land that will remain permanently required will be approximately 183ha, as shown in Table 10.

Table 10: Agricultural land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land (%)
Grade 1	0	0
Grade 2	33.2	18
Subgrade 3a	99	54
BMV subtotal	132.2	72
Subgrade 3b	47	26
Grade 4	3.4	2
Grade 5	0	0
Total agricultural land	182.6	100

- 4.4.31 Of this total requirement, approximately 55.7ha (31%) will comprise newly planted woodlands for visual screening and habitat creation to mitigate environmental effects arising from the Proposed Scheme, as set out in Section 8, Ecology and biodiversity and Section 11, Landscape and visual.
- 4.4.32 A total area of approximately 5.2ha of agricultural land shown on CT-06-201, CT-06-203, CT-06-204-L1 and CT-06-209 (Volume 2: CA1 Map Book) will be engineered to provide replacement floodplain storage. Some of this is BMV land and could be subject to marginal downgrading in agricultural land quality. This assessment assumes that this land will return to agricultural use.
- 4.4.33 The permanent requirement for approximately 132ha of BMV land within the Fradley to Colton area is assessed as an impact of high magnitude, comprising 72% of the overall agricultural land requirement. BMV land is assessed as a receptor of low sensitivity because of its relative abundance in this area. The permanent effect on BMV land is therefore assessed as moderate adverse, which is significant.

Impacts on forestry land

- 4.4.34 The total area of woodland required in the Fradley to Colton area as a result of the Proposed Scheme will be approximately 19.7ha, as set out in Section 8, Ecology and biodiversity, out of a total permanent land requirement (including non-agricultural land) of approximately 199ha (10%). This requirement is mainly from woodlands at Brokendown Wood, Woodend Farm and Tomlinson's Spinney. However, there is no

indication that this land is managed as commercial forestry, and therefore the impacts on these resources are reported in Section 8, Ecology and biodiversity.

- 4.4.35 The permanent requirement for woodland is assessed as an impact of medium magnitude in land use terms. As the extent of woodland in the area is less than the average national woodland cover (10%), the effect on forestry land is assessed as significant in quantitative terms and in terms of the agriculture, forestry and soils assessment. The qualitative assessment of loss of native woodland is addressed in Section 8, Ecology and biodiversity.

Impacts on holdings

- 4.4.36 The permanent effects from the construction of the Proposed Scheme on individual agricultural and related interests are summarised in Table 11. The land required column refers to the area of land required to operate the Proposed Scheme in absolute terms and as a percentage of the overall area farmed. The scale of effect is based on the likely proportion of land required from the holding. The effects of severance are judged on the ease and availability of access to severed land once construction is completed. The impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises. Full details of the nature and scale of effects are set out in Volume 5: Appendix AG-001-001.

Table 11: Summary of permanent effects on holdings from construction

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
CA1/1 Land farmed by J T L Estate Medium sensitivity	5.0ha (<1%) Negligible	Low	Negligible	Minor adverse
CA1/2 Woodend Farm Medium sensitivity	16.6ha (17%) Medium	Medium	Negligible	Moderate adverse due to the proportion of the holding required and severance
CA1/3 Alrewas Hayes Farm Medium sensitivity	0.6ha (4%) Negligible	Negligible	Negligible	Negligible
CA1/4 Common Farm Medium sensitivity	4.3ha (4%) Negligible	Negligible	Negligible	Negligible
CA1/5 Common Lane Farm Medium sensitivity	5.1ha (1%) Negligible	Low	Negligible	Minor adverse
CA1/6 Barn Farm Medium sensitivity	5.8ha (14%) Medium	Low	Negligible	Moderate adverse due to the proportion of the holding required
CA1/7	0ha (0%)	Negligible	Negligible	Negligible

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Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
Land at Common Lane Low sensitivity	Negligible			
CA1/8 Land east of A515 Lichfield Road Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/9 Woodshoot Nurseries High sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/10 Longcroft Farm Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/11 Land at New Buildings Farm (Kings Bromley) Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/12 Hunts Farm Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/13 Tuppenhurst Farm Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/14 Shaw Lane Farm Low sensitivity	0.9ha (17%) Medium	Negligible	High	Moderate adverse due to property demolition
CA1/15 Echills Farm Medium sensitivity	13.5ha (8%) Low	Low	Low	Minor adverse
CA1/16 Trentside Meadows Medium sensitivity	0.7ha (2%) Negligible	Low	Low	Minor adverse
CA1/17 Bromley Lane Farm Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/18 Pipe Hall Farm High sensitivity	7.0ha (2%) Negligible	Negligible	Negligible	Minor adverse
CA1/19 Land at Littleton House Farm	0ha (0%) Negligible	Negligible	Negligible	Negligible

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Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
Low sensitivity				
CA1/20 Church Farm Medium sensitivity	2.4ha (20%) Medium	Negligible	Negligible	Moderate due to the proportion of the holding required
CA1/21 Woodhouse Farm Medium sensitivity	11.0ha (1%) Negligible	Negligible	Negligible	Negligible
CA1/22 Land at Luthbur Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/23 Land at Pipe Lane Low sensitivity	0.2ha (11%) Medium	Negligible	Negligible	Minor adverse
CA1/24 Blythe House Farm Medium sensitivity	2.1ha (4%) Negligible	Negligible	Negligible	Negligible
CA1/25 Quinton's Orchard Farm Medium sensitivity	8.8ha (3%) Negligible	Low	Negligible	Minor adverse
CA1/26 Bentley Hall Farm Medium sensitivity	5.8ha (4%) Negligible	Medium	Negligible	Moderate adverse due to severance
CA1/27 Manor Farm, Blithbury High sensitivity	27.8ha (12%) Medium	Medium	Negligible	Major/moderate adverse due to the proportion of the holding required and severance
CA1/28 Blithbury Reindeer Lodge High sensitivity	0.9ha (7%) Low	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/29 Land south of Blithbury Road Low sensitivity	2.2ha (75%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/30 Land east of Hadley Gate Lane Low sensitivity	1.0ha (26%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/31 Hadley Gate Field Farm Medium sensitivity	2.3ha (7%) Low	Negligible	Negligible	Minor adverse

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Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
CA1/32 Stoneyford Low sensitivity	7.8ha (86%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/33 Hadley Gate Farm Low sensitivity	0.2ha (11%) Low	Negligible	Negligible	Negligible
CA1/34 Blackflatts Farm High sensitivity	0.9ha (1%) Negligible	Negligible	Negligible	Minor adverse
CA1/35 Land at Hadley Gate Cottage Low sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA1/36 Holding No. 6 - Old Wood Estate High sensitivity	1.0ha (6%) Low	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/37 Hurstwood Farm High sensitivity	3.0ha (11%) Medium	Negligible	Negligible	Major/moderate adverse due to the proportion of the holding required
CA1/38 Town End Farm Medium sensitivity	14.0ha (4%) Negligible	Low	Negligible	Minor adverse
CA1/39 Holding No. 8 - Old Wood Farm Medium sensitivity	1.6ha (8%) Low	Negligible	Negligible	Minor adverse
CA1/40† Land north of Hollow Lane Low sensitivity	0.1ha (5%) Negligible	Negligible	Negligible	Negligible
CA1/41† Land at Bank Top Farm Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/42† Hurst Wood Meadow Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/43† Holding No. 2 - Old Wood Farm High sensitivity	1.8ha (5%) Negligible	Negligible	Negligible	Minor adverse
CA1/44† Land at New Barn	0ha (0%) Negligible	Negligible	Negligible	Negligible

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Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
Low sensitivity				
CA1/45† Cawarden Springs Farm Medium sensitivity	1.6ha (1%) Negligible	Negligible	Negligible	Negligible
CA1/46 Land south of Longley Lane Low sensitivity	0.1ha (10%) Low	Negligible	Negligible	Negligible
CA1/47 Crab Tree Farm Low sensitivity	3.3ha (9%) Low	Negligible	Negligible	Negligible
CA1/48 Little Strongbrook Farm Low sensitivity	0.5ha (11%) Medium	Negligible	Negligible	Minor adverse
CA1/49 Border Collie Trust (GB) Medium sensitivity	0.2ha (11%) Medium	Negligible	Medium	Moderate adverse due to the proportion of the holding required and the loss of dog training and exercise facilities
CA1/50 Land at Hamley Fields Low sensitivity	0.2ha (20%) Medium	Negligible	Negligible	Minor adverse
CA1/51 Land at Stockwell Heath Low sensitivity	3.6ha (89%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/52 Land at Rose Cottage Low sensitivity	0.3ha (30%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA1/53 Lea Hall Farm Medium sensitivity	16.7ha (9%) Low	Medium	Negligible	Moderate adverse due to severance
CA1/54 Hamley House Farm Medium sensitivity	1.7ha (11%) Medium	Medium	Negligible	Moderate adverse due to the proportion of the holding required and severance
CA1/55 Little Dunstal Farm Medium sensitivity	2.9ha (3%) Negligible	Low	Negligible	Minor adverse
CA1/56 Hamley Cottage Farm	<0.1ha – (<1%) Negligible	Negligible	Negligible	Negligible

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
Medium sensitivity				
CA1/57 Land at Jonghams Lane Low sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/58 Lount Farm Medium sensitivity	9.2ha (18%) Medium	Low	Negligible	Moderate adverse due to the proportion of the holding required
CA1/59 Oakfields Farm Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible
CA1/60 Hanch Hall Farm Medium sensitivity	0ha (0%) Negligible	Negligible	Negligible	Negligible

†Holding affected by the proposed 132kV power line from Rugeley Power Station to Newlands Lane auto-transformer feeder station only.

4.4.37 Overall, the construction of the Proposed Scheme will permanently affect 44 holdings in the Fradley to Colton area with 18 holdings experiencing moderate or major/moderate permanent effects, which are significant. No holdings will experience major adverse permanent effects.

4.4.38 Two holdings will experience major/moderate adverse permanent effects from construction: Manor Farm, Blithbury (CA1/27) and Hurstwood Farm (CA1/37). Both of these holdings are dairy units, which are generally more sensitive to the effects of land loss and severance than other farm holdings.

4.4.39 Most of the 16 holdings that will experience a moderate adverse permanent effect will have a substantial proportion of land required. This includes Shaw Lane Farm (CA1/14), which will also have property demolished as a result of the Proposed Scheme.

4.4.40 Although financial compensation will be available, there can be no certainty that this will be used to reduce the above adverse effects by the purchase of replacement land or the construction of replacement buildings. Therefore, the above assessment should be seen as the worst case, which could be reduced if the owner and/or occupier is able, and chooses, to use compensation payments to replace assets.

Other mitigation measures

4.4.41 Other mitigation will incorporate climate change adaptation and resilience measures, insofar as reasonably practicable. For example, restored soils in areas that could be prone to drought with climate change could potentially be replaced at greater depths than at present to make them resilient to drought.

4.4.42 A farm pack is being provided to all farmers and landowners that sets out baseline conditions on the farm and the assurances and obligations that HS2 Ltd will accept upon entering the land. This will include advice and appropriate assistance where

there is a need for the landowner to relocate or re-provide agricultural buildings displaced by the Proposed Scheme.

Summary of likely residual significant effects

- 4.4.43 During construction, the total area of agricultural land required in the Fradley to Colton area will be approximately 585ha, of which 368ha is BMV land. This is assessed as a moderate adverse residual effect, which is significant.
- 4.4.44 Sixty holdings will be affected temporarily, of which 45 will experience temporary moderate, major/moderate or major adverse residual effects, which are significant.
- 4.4.45 Once the construction process is complete and land required temporarily has been restored, the residual permanent requirement for agricultural land will be approximately 183ha of which 132ha is BMV land. This is assessed as a moderate residual adverse effect, which is significant.
- 4.4.46 Forty-four holdings will be affected permanently, of which 18 will experience major/moderate or moderate permanent effects following construction, which is significant. Fourteen will be likely to remain as agricultural or rural businesses and the use of compensation payments to purchase replacement land or farm buildings could reduce some of the effects. Four holdings (Shaw Lane Farm (CA1/14), land south of Blithbury Road (CA1/29), Stoneyford (CA1/32) and land at Stockwell Heath (CA1/51)) are unlikely to remain due either to building demolitions or the proportion of the holding required permanently.

Cumulative effects

- 4.4.47 Cumulative effects on agricultural holdings as a result of HS2 Phase One and the Proposed Scheme have been identified. There are five farm holdings directly affected by both Phase One and the Proposed Scheme.
- 4.4.48 There are no cumulative severance, disruption and infrastructure impacts on farm holdings resulting from the interface with HS2 Phase One, with all cumulative effects associated with an increase in land required.
- 4.4.49 The construction of Phase One will require 7.3ha from J T L Estate (CA1/1), with a further 19.2ha required for the construction of the Proposed Scheme. The **total** area of land required temporarily from J T L Estate during the construction of both Phase One and the Proposed Scheme is 26.5ha (2% of the holding). The cumulative effect of the temporary loss of land will result in a minor adverse effect, which is not significant. Although no agricultural land would be restored from Phase One, 14.2ha will be restored from the Proposed Scheme, resulting in a total area of land required permanently from J T L Estate of 12.3ha (1% of the holding). The cumulative effect of the permanent loss of land will result in a minor adverse effect, which is not significant.
- 4.4.50 The construction of Phase One will require 7.3ha from Woodend Farm (CA1/2), with a further 33.1ha required for the construction of the Proposed Scheme. The cumulative area of land required temporarily from Woodend Farm during the construction of both Phase One and the Proposed Scheme is 40.4ha (42% of the holding), which does not change the major/moderate adverse temporary construction effect already experienced by this holding as a result of the Proposed Scheme. After construction,

0.2ha of agricultural land will be restored from Phase One, and 16.5ha will be restored from the Proposed Scheme, resulting in a cumulative area of land required permanently from Woodend Farm of 23.7ha (24% of the holding). This changes the moderate adverse permanent construction effect experienced by this holding as a result of the Proposed Scheme to a major/moderate adverse cumulative effect, which is significant.

- 4.4.51 The construction of Phase One will require 4.5ha from Common Lane Farm (CA1/5), with a further 41.8ha required for the construction of the Proposed Scheme. The cumulative area of land required temporarily from Common Lane Farm during the construction of both Phase One and the Proposed Scheme is 46.3ha (12% of the holding), which does not change the moderate adverse temporary construction effect already experienced by this holding as a result of the Proposed Scheme. After construction, 0.1ha of agricultural land will be restored from Phase One, and 36.7ha will be restored from the Proposed Scheme, resulting in a cumulative area of land required permanently from Common Lane Farm of 9.5ha (2% of the holding), which does not change the negligible permanent construction effect experienced by this holding as a result of the Proposed Scheme.
- 4.4.52 The construction of Phase One will require 17.6ha from Hunts Farm (CA1/12), which will increase to 22.3ha (70% of the holding) with the construction of the Proposed Scheme (4.0ha of which are common to both schemes). The cumulative area of land required from Hunts Farm during the construction of both Phase One and the Proposed Scheme does not change the major/moderate adverse temporary construction effect already experienced by this holding as a result of the Proposed Scheme. After construction, 13.4ha of agricultural land will be restored from Phase One, and 4.7ha will be restored from the Proposed Scheme, resulting in a cumulative area of land required permanently from Hunts Farm of 4.2ha (13% of the holding). This changes the negligible permanent construction effect experienced by this holding as a result of the Proposed Scheme to a moderate adverse cumulative effect, which is significant.
- 4.4.53 The construction of Phase One will require 0.2ha from Tuppenhurst Farm (CA1/13), with a further 2.0ha required for the construction of the Proposed Scheme. The cumulative area of land required temporarily from Tuppenhurst Farm during the construction of both Phase One and the Proposed Scheme is 2.2ha (1% of the holding), which does not change the negligible temporary construction effect experienced by this holding as a result of the Proposed Scheme. After construction of Phase One and the Proposed Scheme, all the agricultural land will be restored, which does not change the negligible permanent construction effect experienced by this holding as a result of the Proposed Scheme.
- 4.4.54 There are no known cumulative effects arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agriculture, forestry or soil in the study area.
- 4.4.55 Route-wide effects on agricultural land quality are reported in Volume 3: Route-wide effects.

4.5 Effects arising from operation

Avoidance and mitigation measures

- 4.5.1 No measures are required to mitigate the operational effects of the Proposed Scheme on agriculture, forestry and soils.

Assessment of impacts and effects

- 4.5.2 Potential impacts arising from the operation of the Proposed Scheme will include:

- noise emanating from moving trains; and
- the propensity of operational land to harbour noxious weeds.

- 4.5.3 Operational airborne sound at the following sensitive livestock receptors have been included in the assessment and the results are presented in Volume 5: Appendix SV-002-001:

- Barn Farm, Rileyhill (CA1/6);
- Pipe Hall Farm (CA1/18);
- Quinton's Orchard Farm (CA1/25);
- Blithbury Reindeer Lodge (CA1/28);
- Border Collie Trust (CA1/49); and
- Hamley House Farm (CA1/54).

- 4.5.4 The predicted sound levels have been considered against the criteria defined in the SMR Addendum. Taking into consideration the noise mitigation included within the Proposed Scheme, as shown on Map Series SV-02 (Volume 5: Sound, noise and vibration Map Book), no likely significant effects from noise on livestock are identified.

- 4.5.5 The propensity of linear transport infrastructure to harbour and spread noxious weeds is a consequence of:

- the management of the highway and railway land; and
- the propensity of the weeds to spread onto such land from adjoining land, which could be exacerbated by the effects of climate change.

- 4.5.6 The presence of noxious weeds (particularly ragwort) will be controlled using an appropriate management regime that identifies and remedies areas of weed growth that might threaten adjoining agricultural interests.

Other mitigation measures

- 4.5.7 No other mitigation measures have been identified.

Summary of likely residual significant effects

- 4.5.8 No residual significant effects on agriculture, forestry and soils have been identified as a result of the operation of the Proposed Scheme.

Cumulative effects

- 4.5.9 There are no known cumulative effects arising from the operation of the Proposed Scheme as a consequence of other development projects affecting agriculture, forestry or soil in the study area.

Monitoring

- 4.5.10 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 4.5.11 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring agriculture, forestry and soil effects during the operation of the Proposed Scheme in the Fradley to Colton area.

5 Air quality

5.1 Introduction

- 5.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme within the Fradley to Colton area. Oxides of nitrogen (NO_x) including nitrogen dioxide (NO₂), fine particulate matter (PM₁₀, PM_{2.5})⁵⁰ and dust have been considered in the assessment. Emissions of all or some of these air pollutants are likely to arise from construction activities, demolition, site preparation works, borrow pits and the use of haul routes. Emissions will also arise from road traffic during construction and operation of the Proposed Scheme.
- 5.1.2 Engagement with Lichfield District Council (LDC) and Staffordshire County Council (SCC) has been undertaken. The purpose of this engagement has been to obtain relevant baseline information, which includes monitoring data in this area. Detailed reports on the air quality data and assessments for this area, are contained within Volume 5: Appendix AQ-001-001.
- 5.1.3 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book. Air quality mapping is presented in the Volume 5: Air quality Map Book, Map AQ-01-101.
- 5.1.4 In addition, the traffic data used for the air quality assessment is set out in Background Information and Data (BID)⁵¹, (see BID-AQ-002-000: Traffic data used for the air quality assessment).

5.2 Scope, assumptions and limitations

- 5.2.1 The scope, assumptions and limitations for the air quality assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)⁵², the SMR Addendum⁵³ and Volume 5: Appendix AQ-001-001.
- 5.2.2 The study areas for the air quality assessment have been determined on the basis of where impacts on local air quality may occur⁵⁴:
- from construction and/or mineral extraction activities (for borrow pits);

⁵⁰ PM_{2.5} and PM₁₀ describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 2.5 and 10 microns in diameter.

⁵¹ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2

⁵² Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

⁵³ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

⁵⁴ The assessment of construction dust emissions has been undertaken where sensitive receptors are located up to a distance of 350m from dust generating activities. The assessment of mineral dust emissions has been undertaken for sensitive receptors located within a distance of 250m from a borrow pit site. The assessment of traffic emissions has been undertaken where sensitive receptors are located up to a distance of 200m from roads screened in for further assessment.

- from changes in the nature of traffic during construction and operation, for example increases in traffic flows during construction or where road closures or restrictions cause diversions and heavier traffic on adjacent roads; or
- where road alignments have changed.

5.2.3 The assessment has incorporated HS2 Ltd's policies on vehicle emissions⁵⁵. These include the use of Euro VI heavy goods vehicles (HGVs), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGVs) during construction of the Proposed Scheme.

5.2.4 The assessment of construction traffic emissions has used traffic data based on an estimate of the average daily flows at the peak year during the construction period (2020-2026). The assessment assumes vehicle emission rates and background pollutant concentrations from year 2020. This is because both pollutant emissions from vehicle exhausts and background pollutant concentrations are anticipated to reduce year by year as a result of vehicle emission controls, and so the year 2020 represents the worst case for the construction assessment.

5.3 Environmental baseline

Existing baseline

Background air quality

5.3.1 The main sources of air pollution in the Fradley to Colton area are emissions from road vehicles and agricultural activities. The main roads within the area are: the A38 Rykneld Street; the A5192 Eastern Avenue; the A515 Lichfield Road; the A513 Rugeley Road; the A51 Stafford Road; the B5014 Uttoxeter Road; the B5013 Uttoxeter Road; and local roads serving the settlements of Kings Bromley, Handsacre and Armitage, Colton and Stockwell Heath.

5.3.2 There are two industrial installations (regulated by the Environment Agency) with permits for emissions to air within the area, namely a National Grid compressor station and the Rugeley Power Station (which ceased operation in 2016). Details of their location are presented in Volume 5: Appendix AQ-001-001. The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

5.3.3 Estimates of background air quality have been obtained from the Department for Environment Food & Rural Affairs (Defra)⁵⁶ for the baseline year of 2016. The data are estimated for 1km grid squares for NO_x, NO₂, PM₁₀ and PM_{2.5}. Background concentrations are within the air quality standards as defined in the SMR and the SMR Addendum, for all pollutants within the Fradley to Colton area.

⁵⁵ HS2 Phase 2a Information Paper E14: Air Quality.

⁵⁶ Department for Environment, Food and Rural Affairs (Defra) (2013) Defra Background Pollutant Concentration Maps; <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013>;

Local monitoring data

- 5.3.4 There are currently five diffusion tube sites located within the Fradley to Colton area for monitoring NO₂ concentrations. These are located along the A38 Lichfield Road, and within Lichfield. Measured concentrations in 2015⁵⁷ exceeded the air quality standard at one of these sites, located along the A38 Lichfield Road. Details of their location and data measurements are presented in Map AQ-01-101, in the Volume 5: Air quality Map Book and Volume 5: Appendix AQ-001-001.

Air quality management areas

- 5.3.5 There is one air quality management area (AQMA) within the Fradley to Colton area that has been declared for exceedances in the annual mean NO₂ standard. The Lichfield AQMA No.2 extends from the A38 Lichfield Road at Wall Island to Alrewas.

Receptors

- 5.3.6 Several locations have been identified in the area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust-generating activities or traffic routes during construction or operation of the Proposed Scheme. Details of their location are presented in Map AQ-01-101, in the Volume 5: Air quality Map Book and Volume 5: Appendix AQ-001-001.
- 5.3.7 Most of the receptors located close to the route of the Proposed Scheme are residential. Other receptors include Rugeley School and Kings Bromley Care Home.
- 5.3.8 There is one statutory designated ecological site identified close to the Proposed Scheme, namely Blithfield Reservoir Site of Special Scientific Interest (SSSI). Other non-statutory sensitive ecological sites, identified close to the Proposed Scheme, include Coventry Canal, Kings Bromley Pit, Trentside Meadows, Pipe Lane, Westfield Covert and Newlands Lane Local Wildlife Sites. Further details of the ecological receptors are set out in Section 8, Ecology and biodiversity.

Future baseline

- 5.3.9 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to be implemented by 2020.
- 5.3.10 The potential cumulative impact from committed developments on air quality in conjunction with the effects from the construction and operation of the Proposed Scheme have been considered as part of this assessment. This has been achieved by including changes in traffic predicted as a result of the committed developments within the traffic data used for the air quality assessments for construction and operation. The future air quality baselines are defined as the 'without the Proposed Scheme' scenarios at each stage.

⁵⁷ At the time of assessment, measurements for 2015 were the latest published annual monitoring baseline data.

Construction (2020)

- 5.3.11 Future background pollutant concentrations have been sourced from the Defra background maps for the first year of construction in 2020⁵⁸, which predict NO₂, PM₁₀ and PM_{2.5} levels in 2020 to be lower than in the 2016 baseline and within the relevant air quality standards.
- 5.3.12 Construction of HS2 Phase One will affect the future baseline in this area as there will be an increase in traffic on the local highway network. This assessment includes the predicted traffic changes associated with the HS2 Phase One construction stage within the future baseline.
- 5.3.13 Committed developments that have been included as future receptors in the assessment of air quality impacts during construction of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-001. No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for air quality.

Operation (2027)

- 5.3.14 Future background pollutant concentrations have been sourced from the Defra background maps for 2027⁵⁹, which predict NO₂, PM₁₀ and PM_{2.5} levels in 2027 to be lower than in the 2016 baseline and within the relevant air quality standards.
- 5.3.15 This assessment includes the predicted traffic changes associated with the HS2 Phase One operational stage. Committed developments that have been included as future receptors in the assessment of air quality impacts during operation of the Proposed Scheme are identified in Volume 5: Appendix AQ-001-001. No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for air quality.

5.4 Effects arising during construction

Avoidance and mitigation measures

- 5.4.1 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the Code of Construction Practice (CoCP). The draft CoCP⁶⁰ includes a range of mitigation measures that are accepted by the Institute of Air Quality Management (IAQM) as being suitable to reduce impacts to as low a level as is reasonably practicable. These measures are generally sufficient to avoid any significant effects from dust during construction.
- 5.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP will be implemented. These include:
- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;

⁵⁸ Department for Environment, Food and Rural Affairs (Defra) (2013) Defra Background Pollutant Concentration Maps 2020; Available online at: <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013>

⁵⁹ Department for Environment, Food and Rural Affairs (Defra) (2013) Defra Background Pollutant Concentration Maps 2027; Available online at: <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013>

⁶⁰ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- inspection and visual monitoring, undertaken in consultation with the local authorities, to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of vehicle routes and designated vehicle waiting areas to suppress dust;
- the use of water spray systems on demolition sites to dampen down fugitive dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- the use of enclosures to contain dust emitted from construction activities; and
- soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

5.4.3 The draft CoCP includes the requirement for site-specific traffic management measures, such as the use of site haul routes for construction vehicles to minimise the need to use public roads.

5.4.4 The use of borrow pits is intended to reduce the need for longer distance transport and import of materials, thereby reducing the volume and impact of road traffic on local roads and communities.

Assessment of impacts and effects

Temporary effects

5.4.5 Impacts from construction of the Proposed Scheme could arise from dust-generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for dust and exposure to NO₂, PM₁₀ and PM_{2.5} concentrations.

Construction dust effects

5.4.6 Construction activities, such as demolition of existing buildings, earthworks, construction of new structures and trackout⁶¹, have been assessed for their risk of having an effect on dust soiling, human health⁶² and ecological sites. There are residential and ecological receptors located within 350m of these activities in the Fradley to Colton area.

5.4.7 It has been identified that there would be a low risk of dust effects and negligible risk of human health effects from demolition activities. For earthworks, there would be a medium to high risk of dust effects and a medium risk of human health effects. For construction, there would be a low to high risk of dust effects and a low to medium

⁶¹ Trackout refers to the transport of dust and dirt from the construction site(s) onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

⁶² Human health effects relate mainly to short-term exposure to particles of size between 2.5µm to 10µm, measured as PM₁₀.

risk of human health effects. For trackout, there would be a high risk of dust effects and a medium risk of human health effects.

5.4.8 No demolition activities would affect any ecological receptors. There would be a low risk of ecological effects from other dust generating activities.

5.4.9 With the application of the mitigation measures contained in the draft CoCP, no significant effects are anticipated from the risks associated with the dust generating activities. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-001, where the scale of dust emissions and the sensitivity of the area and receptors are fully described.

Mineral dust effects

5.4.10 The operation of borrow pits during the construction of the Proposed Scheme has been assessed for the potential of effects on dust soiling, human health and ecological sites in the surrounding area. There will be four borrow pits in operation in this area: a borrow pit at Kings Bromley South near Ashby Stitch culvert and Common Farm; two borrow pits at Kings Bromley North, one around Shaw Lane (north) and one around Shaw Lane (south); and a borrow pit at Blithbury near Trentside Meadows. These borrow pits will be excavated for sands and gravels, which are classified as a soft rock in the assessment.

5.4.11 There are no residential or ecological receptors within 250m of the borrow pit near Ashby Stitch culvert and Common Farm. There are residential receptors located within 250m of the borrow pits around Shaw Lane (north) and Shaw Lane (south), however no ecological receptors are located within 250m of these borrow pits. There are residential and ecological receptors within 250m of the borrow pit near Trentside Meadows.

5.4.12 Assessment of the borrow pit activities has indicated that there would be slight to moderate adverse impacts of 'disamenity'⁶³ dust at three residential receptors within 250m of each of the borrow pits around Shaw Lane (north) and Shaw Lane (south). There would be slight adverse impacts at five residential receptors within 250m of the borrow pit near Trentside Meadows; the Trentside Meadows Local Wildlife Site (LWS) would experience negligible impact from the activities at this borrow pit. Impacts to human health from borrow pit activities are not anticipated to be significant due to the low background PM₁₀ concentrations in the area.

5.4.13 With the application of the mitigation measures contained in the draft CoCP, no significant effects are anticipated from the potential impacts arising from the operation of the borrow pits in this area. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-001.

Construction traffic effects

5.4.14 Construction activity could also have the potential to affect local air quality through the additional traffic generated on local roads as a result of construction vehicles and

⁶³ 'Disamenity' dust refers to coarse dust particles arising from the operation of a borrow pit that can reduce amenity in the local community due to visible dust plumes and dust soiling.

through changes to traffic patterns arising from temporary road diversions and realignments.

- 5.4.15 The assessment of construction traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.
- 5.4.16 Construction traffic data in the study area has been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in the construction period. These were primarily the main roads within the Fradley to Colton area, including the A38 Rykneld Street, Cappers Lane, Wood End Lane, the A51 Stafford Road, the A515 Lichfield Road, the A5192 Eastern Avenue, the A513 Kings Bromley Lane and the B5014 Ridware Road.
- 5.4.17 No significant effects are predicted at any sensitive receptors during construction of the Proposed Scheme. Concentrations of NO₂, PM₁₀ and PM_{2.5} are within the relevant air quality standards both with and without the Proposed Scheme.
- 5.4.18 No significant effects are anticipated at any of the ecological receptors in this area.

Permanent effects

- 5.4.19 No permanent effects on local air quality are likely to arise during construction of the Proposed Scheme.

Other mitigation measures

- 5.4.20 No other mitigation measures in relation to air quality are considered necessary during construction of the Proposed Scheme in the Fradley to Colton area.

Summary of likely residual significant effects

- 5.4.21 No significant residual effects are anticipated for air quality in this area during construction of the Proposed Scheme.

Cumulative effects

- 5.4.22 The air quality assessment described above takes into account predicted changes in traffic as a result of committed developments in the area, including construction of HS2 Phase One adjacent to the Fradley to Colton area. A qualitative assessment has also been undertaken for the construction of HS2 Phase One in conjunction with construction of the Proposed Scheme (without Phase One in the future baseline). This qualitative assessment showed that no significant cumulative effects are anticipated for air quality as a result of construction of the Proposed Scheme and HS2 Phase One.
- 5.4.23 It is assumed that dust emissions from construction of other developments in the area would be controlled by appropriate measures as set out within their respective environmental management controls and therefore no cumulative effects for air quality would be anticipated.

5.5 Effects arising from operation

Avoidance and mitigation measures

- 5.5.1 No specific mitigation measures for air quality are proposed during operation of the Proposed Scheme.

Assessment of impacts and effects

- 5.5.2 Impacts from the operation of the Proposed Scheme could arise from vehicle emissions and relate to changes in the volume, composition and distribution of road traffic and changes in road alignment. There will be no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and therefore no assessment is required. Indirect emissions from sources such as rail and brake wear have been assumed to be negligible.
- 5.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2027: a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.
- 5.5.4 Traffic data for the Fradley to Colton area has been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2027. These were the proposed re-aligned or diverted roads within the Fradley to Colton area and some roads with changes in annual average daily traffic (AADT) or HGV flows, namely the A515 Lichfield Road, the B5013 Uttoxeter Road, Shaw Lane, Pipe Lane, Stonyford Lane, Hadley Gate Lane, Newlands Lane and Moor Lane.
- 5.5.5 No significant effects are predicted at any residential receptor in the operation year. Concentrations of NO₂, PM₁₀ and PM_{2.5} are predicted to be within the relevant air quality standards both with and without the Proposed Scheme.
- 5.5.6 No significant effects are anticipated at any of the ecological receptors in the area.

Other mitigation measures

- 5.5.7 No other mitigation measures are proposed in relation to air quality in the Fradley to Colton area during operation of the Proposed Scheme.

Summary of likely residual significant effects

- 5.5.8 No significant residual effects are anticipated for air quality in this area during operation of the Proposed Scheme.

Cumulative effects

- 5.5.9 The data used for the air quality assessment takes account of predicted changes in traffic as a result of committed developments in the area, including operation of HS2 Phase One adjacent to the Fradley to Colton area. No cumulative effects for air quality are anticipated.

Monitoring

- 5.5.10 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 5.5.11 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring air quality effects during operation of the Proposed Scheme in the Fradley to Colton area.

6 Community

6.1 Introduction

- 6.1.1 This section of the report describes the impacts and likely significant effects on local communities resulting from the construction and operation of the Proposed Scheme within the Fradley to Colton area.
- 6.1.2 The assessment draws on information gathered from engagement with the users and operators of facilities including Conservation, Horticulture and Agriculture for the Disabled Society (CHADS), Henry Chadwick Community Primary School, the Reindeer Lodge and Rugeley School. The purpose of this engagement has been to understand how the facilities are used, to obtain relevant baseline information and inform the design development and assessment of the Proposed Scheme.
- 6.1.3 Further details of the community assessments undertaken within the Fradley to Colton area are contained in Volume 5: Appendix CM-001-001.
- 6.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book. Community assessment maps are provided in the Map Series CM-01 in Volume 5: Community Map Book.

6.2 Scope, assumptions and limitations

- 6.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)⁶⁴ and the SMR addendum⁶⁵.
- 6.2.2 The study area includes the areas of land required both temporarily and permanently for the Proposed Scheme. It also includes a wider corridor within which receptors or resources could be affected by a combination of significant residual effects drawing from the findings of other technical disciplines: noise, vibration, air quality, traffic (in relation to heavy goods vehicles (HGV⁶⁶)) and visual intrusion. In addition, the study area has regard to the proposed routes of construction traffic and takes account of catchment areas for community facilities that could be affected where intersected by the Proposed Scheme. Overall, the study area is taken as the area of land that encompasses the likely significant effects of the Proposed Scheme.
- 6.2.3 In undertaking the assessment, the following area-specific limitations were identified and assumptions made:
- no access was available to the duck pond in Stockwell Heath within the survey period to undertake community quality or user surveys. On a precautionary basis, the assessment has assumed it is of good quality and well used; and

⁶⁴ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

⁶⁵ Volume 5: Appendix CT-001-001/2, Environmental Impact Assessment Scope and Methodology Report Addendum.

⁶⁶ HGV effects are increases in HGV construction traffic flows identified as significant by the Traffic and Transport topic. They contribute to in-combination effects on sensitive community resources which are located adjacent to a designated construction traffic route which experiences a significant increase in HGV traffic flows or a site haul route which experiences a significant number of HGV movements.

- no access was available to Hurst Wood within the survey period to undertake community quality or user surveys. Aerial mapping indicates that the wider woodland area is not accessible from a footpath that runs along the perimeter of the wood, therefore, it is not assessed as a community resource.

6.3 Environmental baseline

Existing baseline

- 6.3.1 The Fradley to Colton area covers approximately 13.5km of the Proposed Scheme in Staffordshire.
- 6.3.2 The route of the Proposed Scheme will extend from the connection with Phase One at Fradley in the south, to Colton in the north-west, passing close to the settlements of Kings Bromley, Pipe Ridware, Blithbury and Colton. Outside of the main settlements, the area is characterised by small clusters of dwellings and individual dwellings within rural areas.

Settlements

- 6.3.3 Kings Bromley is a village of approximately 420 residential properties. The village includes a primary school, places of worship, a public house and Kings Bromley Care Home. South of the main village there are also smaller clusters of residential properties.
- 6.3.4 Nethertown is a hamlet of 16 residential properties located approximately 1.4km north-west of Kings Bromley.
- 6.3.5 Pipe Ridware is a small settlement of eight residential properties with a village church, which was until recently used as a community theatre. Pipe Ridware is located approximately 1.5km north of Handsacre.
- 6.3.6 Blithbury is a small village of approximately 25 residential properties, approximately 3.5km north-west of Rugeley.
- 6.3.7 Approximately 1.1km west of Blithbury there is a small settlement of five residential properties related to Hadley Gate Farm. Approximately 200m south-west of these are a further three residential properties, located along Blithbury Road, which are associated with Rosewood Farm.
- 6.3.8 Stockwell Heath is a small, rural hamlet located north of Colton with approximately 10 residential properties. Colton includes approximately 220 residential properties. Stockwell Heath is closely linked with Colton, as the majority of local services for residents are located in Colton, including a church, a primary school and a pub. Moor Lane and Newlands Lane link the two villages. There is a duck pond located in the centre of the Stockwell Heath between Newlands Lane and Moor Lane. Hamley Heath is located to the west of these settlements and includes a small number of residential properties based around Hamley Heath Farm.

Community facilities

- 6.3.9 To the east of Kings Bromley is Hillcrest Oaklands College, a specialist residential college for girls aged between 12 and 20. The school provides education and living areas for up to 12 girls.

- 6.3.10 The Four Seasons Nature Study Centre is owned and managed by CHADS. The whole site is fully wheelchair accessible with the visitor centre acting as the focal point for many of the activities undertaken by the charity. The facilities are used on at least a weekly basis for activities such as surveying, planting, crafting, gardening or farming. Yoga and meditation classes are also held regularly on site, and other specialist groups hire the site on a less regular basis. The centre is used by a high proportion of people who have limited ability to cope with change due to their protected characteristics⁶⁷.

Recreational facilities

- 6.3.11 Kings Bromley Marina is located approximately 2km south of Kings Bromley. It provides temporary moorings for recreational narrow boat users. There are no permanent residential moorings at this marina.
- 6.3.12 The Reindeer Lodge is located to the south of Blithbury. It is a working reindeer farm and includes a shop, an event barn, tea room and an area referred to as a landing site for Father Christmas. The Reindeer Lodge is a visitor attraction and holds events throughout the year, but it is most popular around the Christmas period. Visits are made by school groups and the public.
- 6.3.13 An area of land to the north of Rugeley Power Station and south of the River Trent is used by Lakeside Golf Club, linked to the Rugeley Power Station social club on the former power station site.

Open space and public rights of way

- 6.3.14 Trentside Meadows local wildlife site is also owned and managed by CHADS. The site is an area of approximately 27.7ha, located between the River Trent and the A513 Rugeley Road, west of Kings Bromley. The ecological value of the site is intrinsically linked to the reason why people visit Trentside Meadows (see Section 8, Ecology and biodiversity for a description of the ecological value of the site). Visits to Trentside Meadows are by appointment only, and generally only take place on average about once a month. Trentside Meadows is predominantly used as grazing land (see Section 4, Agriculture, forestry and soils).
- 6.3.15 The Way for the Millennium, Staffordshire (including Mavesyn Ridware Footpath 30, Hamstall Ridware Footpath 3 and School Lane), is a long distance footpath, which spans the width of the county for approximately 66km running from Newport in the west to Burton upon Trent in the east. The footpath passes Stafford, Colwich, Rugeley, Yoxall and Barton Needwood. Parts of the path are available to horse riders and cyclists.
- 6.3.16 Rugeley to Colton Circular Walk (including Colton Footpath 31, 32, 50, 52 and 70, parts of Newlands Lane and parts of Moor Lane) is an approximately 9.6km long walk along towpaths, lanes and fields linking Rugeley Trent Valley railway station, the Trent and Mersey Canal, Colton, Stockwell Heath and Hurst Wood. A shorter walking route of approximately 6.4km is available using some of these footpaths, which avoids Stockwell Heath and Hurst Wood.

⁶⁷ Nine protected characteristic groups identified through the Equality Act (2010) include: age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion and belief, sex and sexual orientation.

Future baseline

Construction (2020)

- 6.3.17 Volume 5: Appendix CT-004-000⁶⁸ provides details of the developments that are assumed to have been implemented in the Fradley to Colton area by 2020.
- 6.3.18 The following committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for community resources, as set out in Table 12.

Table 12: Committed developments relevant to community

Map book Reference ⁶⁹	Planning reference	Description
CA1/40	13/00270/FULM	Staff/student accommodation block, single storey school block extension, parking, landscaping and relocation of existing sports area
CA1/78	16/00753/PND	Change of use from agricultural building to a residential property on Hadley Gate Lane
CA1/90	16/00462/COU	Change of use from barns to a residential property in Stockwell Heath
CA1/84	14/01231/PND	Change of use from agriculture building to a dwelling in Colton

- 6.3.19 These committed developments form part of the future baseline for the assessment of community effects during construction of the Proposed Scheme.

Operation (2027)

- 6.3.20 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented in the Fradley to Colton area by 2027.
- 6.3.21 No additional committed developments that will materially alter the baseline conditions in 2027 for community resources have been identified in this area.

6.4 Effects arising during construction

Avoidance and mitigation measures

- 6.4.1 The following measures have been incorporated into the Proposed Scheme as part of the design development process that, as a consequence of the measures, avoid or reduce the environmental impacts during construction:
- Shaw Lane will remain open during construction, maintaining connectivity south of Kings Bromley; and
 - approximately 1km of the 132kV overhead line between the substation at the former Rugeley Power Station and Newlands Lane auto-transformer feeder

⁶⁸ Volume 5: Appendix CT-004-000, Planning data.

⁶⁹ Volume 5 Map Book: Maps CT-13-101 to CT-13-105a-L1.

station will be underground which will minimise visual impacts on nearby residential properties.

6.4.2 The following measures have been incorporated into the scheme design as part of the design development process to avoid or minimise, as far as reasonably practicable, the environmental impacts during construction:

- planting and hedgerows south of the Bourne Brook auto-transformer station will screen views of the route and auto-transformer station from residential properties on Common Lane;
- the area required for the construction of the Kings Bromley viaduct has been limited to decrease the number of residential properties demolished on Shaw Lane;
- the area required for construction of the Bourne embankment satellite compound has been sited to limit isolation impacts on a residential property located to the south of the A513 Rugeley Road;
- planting adjacent to the Blithbury package substation will limit visual impacts on residential properties at Echills Farm;
- a landscape bund to the east side of the Blithbury South and Central cuttings will provide visual and acoustic screening of the Proposed Scheme from Rugeley School and residential properties at Blithbury;
- the diversion of Hadley Gate Lane has been designed to minimise the number of residential property demolitions;
- planting adjacent to the 132kV overhead power line cable sealing end compounds will screen views of the infrastructure from nearby residential properties;
- the relocation of the proposed Newlands Lane auto-transformer feeder station to the east side of the route of the Proposed Scheme will reduce the impact on residential properties at Stockwell Heath and Colton;
- planting on the Stockwell Heath embankment will limit views of the Proposed Scheme from residential properties in Stockwell Heath; and
- landscape earthworks and mitigation planting to the south of the Moreton South embankment will limit visual impacts on residential properties on Jonghams Lane.

6.4.3 The draft Code of Construction Practice (CoCP)⁷⁰ includes a range of provisions that will help mitigate community effects associated with construction within this area, including:

- implementation of a community engagement framework to provide appropriate information and resolve community issues (Section 5);

⁷⁰ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- sensitive layout of construction sites to reduce nuisance as far as possible (Section 5);
- maintenance of public rights of way (PRoW) during construction where reasonably practicable (Section 14);
- monitoring and management of flood risk and other extreme weather events, where reasonably practicable, that may affect community resources during construction (Section 16); and
- specific measures in relation to air quality and noise and the avoidance of HGVs operating adjacent to schools during drop off and pick up periods (Section 7, 13 and 14).

Assessment of impacts and effects

Temporary effects

Residential properties

- 6.4.4 It is necessary to carry out minor utility works or minor highways works associated with the construction of the Proposed Scheme within land which falls within the boundaries of residential properties. The scale of impact will be small, and the duration short (up to three months), therefore resulting in minor adverse effects, which are not significant. A full description of the affected properties is included within Volume 5: Appendix CM-001-001.
- 6.4.5 A group of residential properties around Rileyhill, east and west of the A515 Lichfield Road, south of Kings Bromley will be in proximity to the construction of the Proposed Scheme. The works will include Pyford North embankment, the A515 Lichfield Road realignment and works to raise the National Grid Electricity Transmission 400kV overhead power line. All of the properties will experience significant visual effects due to views of road works, utility works, and tall construction equipment associated with the route of the Proposed Scheme. In addition, the presence of construction traffic routes along the A515 Lichfield Road and Common Lane will result in significant increases in HGVs passing the properties. The significant visual and HGV effects will result in an in-combination effect on the amenity of residents of these properties for up to three years in total. This will result in a major adverse effect, which is significant.
- 6.4.6 A group of residential properties along Shaw Lane and A513 Rugeley Road, south-west of Kings Bromley will be in proximity to the construction of the Proposed Scheme. The works will include the Bourne embankment, Kings Bromley viaduct, the A515 Lichfield Road realignment and a borrow pit. A site haul route is proposed along the southern side of the route of the Proposed Scheme. Five properties will experience significant noise effects due to earthworks, road construction and movement of vehicles on the site haul routes. All five properties experience significant visual effects due to tall construction equipment associated with the route of the Proposed Scheme and the movement of construction vehicles. The significant noise and visual effects will result in an in-combination effect on the amenity of residents of these five properties for up to three years in total. This will result in a major adverse effect, which is significant.

- 6.4.7 A group of residential properties in Pipe Ridware will be in proximity to the construction of the Proposed Scheme. The works will include the River Trent viaduct and Pipe Ridware embankment. Approximately five of the properties will experience significant noise effects during the daytime due to site establishment (including vegetation clearance), utility diversions and viaduct construction. Residents of these five properties in Pipe Ridware will also experience significant adverse visual effects due to mid-range views of the construction works associated with the Pipe Ridware embankment and River Trent viaduct, as well as the movement of construction vehicles and stockpiles to the north of Pipe Lane. The noise and visual effects will result in an in-combination effect on residents of five properties for up to one year and two months in total. This will result in a major adverse effect, which is significant.
- 6.4.8 A group of approximately seven residential properties north and south of Blithbury Road, near the junction with Hadley Gate Lane (comprising six existing properties and one proposed development (16/00753/PND)) will be in proximity to the construction of the Proposed Scheme. The works will include Blithbury Central cutting, Hadley Gate Lane diversion and Blithbury Road realignment. These works will result in significant noise effects during the daytime on the seven properties due to site establishment (including demolitions), utility diversions, earthworks and the movement of vehicles. The properties will experience significant visual effects due to views of the road diversion, the construction of route of the Proposed Scheme and stockpiles of materials. In addition, the use of Blithbury Road as a construction traffic route will result in a significant increase in HGVs passing the properties. The noise, visual and HGV effects will result in an in-combination effect on the amenity of residents of these seven properties for up to two years and 10 months in total. This will result in a major adverse effect, which is significant.
- 6.4.9 Residential properties in Stockwell Heath (including the proposed development 16/00462/COU) will be in proximity to the construction of the Proposed Scheme. The works will include the Stockwell Heath embankment, Newlands Lane realignment and Moor Lane diversion. The south-facing properties will experience significant visual effects due to views of the construction of the above elements, stockpiles of materials and the movement of construction vehicles along the site haul route. These works will also result in significant daytime noise effects at six of the properties due to site establishment, earthworks, overbridge construction, and the movement of vehicles. The presence of a site haul route adjacent to the Stockwell Heath embankment will result in a significant increase in HGVs passing the six properties to the south of Stockwell Heath. The noise, visual and HGV effects will result in an in-combination effect on the amenity of residents of six properties in Stockwell Heath for up to three years and three months in total. This will result in a major adverse effect, which is significant.

Community facilities

- 6.4.10 Utility works associated with raising of an existing National Grid transmission 400kV overhead power line, located to the south of Kings Bromley, will temporarily require areas of the access road at Hillcrest Oaklands College (including additional accommodation proposed under development application 13/00270/FULM), in Kings Bromley for up to nine months. The temporary loss of this small area of land will not impact on the ability of the pupils to study at the college and access will be

maintained throughout the construction works. This will result in a minor adverse effect, which is not significant.

- 6.4.11 The Four Seasons Nature Study Centre, located to the south of the A513 Rugeley Road, west of Kings Bromley will be in proximity to the construction of the Proposed Scheme. The works will include the River Trent viaduct and the associated satellite compound. The A513 Rugeley Road will be used as a construction traffic route to access the River Trent viaduct and Bourne embankment satellite compounds. These works will result in significant visual effects from areas of the Four Seasons Nature Study Centre where there will be views out of the site, across the car park to more elevated parts of the River Trent viaduct. In addition, a significant adverse noise effect has been identified at Four Seasons Nature Study Centre on a precautionary basis. The use of the A513 Rugeley Road as a construction traffic route will result in a significant increase in HGVs passing the centre. The visual, noise and HGV effects will result in an in-combination effect on the amenity for users of parts of Four Seasons Nature Study Centre for approximately four years in total. This will result in a major adverse effect, which is significant.

Recreational facilities

- 6.4.12 Access routes for utility works associated with raising of an existing National Grid transmission 400kV overhead power line will temporarily require areas of Kings Bromley Marina for up to nine months. The temporary loss of these small areas of land will not prevent the marina users accessing the marina or their boats. Access will be maintained throughout the construction works. This will result in a negligible adverse effect, which is not significant.
- 6.4.13 The construction of the 132kV power line from the substation at Rugeley Power Station to the Newlands Lane auto-transformer station will require horizontal directional drilling underneath Lakeside Golf Club, adjacent to Rugeley Power Station. These works will not prevent use of the golf course. This will result in a negligible adverse effect, which is not significant.

Open space and public rights of way

- 6.4.14 Part of Trentside Meadows (approximately 4.1ha) is located within land required for the construction of the River Trent viaduct. In addition, approximately 4.8ha of the site will be isolated from the rest of Trentside Meadows during the construction period as there will be no access through or across the construction area. This represents approximately 32% of the open space in total that will not be accessible for public use or for agricultural grazing during the construction period. The construction of River Trent viaduct will take approximately three years and six months to complete. The income generated from grazing is integral to providing funding for the activities undertaken by CHADS at the Trentside Meadows site and their four other sites, and this loss of land is likely to impact the charity's ability to raise this income. The Secretary of State will compensate the charity for this loss of income in accordance with the Compensation Code. Furthermore, activities that take place within the area of Trentside Meadows lost to the Proposed Scheme take place infrequently and could be accommodated within other parts of the site during the construction period. This loss of 32% of Trentside Meadows for approximately three years and six months will result in a minor adverse effect, which is not significant.

- 6.4.15 Within the remaining area of Trentside Meadows, the construction of the Proposed Scheme will result in significant adverse visual effects due to the construction of the River Trent viaduct being highly prominent in views across the Trent valley. In addition, the presence of site haul routes alongside the River Trent viaduct will result in a significant increase in HGVs passing within Trentside Meadows. The combination of visual and HGV effects will result in an in-combination effect on the amenity of users of Trentside Meadows for up to two years and five months in total. This will result in a major adverse effect, which is significant.
- 6.4.16 The Way for the Millennium (including Mavesyn Ridware Footpath 30, Hamstall Ridware Footpath 3 and School Lane) will be temporarily diverted during the period of construction of the River Trent viaduct, however it will remain accessible throughout the construction period. This will result in a negligible adverse effect, which is not significant.
- 6.4.17 The works to divert Moor Lane will require a temporary diversion of the Rugeley to Colton Circular Walk. Access along the Rugeley to Colton Circular Walk will remain available throughout construction. This will result in a negligible adverse effect, which is not significant.
- 6.4.18 The duck pond at Stockwell Heath will be in proximity to the construction of the Proposed Scheme. The works will include the Stockwell Heath embankment, Newlands Lane realignment and Moor Lane diversion. Visitors to the duck pond will experience significant visual effects due to views of the construction of the above elements, stockpiles of materials and the movement of construction vehicles along the site haul route. The presence of a site haul route adjacent to the Stockwell Heath embankment will result in a significant increase in HGVs passing the open space. The combination of visual and HGV effects will result in an in-combination effect on the amenity of visitors to the duck pond at Stockwell Heath for up to two years and seven months in total. This will result in a major adverse effect, which is significant.

Permanent effects

Residential properties

- 6.4.19 The construction of the Kings Bromley viaduct will require the demolition of one residential property, The Byre, on Shaw Lane, south-west of Kings Bromley. This residential property will be permanently lost.
- 6.4.20 The construction of the Blithbury Central cutting will require the demolition of two residential properties, Hadley Gate Cottage and Edlyn Cottage, at Hadley Gate. These residential properties will be permanently lost. The loss of these two residential properties represents a high proportion of this small community of only nine residential properties (including the proposed residential property 16/00747/PND). Therefore, this loss from the housing stock will have a moderate adverse effect, which is significant at the community level.

Community facilities

- 6.4.21 No permanent effects on community facilities are anticipated in the Fradley to Colton area.

Recreational facilities

- 6.4.22 A balancing pond for highway drainage and associated turning head, a new access road to Dimble Cottage and mitigation planting will require one field from the Reindeer Lodge. This will result in the permanent loss of approximately 1.1ha (10%) of land at Reindeer Lodge. The loss of this field will not change the ability of the site to carry out its visitor activities. This will be a minor adverse effect, which is not significant. Impacts on the agricultural viability of the site are assessed in Section 4, Agriculture, forestry and soils.

Open space and public rights of way

- 6.4.23 Once construction of the River Trent viaduct is complete, access will be available beneath the viaduct, so land required from Trentside Meadows for construction will be returned to CHADS and will be available to be returned to its former use, with the exception of small areas for the viaduct piers. This will result in a negligible effect, which is not significant.
- 6.4.24 The Way for the Millennium (including Mavesyn Ridware Footpath 30, Hamstall Ridware Footpath 3 and School Lane) will be permanently diverted around a pier of the River Trent viaduct. This will result in a negligible effect, which is not significant.
- 6.4.25 The Rugeley to Colton Circular Walk (including Colton Footpath 52 and Moor Lane) will be permanently diverted, and will no longer enter Stockwell Heath. This will result in a negligible effect, which is not significant.

Other mitigation measures

- 6.4.26 No further mitigation measures are proposed in the Fradley to Colton area.

Summary of likely residual significant effects

- 6.4.27 The construction of the Proposed Scheme will result in significant temporary in-combination effects on the following resources:
- eight residential properties around Rileyhill due to the combination of visual and HGV effects;
 - five residential properties along Shaw Lane and A513 Rugeley Road, south-west of Kings Bromley due to the combination of noise and visual effects;
 - Four Seasons Nature Study Centre due to the combination of visual, noise and HGV effects;
 - Trentside Meadows due to the combination of visual and HGV effects;
 - five residential properties in Pipe Ridware due to the combination of noise and visual effects;
 - seven residential properties north and south of Blithbury Road due to a combination of noise, visual and HGV effects;
 - six residential properties in Stockwell Heath due to a combination of noise, visual and HGV effects; and

- the duck pond at Stockwell Heath due to a combination of visual and HGV effects.

6.4.28 In addition, there will be permanent adverse effects on the community north and south of Blithbury Road due to the demolition of two residential properties at Hadley Gate.

Cumulative effects

6.4.29 Community wide effects occur where a number of individual impacts on resources come together within a location and have a wider impact on the community, such that they change the experience of a significant proportion of people within that community.

6.4.30 At Stockwell Heath, the construction of the Proposed Scheme will result in an in-combination effect at six residential properties in the hamlet, as well as at the duck pond in the centre of the settlement. Both of the roads that provide access into the hamlet will need to be altered to accommodate the Proposed Scheme. It is expected that the whole community will be affected in some way during construction of the Proposed Scheme, and this will, therefore, result in a community wide effect at Stockwell Heath.

6.4.31 There will be no cumulative effects arising from the combined construction of the Proposed Scheme and HS2 Phase One.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 The following measures have been incorporated into the Proposed Scheme as part of the design development process to avoid or minimise, insofar as reasonably practicable, environmental impacts during operation:

- noise fence barriers along the Pyford North embankment, Kings Bromley viaduct, River Trent viaduct and Bourne embankment to limit noise impacts on Kings Bromley;
- a noise fence barrier along the River Trent viaduct and Pipe Ridware embankment to limit noise impacts on Pipe Ridware;
- a landscape bund near the Blithbury South and Blithbury Central cuttings to limit the visual impacts on Blithbury;
- a landscape bund and noise fence barrier near the Blithbury North cutting to limit the noise and visual impacts on Colton; and
- a landscape bund and a noise fence barrier along the Stockwell Heath embankment and cutting and Moreton South embankment to limit noise and visual impacts on Stockwell Heath and Hamley Heath.

Assessment of impacts and effects

Residential properties

- 6.5.2 A group of residential properties south of Kings Bromley (around Rileyhill, Shaw Lane and Crawley Lane) will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at 22 residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including long range views of the Bourne embankment and River Trent viaduct, overhead line equipment and noise barriers, which will form a new horizon in the south-west. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.
- 6.5.3 Approximately 12 residential properties in Nethertown, north-west of Kings Bromley will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the 12 residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including long range views of the Bourne embankment and River Trent viaduct, including overhead line equipment and noise barriers. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.
- 6.5.4 Approximately seven residential properties north and south of Blithbury Road (including the proposed development 16/0074/PND) will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including close range views of the diverted Hadley Gate Lane and balancing pond and access road and mid-range views of the Blithbury central cutting, Blithbury Road realignment and Blithbury Road overbridge. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.
- 6.5.5 Approximately eight residential properties in Pipe Ridware will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including mid-range views of the River Trent viaduct, Pipe Ridware embankment, overhead line equipment and noise barriers. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.
- 6.5.6 A group of residential properties in Stockwell Heath and Hamley House will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at 20 residential properties during the

daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including foreground views of the Blithbury North cutting and Stockwell Heath embankment, including overhead line. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

- 6.5.7 A group of approximately 11 residential properties in Colton (including the proposed barn conversion 14/01231/PND) will be in proximity to the route of the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All 11 of the properties will experience significant adverse visual effects due to views of the Proposed Scheme including mid-ground views of the Stockwell Heath embankment, the Moor Lane diversion, an access road, noise barriers and overhead line equipment. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

Community facilities

- 6.5.8 Parts of the Four Seasons Nature Study Centre, located to the south of the A513 Rugeley Road, west of Kings Bromley will be in proximity to the construction of the Proposed Scheme. The operation of the Proposed Scheme will result in significant visual effects from some areas of the Four Seasons Nature Study Centre, where there will be views out of the site across the car park to more elevated parts of the River Trent viaduct. In addition, a significant adverse noise effect has been identified at Four Seasons Nature Study Centre on a precautionary basis. The visual and noise effects will result in an in-combination effect on the amenity for users of parts of Four Seasons Nature Study Centre for approximately four years in total. This will result in a moderate adverse effect, which is significant.

Recreational facilities

- 6.5.9 No significant operational effects on recreational facilities are anticipated in the Fradley to Colton area.

Open space and public rights of way

- 6.5.10 No operational effects on open space or public rights of way are anticipated in the Fradley to Colton area.

Other mitigation measures

- 6.5.11 No other mitigation measures are proposed.

Summary of likely residual significant effects

- 6.5.12 The operation of the Proposed Scheme will result in significant permanent in-combination effects on the following resources:

- twenty-five residential properties south of Kings Bromley due to the combination of noise and visual effects;

- twelve residential properties in Nethertown due to the combination of noise and visual effects;
- seven residential properties north and south of Blithbury Road due to the combination of noise and visual effects;
- eight residential properties in Pipe Ridware due to the combination of noise and visual effects;
- twenty residential properties in Stockwell Heath and Hamley House due to the combination of noise and visual effects;
- eleven residential properties in Colton due to the combination of noise and visual effects; and
- Four Seasons Nature Study Centre due to the combination of visual and noise effects.

Cumulative effects

- 6.5.13 No cumulative effects on community resources have been identified in the Fradley to Colton area.

Monitoring

- 6.5.14 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 6.5.15 There are no area-specific community monitoring requirements during operation of the Proposed Scheme. Any area-specific operational monitoring requirements in relation to air quality effects, noise and vibration effects, traffic effects and visual effects that have contributed to the in-combination assessments, are described in the relevant topic chapters.

7 Cultural heritage

7.1 Introduction

- 7.1.1 This section of the report provides a description of the current baseline for heritage assets and the likely impacts and significant effects resulting from the construction and operation of the Proposed Scheme within the Fradley to Colton area. Consideration is given to the extent and value (significance) of heritage assets including archaeological and palaeoenvironmental remains, historic buildings, the built environment and historic landscape.
- 7.1.2 Engagement has been undertaken with Historic England and Staffordshire County Council (SCC). The purpose of this engagement has been to understand the nature of heritage assets within the area, to obtain relevant baseline information and to inform the design development and assessment of the Proposed Scheme.
- 7.1.3 Throughout this section, heritage assets within the study area are identified with a unique reference code (for example FRC001). Further detail on these heritage assets can be found in the gazetteer in Volume 5: Appendix CH-002-001. Detailed reports on cultural heritage baseline and historic landscape character within the Fradley to Colton area are contained in the Volume 5 Appendices. These are:
- Appendix CH-001-001 – Cultural heritage baseline report;
 - Appendix CH-002-001 – Gazetteer of heritage assets; and
 - Appendix CH-003-001 – Cultural heritage impact assessment table.
- 7.1.4 In addition, there are two route-wide cultural heritage appendices:
- Appendix CH-005-000 – Historic landscape character report; and
 - Appendix CH-006-000 – Geoarchaeological desk study report.
- 7.1.5 Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Cultural heritage Map Book.
- 7.1.6 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 7.1.7 In addition, survey reports for the Fradley to Colton area, incorporating geophysical survey and remote sensing studies, are available in Background Information and Data (BID)⁷¹, (see BID-CH-004-001: Cultural heritage survey reports).

⁷¹ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data. Available online at: www.gov.uk/hs2

7.2 Scope, assumptions and limitations

- 7.2.1 The scope, key assumptions and limitations for the cultural heritage assessment are set out in full in Volume 1 (Section 8), the Scope and Methodology Report (SMR)⁷², and the SMR Addendum⁷³.
- 7.2.2 The assessment focuses on the extent to which the Proposed Scheme will affect designated and non-designated heritage assets. Impacts on assets as a result of the Proposed Scheme will occur largely through the physical removal and alteration of heritage assets and changes to their setting.
- 7.2.3 The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out is defined as the land required for the Proposed Scheme plus 500m. This is referred to in the remainder of this assessment as the 500m study area.
- 7.2.4 The setting of all designated heritage assets within the zone of theoretical visibility (ZTV) up to 2km from the land required for the Proposed Scheme has been considered. This is referred to in the remainder of this report as the 2km study area.
- 7.2.5 Impacts on the setting of heritage assets within the ZTV beyond 2km have been considered where professional judgement indicates that a significant effect may occur. No such impacts have been identified within the Fradley to Colton area.
- 7.2.6 The cultural heritage methodology includes the consideration of the intra-project effects of a number of topic assessments, for example, landscape and visual, ecology and biodiversity, and water resources and flood risk. Consequently, these interactions have been included in the assessment of impacts and effects.
- 7.2.7 Where noise is considered, this is within the context of the contribution that this makes to the heritage significance of the assets, and is not a reference to absolute noise levels or sound, or the noise or vibration impacts on the health and quality of life of people who live in or visit the area. Where measurements identified in the sound noise and vibration studies⁷⁴ indicate a significant effect, this has triggered an assessment of the contribution that tranquillity makes to the significance of the heritage asset.
- 7.2.8 The baseline studies informing this assessment have been drawn from a wide and comprehensive range of information sources. These have been supported by a programme of non-intrusive survey, including extensive geophysical survey.
- 7.2.9 Heritage assets within the land required to construct the Proposed Scheme are assumed to require complete removal and the assessment has been undertaken on that basis. With respect to overhead line diversions/realignments in particular, it is likely that the majority of the heritage assets can in fact be retained, as the land is only required to allow for raising or lowering of pylons and/or re-stringing of cables, or to provide an access route to the works.

⁷² Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

⁷³ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

⁷⁴ Volume 5: Appendix SV-002-001: CA1 Fradley to Colton. Sound, noise and vibration report, Tables 15 and 16.

- 7.2.10 Common features of the historic landscape such as marl pits, field boundaries and former areas of ridge and furrow are not individually considered and have not been included in the baseline, and impacts on them are not assessed individually. However, they are considered to contribute to the historic landscape character of the area and are considered within the overall assessment of impacts on historic landscape.
- 7.2.11 In undertaking the assessment, the following limitations were identified:
- although the LiDAR⁷⁵ data examined covers the majority of the 500m study area, there were some areas for which data was unavailable⁷⁶; and
 - not all areas within the 2km study area were available for field survey (due to limited land access or site conditions) such as site reconnaissance visits and geophysical survey⁷⁷.
- 7.2.12 Limitations in the LiDAR data were not considered to be of a scale or significance that would have any impact on the robustness of the assessment.
- 7.2.13 Where survey data are limited, a precautionary baseline has been built up according to the guidance reported in the SMR and the SMR Addendum.

7.3 Environmental baseline

Existing baseline

- 7.3.1 Documentary baseline data was collated from a variety of sources in compiling this assessment, as set out in Volume 5: Appendix CH-001-001, including:
- Staffordshire Historic Environment Record (HER)⁷⁸;
 - Staffordshire Record Office collections;
 - material held at the William Salt Library, Stafford;
 - historic Ordnance Survey mapping; and
 - other published sources (full references are provided in Volume 5: Appendix CH-001-001).
- 7.3.2 In addition to collating this baseline data, the following surveys were undertaken, as set out in BID-CH-004-001: Cultural heritage survey reports:
- non-intrusive geophysical surveys;
 - targeted fieldwalking surveys;
 - detailed and systematic transcription of remote sensing data including LiDAR and aerial photographs;

⁷⁵ Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.

⁷⁶ For details see the Remote Sensing Survey Report, in the Background Information and Data document, BID-CH-004-001.

⁷⁷ For details see the Geophysical Survey Report, in the Background Information and Data document, BID-CH-004-001.

⁷⁸ Staffordshire Historic Environment Record. Available online at: <https://www.staffordshire.gov.uk/environment/eLand/planners-developers/HistoricEnvironment/Historic-Environment-Record/HistoricEnvironmentRecord.aspx>

- walkover and site reconnaissance of sites and buildings of potential heritage significance; and
- setting assessments of all accessible designated heritage sites within 2km of the land required for the Proposed Scheme.

Designated assets

7.3.3 The following designated heritage assets are located partially or wholly within the land required for the Proposed Scheme (see Volume 5: Cultural heritage Map Book: Maps CH-02-201 to CH-02-202a):

- Fradley Junction Conservation Area (FRC007); and
- Trent and Mersey Canal Conservation Area (FRC008).

7.3.4 The following designated heritage assets are located partially or wholly within the 2km study area (see Volume 5: Cultural heritage Map Book: Maps CH-01-201 to CH-01-205a):

- four scheduled monuments: a moated site⁷⁹ and plunge bath at the Manor House, Streethay (FRC217); a Neolithic causewayed enclosure at Fradley and Streethay (FRC003); the moated site of Handsacre Hall (FRC055); and the Manor House, Hamstall Ridware (part of Hamstall Ridware Conservation Area (FRC112));
- six Grade I listed buildings: Church of St Nicholas, Mavesyn Ridware and Gatehouse at Old Hall, Mavesyn Ridware (both part of Mavesyn Ridware Conservation Area (FRC097)); Church of St Michael and All Angels, Hamstall Ridware (part of Hamstall Ridware Conservation Area (FRC112)); Church of All Saints, Kings Bromley (FRC068); and Blithfield Hall and the Church of St Leonard, Blithfield (FRC142);
- nineteen Grade II* listed buildings: the Church of St John, Armitage with Handsacre (FRC151); The Church of St Peter, Yoxall (FRC154); the Church of St Augustin, Rugeley (FRC224); the Church of St Mary, Colton (FRC120); the Old Hall, Mavesyn Ridware (FRC059); Hamstall Hall and associated gatehouse and tower, Hamstall Ridware (all three part of Hamstall Ridware Conservation Area (FRC112)); Hanch Hall (FRC014); the main gateway and orangery at Blithfield Hall (both part of FRC142); The Old Rectory, Rake End (FRC101); Brereton Hall (part of Brereton Conservation Area (FRC225)); Colton House (part of FRC120); Hill Top Farmhouse and Hill Top Thatched Cottages (both part of FRC150); High Bridge, Mavesyn Ridware (FRC060); the Hollies, Yoxall (FRC154); and Brindley Bank Pumping Station (FRC147);
- five Grade II listed buildings within the Trent and Mersey Canal Conservation Area (FRC008): Trent and Mersey Canal milepost, south-east of Woodend Lock (FRC009); Trent and Mersey Canal Bridge 53 at Woodend Lock (FRC010); Trent and Mersey Canal Woodend Lock Cottage (FRC011); Bridge number 60,

⁷⁹ A platform, generally square, surrounded by a ditch marking the former site of a medieval manorial/high status residence.

Rugeley (FRC201); and Viaduct over Trent and Mersey Canal, Rugeley (FRC200);

- six Grade II listed buildings within the Fradley Junction Conservation Area (FRC007): Bridge Number 51 and lock; Bridge 52 and Shade House Lock; Middle Lock; The Swan and attached buildings; Wharf House; and Ivy Leigh and attached cottages;
- individual Grade II listed buildings comprising: Alrewas Hayes Farmhouse (FRC017); Former farmhouse, east of Hanch Hall Farmhouse (FRC015); Hunger Hill Farmhouse (FRC111); Woodhouse Farmhouse (FRC089); Bentley Hall Farmhouse (FRC092); Bentley Hall Cottage (FRC093); Pipe Ridware Hall and associated garden walls, gate piers and dovecot remains (all four part of FRC078); Hamley House, and gate piers and attached garden wall to the south-west (both part of FRC127); Lea Hall Farmhouse building (FRC137); Wheelwright Cottage and attached workshop (FRC079); Lea Hall Farm Cottage (FRC138); the High Bridge east of Hill Ridware (FRC060); a chimney stack at Littlehay Manor (FRC122); the Seedy Mills Pumping Station (FRC013); an ornamental bridge across Rising Brook (FRC229); a grotto at Hagley Hall (FRC230); and roadside mileposts on Tewnalls Lane (FRC012) and the A513 Rugeley Road (FRC047);
- a further 167 Grade II listed buildings, predominantly within the settlements at: Kings Bromley (FRC066 and FRC067); Admaston (FRC 139); Armitage with Handsacre (FRC052); Brereton (part of Brereton Conservation Area (FRC225)); Mavesyn Ridware (FRC059); Hill Ridware (FRC098, FRC099 and FRC100); Rugeley (FRC224 and FRC227); Rake End (FRC102 and FRC103); Hamstall Ridware (FRC112); Yoxall (FRC154); and Morrey (FRC155); and
- eleven further conservation areas: Admaston and Blithfield Conservation Area (FRC146); Brereton Conservation Area (FRC225); Rugeley Conservation Area, Sheepfair/Bow Street Conservation Area and Church Street Conservation Area (all three part of FRC227); Talbot Street/Lichfield Road Conservation Area (FRC228); Longdon Green Conservation Area (FRC177); Mavesyn Ridware Conservation Area (FRC059); Hamstall Ridware Conservation Area (FRC112); Yoxall Conservation Area (FRC154); and Colton Conservation Area (FRC120).

Non-designated assets

- 7.3.5 All non-designated heritage assets within the 500m study area are listed in the gazetteer in Volume 5: Appendix CH-002-001, and identified on Maps CH-01-201 to CH-01-205a (Volume 5: Cultural heritage Map Book).
- 7.3.6 The following non-designated assets of moderate value lie wholly or partially within the land required for the Proposed Scheme:
- buried archaeological remains of two possible Bronze Age round barrows, north-west of Fradley Wood, Alrewas (FRC018);

- buried archaeological remains of one probable Bronze Age round barrow and four rectilinear enclosures of probable Iron Age or Roman date, south of Ashby Sitch (FRC019);
- buried archaeological remains from multiple periods at Bourne Brook including: several Bronze Age round barrows; land boundaries and enclosures defined by pit alignments of probable Iron Age date; rectilinear enclosures of probable Iron Age or Roman date; and undated field boundaries (FRC020);
- buried archaeological remains of three Bronze Age round barrows, a pit alignment of probable Iron Age date, and undated linear features, to the south of Kings Bromley Wharf (FRC021);
- buried archaeological remains of nine Bronze Age round barrows and field system, and trackway defined by pit alignments of probable Iron Age date, Eastfields, Kings Bromley (FRC158);
- buried archaeological remains of a Bronze Age round barrow within an enclosure of probable Iron Age or Roman date, west of Shaw Lane Farm (FRC029);
- standing earthwork remains of the deserted medieval and post-medieval settlement of Crawley, including probable house platforms, track ways and ridge and furrow (FRC031);
- buried archaeological remains of a Bronze Age barrow cemetery containing 12 round barrows, north-west of Echills, Kings Bromley (FRC040);
- buried archaeological remains of a pit alignment of probable Iron Age date, north-west of Echills (FRC038);
- buried archaeological remains of a rectangular enclosure of probable prehistoric date, north-east of Handsacre (FRC039);
- buried archaeological remains of a prehistoric enclosure, north-east of Rugeley (FRC178);
- buried archaeological remains of four Bronze Age burnt mounds at Lount Farm, Colton (FRC133);
- buried archaeological remains of a medieval glassworks at Lount Farm, Colton (FRC134);
- buried archaeological remains of an east-west aligned pit alignment of probable Iron Age date, north-east of Handsacre (FRC042);
- a complex of multi-period features near Glebe Farm, comprising of two possible Neolithic causewayed enclosures, five Bronze Age round barrows, a pit alignment of probable Iron Age date, and an undated double-ditched trackway (FRC044);
- buried archaeological remains of two Bronze Age round barrows and undated pits and field boundaries, east of Pipe Ridware Hall (FRC074);

- buried archaeological remains of pits, linear features, and a Bronze Age round barrow of prehistoric or Romano-British round house, north of Pipe Ridware (FRCo84);
- standing earthwork remains at Quinton's Orchard of a medieval moated site and fishpond, which may have been a manorial residence (FRCo88); and
- buried archaeological remains of a rectilinear enclosure of probable Iron Age or Roman date, to the west of Pipe Wood Lane, Mavesyn Ridware (FRCo95).

7.3.7 The following non-designated assets of low value lie wholly or partially within the land required for the Proposed Scheme:

- RAF Lichfield/Fradley Airfield (FRCo04);
- a Second World War pillbox, west of Fradley (FRCo194);
- the High Bridges to Uttoxeter turnpike road (FRCo24);
- a palaeochannel – the former route of a watercourse – situated immediately north-west of Rileyhill Farm (FRCo199);
- the earthwork remains of medieval ridge and furrow, Kings Bromley (FRCo26);
- a former post-medieval field boundary, south of Kings Bromley (FRCo27);
- a post-medieval water meadow, to the north of Rugeley (FRCo180);
- the location of a former post-medieval water meadow, west of Kings Bromley Wharf (FRCo195);
- a 19th century cottage called Cranberry (FRCo148);
- buried archaeological remains of a possible pre-enclosure road, south of Kings Bromley (FRCo45);
- buried archaeological remains of a possible multi-period field system, south of Kings Bromley (FRCo30);
- Shaw Lane Farm, a 19th century courtyard farm, south of Kings Bromley (FRCo71);
- a late 19th century milestone on the A515 Lichfield Road, Kings Bromley (FRCo50);
- buried archaeological remains of a field system of probable medieval date, north-east of Echills, Kings Bromley (FRCo32);
- surviving earthworks of a post-medieval water meadow, north of Kings Bromley (FRCo160);
- buried archaeological remains of undated field systems to the south-west, west and north-west of Echills, Kings Bromley (FRCo33 and FRCo34);
- the route of the former Rugeley and Alrewas turnpike road (FRCo62);

- the route of the former Lichfield to Kings Bromley turnpike road (FRCo63);
- a landscape park around the manor house at Kings Bromley, likely to have been established in the post-medieval period (FRCo64);
- earthwork remains of narrow ridge and furrow located immediately to the east of Stockwell Heath (FRC117);
- buried archaeological remains of boundaries relating to a medieval to post-medieval field system, east of Stockwell Heath (FRC145);
- buried archaeological remains of an undated field system, west of Kings Bromley (FRC096);
- buried archaeological remains of an undated field system, north-west of Echills, Kings Bromley (FRCo41);
- earthwork remains of a post-medieval water meadow at Pipe Ridware (FRCo72);
- post-medieval water meadow, north of Colton (FRC126);
- buried archaeological remains, visible as cropmarks, associated with the site of the former medieval and post-medieval manor house believed to be on the site of Colton Hall Farm, south-east of Colton (FRC174);
- the possible site of a medieval deer park lying around Colton Hall Farm (FRC153);
- buried archaeological remains, visible as cropmarks, of a medieval or post-medieval hollow way that ran along the eastern side of the B5013 Uttoxeter Road (FRC176);
- buried archaeological remains and some surviving earthwork remains of a hollow way that ran along the western side of the B5013 Uttoxeter Road (FRC175); and
- surviving earthwork remains of a post-medieval water meadow near Lount Farm, Colton (FRC132).

7.3.8

There are a number of non-designated heritage assets within the 500m study area, the setting of which may be affected by the Proposed Scheme, as follows:

- Echills, a farmstead, which is purported to have been the stud farm for Kings Bromley Manor, that retains most of its historic farm buildings (FRC166);
- Jongham's Cottage, an 18th or 19th century farmworkers cottage, north-west of Colton (FRC136);
- Common Farm, a 19th century farmstead that retains many of its historic farm buildings, east of Rileyhill (FRC163);
- Rileyhill Farm, a 19th century farmstead that retains most of its historic farm buildings, Rileyhill (FRC164);

- Woodgate, a 19th century farmstead that retains most of its historic farm buildings, east of Kings Bromley (FRC165);
- former Church of St James (Ridware Theatre), churchyard and fragment of medieval churchyard cross, Pipe Ridware (FRCo80);
- Parva House, a 19th century farmstead, Pipe Ridware (FRCo81);
- Colton Hall Farm, a 19th century farmstead that retains many of its historic farm buildings, south-east of Colton (FRC173);
- Littlehay Manor Farmhouse, a 19th century farmstead, Colton (FRC123); and
- Woodend Common Barn, a late 19th century barn in fields, west of Fradley Junction (FRCo16).

Historic landscape

7.3.9

Analysis has been undertaken of the historic landscape character within and around the land required for the Proposed Scheme. This was based on the outputs of the Staffordshire County Council (SCC) Historic Landscape Characterisation (HLC), geological and geographical data sources, site visits and professional judgement. For the purpose of assessment the Proposed Scheme has been divided into a number of Historic Landscape Character Areas (HLCAs) (see Volume 5: Appendix CH-005-000). Within the Fradley to Colton area these are as follows:

- HLCA 1 Fradley Heath: this HLCA extends across floodplain gravels to the north-east of Lichfield, and incorporates the settlement and commercial development at Fradley. It remained largely unenclosed heathland until the end of the 18th century with the construction of the Trent and Mersey and Coventry canals. It is an area that has seen extensive change and development within recent decades and the heritage value of this HLCA is considered to be low;
- HLCA 2 Kings Bromley, the Trent Valley and the Ridwares: this HLCA extends across the Trent floodplain either side of Kings Bromley. It contains a regionally significant concentration of important prehistoric remains, indicated by an extensive network of cropmarks. This is a reflection of extensive arable cultivation on free-draining Pleistocene gravels. The fields retain many of their early enclosure boundaries. The area also contains the historic villages of Mavesyn Ridware, Pipe Ridware and Orgreave. The heritage value of this HLCA is considered to be moderate;
- HLCA 3 Rugeley, Armitage and Handsacre: this HLCA includes the section of the Trent Valley to the west of the Kings Bromley floodplain. It incorporates the medieval settlements at Rugeley and Armitage and Handsacre, which have been largely obscured by industrial and modern development, including Rugeley Power Station and major linear infrastructure. The heritage value of this HLCA is considered to be low; and
- HLCA 4 Colton and Hamstall Ridware: this HLCA extends across the higher ground between the Rivers Trent and Blithe, an area of extensive arable

farmland. It contains traces of at least two deer parks, at Stockwell Heath and Colton Hall. The field systems exhibit a significant level of historic legibility, in particular through the survival of extensive piecemeal enclosure believed to date to the medieval period and earlier parts of the post-medieval period. The heritage value of this HLCA is considered to be low.

Cultural heritage overview

- 7.3.10 This overview of the cultural heritage baseline is drawn from the more detailed analysis set out in the Cultural heritage baseline report (Volume 5: Appendix CH-001-001). This also contains references and a timeline setting out the chronological limits of the periods referred to below. This overview refers to heritage assets within the 500m study area, unless specified otherwise.
- 7.3.11 There are a number of river and stream valleys along the route of the Proposed Scheme, containing Pleistocene (Ice Age) fluvio-glacial and River Terrace Deposits and/or deposits of Holocene (post-Ice Age) Alluvium. The largest, and that with the greatest potential for archaeological significance, is the Trent Valley where the fluvio-glacial sands and gravels extend from Fradley to Handsacre. The similarly composed river-terrace deposits that flank both sides of the River Trent are likely to have originated as seasonal outwash deposits at the edge of the late-Devensian ice-sheet. As such, they have the potential to protect earlier archaeological and palaeoenvironmental remains, contain redeposited artefacts of earlier date, and to contain in-situ archaeological and palaeoenvironmental remains of Upper Palaeolithic date. In particular, such deposits may occur in the vicinity of the borrow pits associated with the Proposed Scheme. Holocene Alluvium and waterlogged Peat have the potential to contain exceptionally well-preserved prehistoric archaeological and palaeoenvironmental remains dating back over the past 10,000 years. The valleys of Pyford Brook, Bourne Brook, the River Trent and Moreton Brook all contain Holocene alluvial deposits.
- 7.3.12 A complete quartzite handaxe of Lower or Middle Palaeolithic date was recovered during field walking in August 2011 at an unknown location within the Kings Bromley parish and hints at the potential for similar finds within the study area. There is also evidence of potential Mesolithic activity within the study area from a single diffuse scatter of worked flint to the north of Rake End (FRC105) that contained Mesolithic or Early Neolithic cores, flakes and blades. Where systematic field walking surveys have been undertaken in various landscapes across the West Midlands, they have revealed a preference during the Mesolithic and Early Neolithic for settlement on well-drained elevated terrain close to water sources. The apparent absence of Mesolithic activity within the study area is, therefore, likely to be a result of insufficient systematic surface collection, rather than an accurate reflection of past activity.
- 7.3.13 There is a network of cropmarks across the fluvio-glacial sands and gravels that extend from Fradley to Handsacre, including within the area of the borrow pits associated with the Proposed Scheme, and along the River Terrace Deposits that flank both sides of the River Trent within and beyond the study area. These cropmarks comprise a single multi-period landscape that contains monuments and other remains that range in date from the Early Neolithic to the post-medieval period.

- 7.3.14 An ovoid enclosure within the study area to the north-east of Handsacre (part of FRC044), which is defined by a single interrupted ditch circuit, is likely to be an Early Neolithic causewayed enclosure. A similarly shaped and sized enclosure defined by a single continuous ditch approximately 150m to the west of the possible causewayed enclosure (also part of FRC044) could also be of Neolithic date. A triple-ditched causewayed enclosure 10 times as large, a non-designated asset outside the study area, is visible as a cropmark on the north bank of the River Trent at Mavesyn Ridware, approximately 1.2km to the west of the Proposed Scheme. There is a third causewayed enclosure in the Trent Valley to the west of Alrewas (FRC003). There are cropmark remains of a possible Neolithic cursus monument⁸⁰ at Hill Ridware (FRC162), and to the west of Pipe Ridware Hall (FRC170). These monuments suggest a Neolithic population engaged in significant ritual/funerary activity in this part of the Trent Valley.
- 7.3.15 The evidence for Bronze Age activity within the study area is extensive, and is primarily funerary and focused upon watercourses. This includes a pair of ring ditches⁸¹ adjacent to Pyford Brook (FRC018), between 20 and 40 further ring ditches within a cropmark complex straddling Bourne Brook (FRC020), and at least nine additional ring ditches in a barrow cemetery to the north of Crawley Brook (FRC158). A barrow cemetery, comprising of 12 ring ditches, straddles the unnamed brook that runs north, then north-east, past Tuppenhurst Farm (FRC040), and there are a further five ring ditches close to the south bank of the River Trent, to the north of Handsacre (FRC044). There are two ring ditches at Nethertown to the north of the River Trent (FRC109), two ring ditches to the east of Pipe Ridware (FRC074), three ring ditches to the west of Pipe Ridware (FRC077 and FRC075), and one ring ditch in the field to the south of Bentley Hall Cottage (FRC094). At Colton, the remains of four burnt mounds⁸² of probable Late Bronze Age date have been identified along Moreton Brook (FRC133). There are no certain remains of Bronze Age occupation within the study area. However, it has been argued that within the West Midlands, ring ditches in river terrace locations were sited close to occupation sites, and that contemporary settlements are likely to be present within approximately 50m of a burnt mound.
- 7.3.16 In the West Midlands, the landscape was divided up with physical boundaries for the first time in the Middle Iron Age, and the earliest boundaries were defined by rows of discrete pits (pit alignments) rather than continuous ditches. Within the study area, a number of pit alignments, visible as cropmarks on aerial photographs, run parallel and at right angles to Bourne Brook (FRC020 and FRC021) and Crawley Brook (FRC158) and would appear to divide up the landscape into fields. At Bourne Brook (FRC020), some pit alignments are extended by continuous ditches, suggesting that at least some of the continuous cropmark ditches arrayed across the study area to the south of the River Trent may also be of Iron Age date. To the north of Bourne Brook, several pit alignments not associated with enclosures may have been ranch boundaries (FRC035, FRC036, FRC037, FRC038 and FRC042). There is a single pit alignment within the study area to the north of the River Trent, at Pipe Ridware (part of FRC075), while

⁸⁰ Ritual monuments dating to the Neolithic period comprising avenues formed by parallel bank/ditches which connect to form terminals at either end of the monument. They vary in length and width.

⁸¹ The circular cropmark remains of flattened round barrows.

⁸² The function of burnt mounds is uncertain, although their key elements – burnt stones and lined pits beside water - suggest the heating of water using hot rocks.

other boundaries defined by continuous ditches at and to the north of Pipe Ridware (FRCo83 and FRCo84) are likely to be of Iron Age or Roman date.

- 7.3.17 The cropmark complex at Bourne Brook (FRCo20) also contains several enclosures defined by pit alignments, while a number of rectilinear enclosures adjacent to Ashby Sitch (FRCo19), at Bourne Brook (FRCo20), and to the west of Pipe Wood (FRCo95) are of a similar size and shape to settlement enclosures excavated elsewhere within the West Midlands. The rectilinear cropmark enclosures to the west of Shaw Lane Farm (FRCo29), to the north-east of Handsacre (FRCo39) and the possible enclosures to the east of Woodhouse Farm, Mavesyn Ridware (FRCo90), are also possibly of Iron Age date. There is also cropmark evidence of an Iron Age square barrow at Pipe Ridware (FRCo83), and just outside the study area to the north of Marsh Barn Farm, Handsacre (FRCo171).
- 7.3.18 There is no evidence in the cropmark record for any monuments of distinctively Romanised form, such as villas. However, settlement activity within the study area is evidenced by the presence of Romano-British artefacts found in Kings Bromley (FRCo158), an early Roman mortarium (mixing bowl) recovered near Bourne Brook (FRCo20), and a late-Roman radiocarbon date for charcoal recovered from the cropmark complex to the north of Pipe Ridware (FRCo84). It is also possible that some of the cropmark features described as Iron Age, above, may have carried on in use into the Romano-British period, or have been first constructed then.
- 7.3.19 There are no known physical remains of Early Medieval date within the study area, but documentary and place-name evidence suggests they may exist at Rileyhill, Crawley, Handsacre, Kings Bromley, Pipe Ridware, and Colton.
- 7.3.20 Settlements and manors in and around the study area already existed in 1086 at Kings Bromley, Handsacre, at each of the three Ridwares, and at Colton. Blithbury is first mentioned in documents in the 12th century and Hill Ridware and Rake End in those of the 14th century. It is possible that some of the cropmark field systems within the study area to the south of the River Trent have their origins at this time, a suggestion lent support by the name of one of the farmsteads in their midst: Echills (FRCo166), which derives from an Old English word meaning "land added to an estate".
- 7.3.21 There are two medieval moated sites in the area of Pipe Ridware, one at Quintons Orchard (FRCo88), which is likely to have contained a manor house, and one to the west of Pipe Ridware Hall (FRCo76). The sites of Littlehay Manor House (FRCo124) and possibly the manor house of the de Wasteneys (FRCo172), two of the three medieval manor houses at Colton, both lie within the study area. The remains of one deer park survive to the north and west of Newlands Lane, Colton, and it has been conjectured that a second surrounded the manor house of the de Wasteneys. Also, at Colton there are the archaeological remains of a probable medieval glassworks (FRCo134), which survive under pasture at Mount Farm. Earthworks formerly visible in the field to the north-west of Pipe Ridware Hall (FRCo82) may have been the remains of former house platforms abandoned during the late-medieval period.
- 7.3.22 During the post-medieval period, the medieval open fields were enclosed. North of the River Trent, enclosure was piecemeal, and was affected by means of local exchange and purchase. The chronology of the enclosure here is unknown in detail, but the 17th century origins of many of the farmsteads within the landscape suggests

the process was well underway and perhaps almost complete by that date. To the south of the River Trent, much land was enclosed by Act of Parliament in the 18th and 19th century, which produced a landscape of contemporary farmsteads, fields and lanes. There was agricultural innovation in the form of floated water meadows⁸³, examples of which survive within the study area at Kings Bromley (FRC160), Pipe Ridware (FRC072) and Colton (FRC126 and FRC132).

- 7.3.23 A second major change in the landscape in the post-medieval period resulted from the construction of canals, designed to increase the efficiency of transporting raw materials to producers and finished products to market. The Trent and Mersey Canal (FRC008), opened in 1777, was the second of the country's arterial canals while the need to link Liverpool to London led to the construction of the Coventry Canal (FRC001), which was completed in 1789 and joins the Trent and Mersey Canal at Fradley Junction (FRC007).
- 7.3.24 During the 20th century, several of Staffordshire's country houses, which had developed during the post-medieval period, ceased to be domestic residences. Within the study area, the Kings Bromley Manor (FRC066) was demolished in 1928, and 85% of its landscape park was lost to gravel extraction and a golf course in the later 20th century. A short distance beyond the study area at Colton, Bellamour Hall was entirely demolished and Bellamour Old Hall (both at FRC119) was partially demolished during the 20th century. RAF Lichfield (FRC004), known locally as Fradley Airfield and built between 1939 and 1940, was used to train aircrews for bombing operations using Wellington bombers. The airfield it was closed in 1958.

Future baseline

Construction (2020)

- 7.3.25 Volume 5: Appendix CT-004-000 provides details of the developments in the Fradley to Colton area that are assumed to have been implemented by 2020.
- 7.3.26 HS2 Phase One will be under construction by 2020, which will alter the future baseline conditions for the Proposed Scheme. This will be through the presence of construction equipment (e.g. cranes, vehicles) as well as movement, lights and noise associated with construction and the emerging final form of the Phase One scheme itself. This has the potential to affect heritage assets that fall within the study area of the Proposed Scheme. This is considered in the cumulative assessment of the construction phase of the Proposed Scheme.
- 7.3.27 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for heritage assets.

Operation (2027)

- 7.3.28 Volume 5: Appendix CT-004-000 provides details of the developments in the Fradley to Colton area that are assumed to have been implemented by 2027.
- 7.3.29 The combined effect of the presence of HS2 Phase One during operation as well as noise and movement from trains running along it will alter the future baseline

⁸³ A form of irrigation involving the creation of networks of channels designed to keep agricultural land damp thereby increasing its fertility.

conditions for the Proposed Scheme. This has the potential to affect heritage assets that fall within the study area of the Proposed Scheme. This is considered in the cumulative assessment of the operational phase of the Proposed Scheme.

- 7.3.30 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for heritage assets.

7.4 Effects arising during construction

Avoidance and mitigation measures

- 7.4.1 The design of the Proposed Scheme avoids physical impacts on any scheduled monuments, registered parks or gardens, registered battlefields or listed buildings within the Fradley to Colton area.

- 7.4.2 The following measures have been incorporated into the design of the Proposed Scheme which will reduce impacts on the following assets:

- landscape bunds along the Stockwell Heath cutting which will reduce the visual impact on the Grade II listed Hamley Heath House, gate piers and garden walls (FRC127);
- landscape earthworks at the Pyford South embankment and Pyford Brook viaduct which will reduce the visual impact on the Trent and Mersey Canal Conservation Area (FRC008), Alrewas Hayes Farmhouse (FRC017), and the Fradley Junction Conservation Area (FRC007);
- landscape earthworks at the realigned Shaw Lane which will reduce the visual impact on the Kings Bromley Conservation Area (FRC069);
- landscape earthworks at Woodhouse Farm which will reduce the visual impact of the Pipe Ridware embankment on the Grade II listed Woodhouse Farmhouse (FRC089); and
- landscape earthworks along the route of the Proposed Scheme between Stockwell Heath and Colton which will reduce the visual impact on the Colton Conservation Area (FRC120), which includes the Grade II* listed Church of St Mary and the Grade II* listed Colton House.

- 7.4.3 Section 8 of the draft Code of Construction Practice⁸⁴ (CoCP) sets out the measures that will be adopted, insofar as reasonably practicable, to control effects on heritage assets. These include:

- management measures that will be implemented for heritage assets that are to be retained within the land required for the Proposed Scheme;
- route-wide principles, standards and techniques for works affecting heritage assets; and

⁸⁴ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- a programme of historic environment investigation and recording (including archaeology and historic buildings) to be undertaken prior to or during construction works affecting the heritage assets.

Assessment of impacts and effects

- 7.4.4 Impacts on all heritage assets described above have been assessed⁸⁵. However, only those leading to significant effects are described in the construction assessment set out below.

Temporary effects

- 7.4.5 The construction works, comprising excavations and earthworks and including temporary works such as construction compounds, storage areas, and diversion of existing roads and services, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required for the Proposed Scheme and assets in the wider study area due to the visibility of plant, cranes and equipment.
- 7.4.6 The following significant effects are expected to occur as a result of temporary impacts on designated or non-designated heritage assets due to changes to their settings.
- 7.4.7 Shaw Lane Farm (FRCo71), an asset of low value, will be subject to a temporary change in its setting. The building derives some of its significance from its rural setting, particularly from the landscape to the south. Construction of the Kings Bromley viaduct, approximately 20m to the south of the farmhouse, will introduce visual and noise impacts, affecting the setting of the building. This will constitute a high adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately three years and three months.
- 7.4.8 Woodhouse Farmhouse (FRCo89), an asset of moderate value, will be subject to a temporary change in its setting. The building derives significance from its rural setting, particularly from its views across the fields to the south-west with which it is historically and functionally associated. Construction of the landscape earthworks associated with the Pipe Ridware embankment, approximately 60m to the south of Woodhouse Farmhouse, will introduce noise and visual impacts into the rural sound environment of Woodhouse Farmhouse, affecting its rural character. This will constitute a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately one year and six months.
- 7.4.9 Bentley Hall Farmhouse (FRCo92), an asset of moderate value, will be subject to a temporary change in its setting. Construction activities associated with the Blithbury South cutting, located approximately 50m to the north, will introduce noise and visual impacts into the rural sound environment of Bentley Hall Farmhouse, affecting its rural character. This will constitute a medium adverse impact and moderate adverse significant effect. Construction activity will take place over approximately one year and three months.

⁸⁵ These are set out in detail in the Impact Assessment Table, Volume 5: Appendix CH-003-001, Cultural heritage impact assessment table.

- 7.4.10 Hamley House and attached gate piers and garden wall to the south-west (FRC127), an asset of moderate value, will be subject to a temporary change in its setting. Hamley House, which is a 17th century rural farmstead in a peaceful rural environment, will experience noise impacts associated with the construction of the Stockwell Heath embankment (approximately 130m to the north), the realignment of the B5014 Uttoxeter Road (approximately 460m to the west) and the diversion of Moor Lane (approximately 130m to the east). This will constitute a medium adverse impact and moderate adverse significant effect. Construction activity will take place over approximately one year and nine months.
- 7.4.11 Hamley Heath House (FRC135), an asset of low value, will be subject to a temporary change in its setting. The building derives some of its significance from its rural setting, particularly from the front elevation towards the south-east. Construction activities associated with the realignment of the B5014 Uttoxeter Road (adjacent to the building) and the construction of the Moreton South embankment and landscape earthworks (approximately 200m to the north) will introduce noise impacts. This will constitute a high adverse impact and a moderate adverse significance effect. Construction activity will take place over approximately one year and six months.
- 7.4.12 Echills (FRC166), an asset of low value, will be subject to a temporary change in its setting. The building derives some of its significance from the surrounding rural setting, particularly to the south. The Bourne embankment pre-cast yard and the Bourne embankment pre-cast laydown yard are to be established immediately to the south-east and north of the building while the excavation of a borrow pit adjacent to the realigned Shaw Lane will be undertaken approximately 150m to the south-east of the building. In addition, a site haul route will be located to the north. Construction and excavation activities and the movement of construction traffic will introduce noise and visual impacts on the building's rural setting. This constitutes a high adverse impact and a moderate adverse significant effect. Construction activity will take place over up to four years.
- 7.4.13 Hunger Hill Farmhouse (FRC111), an asset of moderate value, will be subject to a temporary change in its setting. The building derives some of its significance from the views across the Trent Valley landscape from its south-facing elevation, and from the surrounding rural landscape due to its location on higher ground overlooking the valley. Construction of the Pipe Ridware embankment (approximately 700m to the south), the diversion of Pipe Lane (approximately 370m to the south), the excavation of the borrow pit at Blithbury to the east of the River Trent viaduct (approximately 740m to the south-east), and the movement of construction traffic from the Pipe Ridware embankment satellite compound (approximately 620m to the south-west), will represent a noise and visual impact on the building's rural setting. This constitutes a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over up to four years.
- 7.4.14 Alrewas Hayes Farmhouse (FRC017), an asset of moderate value, will be subject to a temporary change in its setting. The building derives some of its significance from its rural, isolated and tranquil setting as an asset separated from the closest main road by a long driveway, and from its rural setting through views across the landscape to the south from its main elevation. The trackway adjacent to the building will be used to access the Pyford South embankment and Pyford Brook viaduct during construction

and will introduce noise and visual impacts in the building's immediate setting. This constitutes a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately two years and three months.

- 7.4.15 Jongham's Cottage (FRC136), an asset of low value, will be subject to a temporary change in its setting. The building derives some significance from its rural setting. Construction of the Moreton South embankment, approximately 120m to the north, will introduce noise and visual impacts in the rural setting. This constitutes a high adverse impact and a temporary moderate adverse significant effect. Construction activity will take place over approximately one year and six months.
- 7.4.16 Lea Hall Farmhouse (FRC137), an asset of moderate value, will be subject to a temporary change in its setting. The building derives some of its significance from its rural landscape, particularly through views from the main south facing elevation across the Trent Valley. Construction works associated with the realignment of the B5014 Uttoxeter Road, approximately 50 to the east, will introduce noise into the relatively quiet setting and the construction of the Moreton South embankment, approximately 700m to the south, will introduce a visual impact on the rural landscape of the building. This constitutes a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately one year and nine months.
- 7.4.17 Lea Hall Farm Cottage (FRC138), an asset of moderate value, will be subject to a temporary change in its setting. The building derives some of its significance from its rural landscape, particularly through views from the main south facing elevation across the Trent Valley. The construction of the Moreton South embankment, approximately 700m to the south, will represent a visual impact on the rural landscape of the building. This constitutes a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately one year and six months.
- 7.4.18 No significant temporary effects on HLCAs will result from the construction of the Proposed Scheme within the Fradley to Colton Area.

Permanent effects

- 7.4.19 Permanent significant effects can occur either as a result of physical impacts on heritage assets within the land required for the Proposed Scheme, or through changes to the setting of heritage assets through the presence of the Proposed Scheme.
- 7.4.20 The following significant effects are expected to occur as a result of permanent physical impacts on heritage assets within the land required for the Proposed Scheme.
- 7.4.21 Cranberry cottage (FRC148), an asset of low value, will be demolished due to the construction of the Pyford South embankment. This will constitute a high adverse impact and a moderate adverse significant effect.
- 7.4.22 Buried archaeological remains of several Bronze Age round barrows, Iron Age pit alignments and enclosures of Iron Age or Roman date, a component part of an extensive cropmark complex at Bourne Brook (FRC020), are assets of moderate value. The assets will be removed during the construction of the Pyford North embankment, the establishment of Pyford North embankment satellite compound, the raising of a National Grid Electricity Transmission 400kV overhead power line, the realignment of

the A515 Lichfield Road and the presence of material stockpiles. This will constitute a high adverse impact and a major adverse significant effect.

- 7.4.23 Buried archaeological deposits related to the cropmark remains of a field system of probable medieval date north-east of Echills (FRCo32), an asset of low value, will be removed by the construction of the Kings Bromley viaduct and the establishment of the Bourne embankment satellite compound, the Bourne embankment pre-cast yard, the Bourne embankment pre-cast laydown yard and the adjacent transfer node. This will constitute a high adverse impact and a moderate adverse significant effect.
- 7.4.24 Buried archaeological deposits associated with the cropmark remains of four Bronze Age round barrows north-west of Echills (FRCo40), an asset of moderate value, will be removed by the construction of the River Trent viaduct and the establishment of the River Trent viaduct satellite compound. This will constitute a high adverse impact and a major adverse significant effect.
- 7.4.25 Buried archaeological remains associated with an Iron Age pit alignment north-west of Echills (FRCo38), an asset of moderate value, will be partially removed by the construction of the River Trent viaduct and the establishment of the River Trent viaduct satellite compound. This will constitute a high adverse impact and a major adverse significant effect.
- 7.4.26 Buried archaeological remains associated with a prehistoric cropmark enclosure north of Handsacre (FRCo39), an asset of moderate value, will be removed by the construction of the River Trent viaduct and the establishment of the River Trent viaduct satellite compound. This will constitute a high adverse impact and a major adverse significant effect.
- 7.4.27 Buried archaeological deposits associated with the cropmark remains of two Bronze Age round barrows (FRCo74), an asset of moderate value, will be removed by the construction of the River Trent viaduct. This will constitute a high adverse impact and a major adverse significant effect.
- 7.4.28 Buried archaeological remains associated with a cropmark enclosure of probable Iron Age or Romano-British date to the west of Pipe Lane (FRCo95), an asset of moderate value, will be partially removed by the construction of the Blithbury South cutting and adjacent landscape bund, and the adjacent material stockpile. This will constitute a high adverse impact and a major adverse significant effect.
- 7.4.29 Buried archaeological remains associated with a group of linear, curvilinear and rectangular cropmarks (FRCo174), an asset of low value, and will be removed by the construction of the 132kV power line from National Grid Rugeley substation to the Newlands Lane auto-transformer feeder station. This will constitute a high adverse impact and a moderate adverse significant effect.
- 7.4.30 Earthwork remains associated with a post-medieval water meadow at Lount Farm, Colton (FRCo132), an asset of low value, will be removed by the underground diversion of a Western Power Distribution 132kv overhead power line. This will constitute a high adverse impact and a moderate adverse significant effect.
- 7.4.31 Buried archaeological remains associated with two circular enclosures, which may represent the remains of Bronze Age round barrows (FRCo18), an asset of moderate

value, will be partially removed by the construction of the Pyford Brook viaduct. This constitutes a medium adverse impact and a moderate adverse significant effect.

- 7.4.32 Buried archaeological remains associated with possible Bronze Age round barrows, Iron Age or Romano-British rectilinear settlement enclosures and linear features associated with medieval field boundaries (FRCo19) is an asset of moderate value. This asset will be partially removed by the excavation of the borrow pit (to either the assumed average depth or maximum depth) located on both sides of Crawley Lane on the east and to the south of Ashby Sitch. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.33 Buried archaeological remains associated with three probable Bronze Age round barrows and an Iron Age pit alignment (FRCo21), an asset of moderate value, will be partially removed by works associated with the raising of a National Grid Electricity Transmission 400kV overhead power line. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.34 Buried archaeological remains of a possible Bronze Age round barrow located within a possible Iron Age or Romano-British period square enclosure (FRCo29), an asset of moderate value, will be removed by the excavation of borrow pit (to either the assumed average depth or maximum depth) adjacent to the realigned Shaw Lane. This constitutes a high adverse impact and a major adverse significant effect.
- 7.4.35 Buried archaeological remains of a possible multi-period field system (FRCo30), an asset of low value, will be removed by the excavation of the borrow pit (to either the assumed average depth or maximum depth) adjacent to the realigned Shaw Lane. This constitutes a high adverse impact and a moderate adverse significant effect.
- 7.4.36 Buried archaeological remains associated with the deserted settlement of Crawley, which includes house platforms and hollow ways (FRCo31), an asset of moderate value, will be partially removed by the excavation of a borrow pit (to either the assumed average depth or maximum depth) adjacent to the realigned A515 Lichfield Road. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.37 Buried archaeological remains associated with a rectangular enclosure of prehistoric date (FRCo178), an asset of moderate value, will be partially removed by construction of the 132kV power line from National Grid Rugeley substation to the Newlands Lane auto-transformer feeder station. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.38 Buried archaeological remains of four possible Bronze Age burnt mounds (FRCo133), an asset of moderate value, will be partially removed by works associated with wetland habitat creation at Moreton Brook viaduct. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.39 Buried archaeological remains associated with a probable medieval glassworks (FRCo134), an asset of moderate value, will be partially removed by works associated with wetland habitat creation at Moreton Brook viaduct. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.40 Buried archaeological remains of a probable Iron Age pit alignment (FRCo42), an asset of moderate value, will be removed by grassland habitat to the south-west of the

River Trent viaduct. This constitutes a high adverse impact and a major adverse significant effect.

- 7.4.41 Buried archaeological remains of a number of prehistoric features including a probable Neolithic causewayed enclosure, an Iron Age pit alignment along with prehistoric double and single ring ditches (FRCo44), an asset of moderate value, will be partially removed by grassland habitat creation to the south-west of the River Trent viaduct. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.42 Buried archaeological remains of numerous pits and ditches dating from the Bronze Age to the Romano-British period, which includes a circular ditch that may represent a round house or burial mound (FRCo84), an asset of moderate value, will be partially removed by the establishment of the Pipe Ridware embankment satellite compound grassland habitat creation adjacent to Pipe Lane. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.43 Buried archaeological remains of a medieval moated site and its fishpond (FRCo88), an asset of moderate value, will be partially removed by works associated with woodland and grassland habitat creation to the south-west of the Woodhouse culvert. This constitutes a medium adverse impact and a moderate adverse significant effect.
- 7.4.44 Buried archaeological remains of a possible post-medieval, pre-enclosure road (FRCo45), an asset of low value, will be removed by the excavation of the borrow pit (to either the assumed average depth or maximum depth) adjacent to the realigned A515 Lichfield Road. This constitutes a high adverse impact and a moderate adverse significant effect.
- 7.4.45 A late 19th century milestone (FRCo50), an asset of low value, will be removed by the excavation of a borrow pit adjacent to the realigned A515 Lichfield Road. This constitutes a high adverse impact and a moderate adverse significant effect.
- 7.4.46 Shaw Lane Farm (FRCo71), an asset of low value, will be permanently affected by the construction of the Kings Bromley viaduct and the realignment of Shaw Lane, which will require the demolition two of the farm outbuildings (one of which has been converted into a residential property). The asset derives some of its significance from the relationships between the various buildings that make up the farm (farmhouse, stables, barn, and wellhouse) and from its relationship with its historic access lane. This constitutes a high adverse impact and moderate adverse significant effect.
- 7.4.47 Earthwork remains of narrow ridge and furrow (FRCo117), an asset of low value, will be removed by the construction of the Stockwell Heath embankment and Stockwell Heath cutting. This constitutes a high adverse impact and a moderate adverse significant effect.
- 7.4.48 A hollow way to the west of the B5013 Uttoxeter Road (FRCo176), an asset of low value, will be removed by the realignment of the B5013 Uttoxeter Road and the construction of the Stockwell Heath cutting and the Moreton South embankment. This constitutes a high adverse impact and a moderate adverse significant effect.
- 7.4.49 The former route of a watercourse (FRCo199), an asset of low value, will be removed by works associated with the raising of a National Grid Electricity Transmission 400kV

overhead power line. This constitutes a high adverse impact and a moderate adverse significant effect.

- 7.4.50 The following significant effects will occur as a result of permanent impacts on designated or non-designated heritage assets as a result of changes to their settings.
- 7.4.51 Shaw Lane Farm (FRC071), an asset of low value, will be subject to a permanent change in its setting. The significance of the building lies partly in its relationship to the surrounding agricultural landscape, with which it has a close functional and historical relationship. The presence of Kings Bromley viaduct, approximately 20m to the south, will be visually dominant within the rural setting of the asset from which it derives some of its significance. This will constitute a high adverse impact and moderate adverse significant effect.
- 7.4.52 Woodhouse Farmhouse (FRC089), an asset of moderate value, will be subject to a permanent change in its setting. The significance of the building lies partly in its relationship to its surrounding fields, the layout of which is indicative of that which would have existed when the farmstead was first built in the 17th century. Views south across open fields, which are likely to have been farmed from Woodhouse Farmhouse, towards Quinton's Orchard, the site of the medieval manor house and subsequent historic farmsteads on the same site, are an important part of the farmhouse's setting. Views to the south will be obstructed by the presence of the Pipe Ridware embankment, approximately 110m to the south, of the south-facing farmstead, although landscape earthworks will reduce the visual impact. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.53 Bentley Hall Farmhouse (FRC092), an asset of moderate value, will be subject to a permanent change in its rural setting. The significance of the building is supported by its historic relationship to its surrounding fields. The relationship will be weakened, as the route of the Proposed Scheme will be in Blithbury South cutting located approximately 160m to the north. Overhead line equipment will also be visible from the farmhouse. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.54 Echills (FRC166), an asset of low value, will be subject to a permanent change in its setting. The building gains some of its significance from its rural setting and its relationship with its historic access lanes. The presence of Bourne embankment, approximately 90m to the north, will alter the rural setting of the building. This constitutes a high adverse impact and moderate adverse significant effect.
- 7.4.55 Alrewas Hayes Farmhouse (FRC017), an asset of moderate value, will be subject to a permanent change in its setting. The building derives some of its significance from its rural setting through views across the landscape to the south from its main elevation. The presence of the Pyford North embankment, approximately 750m to the south, will result in a visual impact into the rural landscape. Whilst a landscape bund will reduce the impact, the embankment and viaduct will remain a prominent feature within the landscape. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.56 Jongham's Cottage (FRC136), an asset of low value, will be subject to a permanent change in its setting. The 18th or 19th century farmhouse derives some significance from its rural setting, which will be altered through the presence of the Moreton South

embankment, located approximately 130m to the north. This will constitute a high adverse impact and a moderate adverse significant effect.

- 7.4.57 Hunger Hill Farmhouse (FRC111), an asset of moderate value, will be subject to a permanent change in its setting. The building derives some of its significance from its views across the Trent Valley landscape from its south-facing elevation and from the surrounding rural landscape due to its location on higher ground overlooking the valley. The presence of Pipe Ridware embankment and landscape bunds, approximately 700m to the south, will result in a visual impact and alter the building's rural setting. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.58 Hamley House and attached gate piers and garden wall to the south-west (FRC127), an asset of moderate value, will be subject to a permanent change in its setting. The building derives some of its significance from position on a south-facing slope, with a tree-lined drive and views across the Trent Valley landscape and from its historical and functional relationship with the surrounding agricultural landscape. Although principal views from the house are across the Trent Valley to the south-west, Stockwell Heath embankment will be visible, approximately 200m to the north, and will alter the building's rural setting. This will constitute a medium adverse impact and moderate adverse significant effect.
- 7.4.59 Lea Hall Farmhouse (FRC137), an asset of moderate value, will be subject to a permanent change in its setting. The building derives some of its significance from its rural landscape, particularly through views from the main south facing elevation across the Trent Valley. The presence of Moreton South embankment, approximately 700m to the south, will represent a prominent change to the rural setting of building. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.60 Lea Hall Farm Cottage (FRC138), an asset of moderate value, will be subject to a permanent change in its setting. The building derives some of its significance from its rural landscape, particularly through views from the main south facing elevation across the Trent Valley. The presence of Moreton South embankment, approximately 700m to the south, will represent a prominent change to the rural setting of asset. This will constitute a medium adverse impact and a moderate adverse significant effect.
- 7.4.61 No significant permanent effects on HLCAs will result from the construction of the Proposed Scheme within the Fradley to Colton area.

Other mitigation measures

- 7.4.62 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of:
- suitable locations for advance planting, to reduce impacts on the setting of heritage assets; and
 - locations where the physical impacts on below ground heritage assets can be reduced through the design of earthworks.

- 7.4.63 Milestones and/or mileposts that have to be removed during construction will be, wherever it is reasonably practicable to do so, returned to their original location before operation commences.

Summary of likely residual significant effects

- 7.4.64 The temporary effects of construction activity on the setting of heritage assets have been considered. However, they are largely reversible in nature and will be restricted to the duration of the construction works.
- 7.4.65 As no mitigation beyond that described above has been identified the residual effects are the same as those reported under permanent effects.

Cumulative effects

- 7.4.66 A detailed assessment has been undertaken of committed developments that have the potential to lead to cumulative effects with the Proposed Scheme. The following effects from temporary or permanent impacts to heritage assets have been identified within the study area.

Proposed Scheme and HS2 Phase One

- 7.4.67 The cumulative effects on heritage assets during construction of the Proposed Scheme and HS2 Phase One are reported below.
- 7.4.68 The Trent and Mersey Canal Conservation Area (FRC008), an asset of moderate value, will experience temporary and permanent changes in its rural setting as a result of the construction of HS2 Phase One. The relationship between the various locks, cottages and bridges along the canal, and between the canal and the surrounding landscape are all important aspects of the historic setting of the Conservation Area. Changes to the Conservation Area will occur as a result of the construction of the Trent and Mersey Canal viaduct across the canal on the Manchester Spur (where the Proposed Scheme connects to HS2 Phase One). This will constitute both a temporary and permanent medium adverse impact and a moderate adverse significant effect (see HS2 Phase One ES, Appendix CH-003-022⁸⁶). HS2 Phase One will also involve the construction of the Handsacre Link immediately south-east of the Conservation Area at the crossing of Curborough Brook. This will constitute both a temporary and permanent low adverse impact and a minor adverse effect, which is not significant. (see HS2 Phase One SES and AP2 ES Appendix CH-003-022⁸⁷).
- 7.4.69 The Trent and Mersey Canal Conservation Area will experience an additional temporary and permanent change as a result of the connection of HS2 Phase One with the Proposed Scheme on the Pyford Brook South embankment. This will involve the construction of Pyford Brook South embankment and, beyond it, the Pyford Brook viaduct, approximately 200m to 600m to the west of the Conservation Area to the south of Fradley Junction (FRC007). The establishment of the Pyford Brook Viaduct satellite compound, approximately 300m north of the Conservation Area near

⁸⁶ <http://webarchive.nationalarchives.gov.uk/20140806173413/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/cultural-heritage/CH-003-022.pdf>

⁸⁷ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/444084/Volume_5_CFA22_Whittington_to_Handsacre.pdf

Woodend Lock (FRCo10), will also impact on the setting of the Conservation Area. The noise and movement of plant during construction of the embankment and viaduct, affecting views out from and along the canal, will alter its peaceful rural character. This will constitute both a temporary and permanent low adverse impact and a minor adverse effect, which is not significant.

- 7.4.70 The combination of HS2 Phase One and the Proposed Scheme will therefore result in a temporary and permanent medium adverse impact and a moderate adverse cumulative effect, which is significant.
- 7.4.71 The Trent and Mersey Woodend Lock Cottage (FRCo11), an asset of moderate value, will experience a permanent change in its rural setting as a result of the construction of HS2 Phase One. Specifically noise and movement from the construction of the Handsacre Link, a short distance to the south, will affect the peaceful, rural setting of the asset. This will constitute a temporary and permanent medium adverse impact and a moderate adverse significant effect (HS2 Phase One SES and AP2 ES Appendix CH-003-022).
- 7.4.72 The Trent and Mersey Woodend Lock Cottage will experience an additional permanent change in its rural setting as a result of the Proposed Scheme. Woodland habitat creation around the Pyford Brook embankment and the Pyford Brook viaduct will be visible within the rural setting of the asset. The noise and movement of plant during construction of the embankment and viaduct, approximately 300m to the north, will alter its peaceful rural character. This will constitute a temporary and permanent low adverse impact and minor adverse effect, which is not significant.
- 7.4.73 The combination of HS2 Phase One and the Proposed Scheme will therefore result in a temporary and permanent medium adverse impact and a moderate adverse cumulative effect, which is significant.

Phase 2a and other committed developments

- 7.4.74 No cumulative effects on heritage assets have been identified from other committed developments in the Fradley to Colton area.

7.5 Effects arising from operation

Avoidance and mitigation measures

- 7.5.1 The following measures have been incorporated into the design of the Proposed Scheme, which will reduce the impacts and effects on heritage assets as shown on the CT-06 Map Series within the Volume 2: CA1 Map Book:
- noise barriers along the Kings Bromley viaduct which will reduce noise effects on the setting of the Kings Bromley Conservation Area (FRCo69);
 - noise barriers along the River Trent viaduct which will reduce noise effects on the setting of Pipe Ridware Hall, including remains of a dovecot, garden walls and gate piers, and farmstead (FRCo78) and Wheelwright Cottage (FRCo79);
 - landscape bunds and noise barriers along the Stockwell Heath cutting which will reduce noise and visual effects on the setting of Hamley House and its gate piers and garden wall (FRC127);

- noise barriers and landscape earthworks which will reduce the noise and visual effects on the setting of Woodhouse Farmhouse (FRCo89); and
- landscape planting which will increasingly reduce impacts on the setting of the assets within the area as it matures.

Assessment of impacts and effects

- 7.5.2 The assessment considers the Proposed Scheme once operational and all effects are considered to be permanent. There will be no physical impacts on buried archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on heritage assets due to changes in their settings arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction phase and are not repeated in detail here, although they will endure through the operation of the Proposed Scheme. Where there is a combined effect on the setting of an asset from the presence of the constructed scheme and its operation, this is reported in the assessment of operation.
- 7.5.3 Significant effects will occur as a result of permanent changes to the setting of the following assets arising from the impacts of railway operation.
- 7.5.4 Shaw Lane Farm (FRCo71), an asset of low value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. The significance of the farm lies partly in its relationship to the surrounding peaceful rural landscape. Trains running on the Kings Bromley viaduct will introduce noise and visual impacts and alter the rural setting of the building. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant.
- 7.5.5 Woodhouse Farmhouse (FRCo89), an asset of moderate value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. The significance of the farm lies partly in its relationship to the surrounding peaceful rural landscape. Trains running on the Pipe Ridware embankment will introduce noise impacts and alter the rural setting of the building, although noise barriers and landscape earthworks will be provided to reduce the noise and visual effects. In combination with the permanent effects the Proposed Scheme the effect will remain as moderate adverse significant.
- 7.5.6 Bentley Hall Farmhouse (FRCo92), an asset of moderate value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. The significance of the farm lies partly in its relationship to the surrounding peaceful rural landscape. Trains running in the Blithbury South cutting will introduce noise impacts and alter the rural setting of the building. In combination with the permanent effects the Proposed Scheme the effect will remain as moderate adverse significant.
- 7.5.7 Hamley House and attached gate piers and garden wall to the south-west (FRCo127), an asset of moderate value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. The significance of the farm lies partly in its relationship to the surrounding peaceful rural landscape. Trains running on the Pipe Ridware embankment will introduce noise impacts and alter the rural setting of the building. Landscape bunds and noise barriers will be provided along the Stockwell Heath cutting to reduce noise and visual effects. In combination with the

permanent effects the Proposed Scheme the effect will remain as moderate adverse significant.

- 7.5.8 No significant effects on HLCAs will result from the operation of the Proposed Scheme in the Fradley to Colton area.

Other mitigation measures

- 7.5.9 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures beyond those included within the Proposed Scheme design have been identified. Potential opportunities for further mitigation such as planting and noise fencing have not been identified at this stage, but will be considered as part of the detailed design process.

Summary of likely residual significant effects

- 7.5.10 As no mitigation beyond that described has been identified, the residual effects are the same as those reported in the assessment of effects during operation.

Cumulative effects

Proposed Scheme and HS2 Phase One

- 7.5.11 The cumulative effects on heritage assets during operation of the Proposed Scheme and HS2 Phase One are reported below.
- 7.5.12 The Trent and Mersey Canal Conservation Area (FRCoo8), an asset of moderate value, will experience a permanent change in its rural setting as a result of the operation of HS2 Phase One, which will cross the Conservation Area on the Pyford Brook viaduct. The noise and movement of the passing trains will change the quiet, rural character of the canal in this area. This will constitute a permanent medium adverse impact and a moderate adverse significant effect (HS2 Phase One SES and AP2 ES Appendix CH-003-022⁸⁸).
- 7.5.13 The Trent and Mersey Canal Conservation Area will experience an additional permanent change as a result of trains running on the route of the Proposed Scheme, which will introduce additional noise impacts into the rural setting of the Conservation Area. This will constitute a permanent low adverse impact and a minor adverse effect, which is not significant. The combination of HS2 Phase One and the Proposed Scheme will therefore result in a permanent medium adverse impact and moderate adverse cumulative effect, which is significant.

Phase 2a and other committed developments

- 7.5.14 A detailed assessment has been undertaken of committed developments that have the potential to lead to cumulative effects with the Proposed Scheme. No further cumulative effects on heritage assets during operation have been identified in the Fradley to Colton area.

⁸⁸ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/444084/Volume_5_CFA22_Whittington_to_Handsacre.pdf

Monitoring

- 7.5.15 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 7.5.16 There are no area-specific heritage monitoring requirements during operation of the Proposed Scheme. It is assumed that all heritage assets within the land required for the Proposed Scheme will be removed during construction unless expressly excluded as a result of the mitigation process.

8 Ecology and biodiversity

8.1 Introduction

- 8.1.1 This section of the report describes the ecological baseline and identifies likely impacts and significant ecological effects that will arise from the construction and operation of the Proposed Scheme in the Fradley to Colton area. This includes effects upon sites recognised or designated on the basis of their importance for nature conservation.
- 8.1.2 Engagement has been undertaken with national organisations and regional and local stakeholders including: Natural England; Environment Agency; Forestry Commission; Staffordshire Wildlife Trust; Royal Society for the Protection of Birds (RSPB); Woodland Trust; Staffordshire County Council (SCC); and the Conservation, Horticulture, Agriculture for the Disabled Society (CHADS). The purpose of this engagement has been to obtain relevant baseline information and inform the design development and assessment of the Proposed Scheme.
- 8.1.3 In addition, baseline information collated as part of the Environmental Impact Assessment (EIA) for HS2 Phase One has been used to inform the assessment of the Proposed Scheme in the Fradley and Colton area.
- 8.1.4 Volume 5 contains supporting information to the ecological assessment reported in this section, including:
- ecological baseline data - designated sites (see Volume 5: Appendix EC-001-000); and
 - an ecology register of local level effects, which are not reported individually in Volume 2 (see Volume 5: Appendix EC-016-001).
- 8.1.5 Map Series EC-01 showing statutory and non-statutory designated sites of relevance to the assessment in the Fradley to Colton area is provided in the Volume 5: Ecology Map Book.
- 8.1.6 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 8.1.7 In addition, ecological baseline data relating to habitats and species recorded in the Fradley to Colton area is set out in Background Information and Data (BID)⁸⁹ (see BID-EC-002-000 to BID-EC-014-000) and accompanying Map Series EC-02 to EC-12 (see BID Ecology Map Books).

⁸⁹ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2

8.2 Scope, assumptions and limitations

- 8.2.1 The scope, assumptions and limitations for the ecological assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)⁹⁰ and the SMR Addendum⁹¹.
- 8.2.2 A route-wide Water Framework Directive (WFD) compliance assessment has been undertaken in conjunction with the environmental assessment (Section 15, Water resources and flood risk). Details of the assessment are presented in Volume 5: Appendix WR-001-000.
- 8.2.3 Access was obtained to the majority of land where general habitat survey (Phase 1 habitat survey) was proposed. However, access could not be gained in time for seasonally constrained surveys at a few locations that have potential to support key ecological features. These include: Westfield Covert; west of Kings Bromley; and Pipe Wood, south of Blithbury. Further details are provided in Background Information and Data: BID-EC-002-000 to BID-EC-014-000.
- 8.2.4 Where data are limited, such as due to the absence of field surveys, a precautionary baseline has been built up according to the guidance reported in the SMR and the SMR Addendum. This constitutes a 'reasonable worst case' basis for the subsequent assessment and development of mitigation. Background Information and Data: BID-EC-002-000 to BID-EC-014-000 identify these survey locations where applicable. Where the assessment has been based upon limited data, the ecological receptor is described as 'of up to' a specific value.
- 8.2.5 The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the Proposed Scheme. Unless otherwise stated, the description of effects assumes that land within the Bill limits will be subject to habitat loss resulting from development of the Proposed Scheme, with the land required for construction purposes only being reinstated following completion of construction. With respect to overhead line diversions/realignments in particular, it is likely that the majority of the habitats within the land required for the Proposed Scheme can in fact be retained, and land is only required to allow for raising or lowering of pylons and/or re-stringing of cables, or to provide an access route to the works.

8.3 Environmental baseline

Existing baseline

- 8.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports presented in Volume 5: Appendix EC-001-000 and Background Information and Data: BID-EC-002-000 to BID-EC-015-000, and maps presented in Volume 5: Map Series EC-01 and BID Ecology Map Books: Map Series EC-02 to EC-12. Statutory and non-statutory designated sites are shown on Volume 5: Maps EC-01-301 to EC-01-305a.

⁹⁰ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

⁹¹ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

8.3.2 Land required for and adjacent to the Proposed Scheme in the Fradley to Colton area consists mainly of agricultural land, woodland and floodplain. The topography is undulating and crosses floodplain grazing marsh in the Trent Valley near Kings Bromley.

Designated sites

8.3.3 There are no statutory designated sites of international importance within 2km of the Proposed Scheme in the Fradley to Colton area.

8.3.4 There are no statutory designated sites of national importance within 500m of the Proposed Scheme in the Fradley to Colton area.

8.3.5 There is one nationally important Site of Special Scientific Interest (SSSI) of potential relevance to the assessment in the Fradley to Colton area. The land required for the Proposed Scheme is located within the Natural England Impact Risk Zone⁹² for Blithfield Reservoir SSSI.

8.3.6 Blithfield Reservoir SSSI, covering an area of approximately 463.9ha, is Staffordshire's largest area of standing water and is nationally important for goosander, regularly supporting more than 1% of the total British wintering population. The reservoir and its woodland and farmland surroundings are an important wintering locality for an outstanding variety of birds. A number of the grassland fields adjoining the reservoir are grazed by regionally significant numbers of wigeon. This SSSI is located north of Stockwell Heath, approximately 730m north-west of the land required for the Proposed Scheme.

8.3.7 There are 10 Local Wildlife Sites (LWS) of potential relevance to the assessment in the Fradley to Colton area, each of which is of county value. Three of these sites are also listed on the Ancient Woodland Inventory (AWI). They are:

- Curborough House Hedgerows LWS, comprising a pair of parallel hedgerows, each approximately 543m in length. Each comprises of a species-rich hedgerow with standard trees. The LWS is valued for the high number of woody species and mature pedunculate oak standard trees approximately every 50m. This LWS is located adjacent to Netherstowe Lane, adjacent to the land required for the Proposed Scheme;
- Big Lyntus LWS and AWI site, covering an area of approximately 7ha, is designated for a mixture of mixed semi-natural broadleaved woodland, that was clear felled during the Second World War, and a number of adjoining areas of broadleaved and coniferous plantation with a diverse ground flora including bluebell and yellow archangel. The northern part of the woodland is replanted ancient woodland with a high canopy dominated by semi-mature beech and scots pine trees. Ground flora is limited to the edges of the woodland or patches where there are gaps in the canopy, where bluebell, wood sage, greater stitchwort and yellow archangel are present, with common nettle and

⁹² The Impact Risk Zones are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks to SSSIs posed by development proposals and indicate the types of development proposal which could potentially have adverse impacts.

cleavers being frequent species. This LWS is located south of Wood End Lane, partially within the land required for the Proposed Scheme;

- Kings Bromley Wharf to Fradley Junction, Coventry Canal LWS, covering an area of approximately 8.9ha, is designated for supporting a range of emergent wetland plant species, although the amount of marginal vegetation differs from place to place. It is usually comprised of reed sweet-grass, branched bur-reed and sweet-flag. Additional species occur in various localities, including some such as flowering rush, arrowhead and greater tussock-sedge, which are rare or uncommon in the county. The diverse marginal and emergent vegetation supports a range of invertebrates, including butterflies, dragonflies and damselflies. The site also includes approximately 1.6ha of broadleaved woodland. This LWS is located between Wood End Lock and Ravenshaw Wood, partially within the land required for the Proposed Scheme;
- John's Gorse LWS and AWI site, covering an area of approximately 2.7ha, consists of two areas of ancient semi-natural broadleaved woodland. The woodland canopy species include sycamore, hazel, rowan, elder, birch and alder. The more northerly woodland block is heavily grazed, with the southern block fenced off and less affected by cattle. The LWS is located immediately adjacent to the land required for the Proposed Scheme, which passes between the two areas of woodland;
- Kings Bromley Pit (north-west of Manor Park) LWS, covering an area of approximately 5.9ha, comprises a number of gravel pits that are now used for recreational pursuits. Areas of amenity grassland, acidic grassland with scrub, semi-natural and planted broadleaved woodland, carr, reed swamp and disturbed ground adjoin the pools. Woodland canopy species include mature oak and willow, with extensive scrub and wetland plant species. Less than 0.1ha of this LWS is ancient woodland. This LWS is located north of the A513 Rugeley Road, near Rookery Lodge, adjacent to the land required for the Proposed Scheme;
- Trentside Meadows LWS, covering an area of approximately 27.5ha, is designated for floodplain meadow with species-rich grassland. The LWS also includes areas of semi-improved grassland and woodland, covering approximately 0.5ha. This LWS is located between the A513 Rugeley Road and the River Trent, east of Pipe Ridware, partially within the land required for the Proposed Scheme;
- Pipe Wood Lane LWS is a hedgerow approximately 879m in length. It has a large number of species (13) located within the hedgerow canopy with a good hedgerow structure. This LWS is located on Pipe Wood Lane, south of Blithbury, partially within the land required for the Proposed Scheme;
- Cawarden Springs Wood LWS and AWI site, covering an area of approximately 3.7ha, comprises of ancient semi-natural woodland, which was subject to extensive felling approximately 100 years ago. This LWS is located west of Springs Cawarden Farm, north of Rugeley, immediately adjacent to the land required for the Proposed Scheme;

- Newlands Lane LWS is a hedgerow approximately 1.3km in length. It is designated for its good connectivity to the surrounding landscape and has a good hedgerow structure. The hedgerow is species-poor and dominated by hawthorn with blackthorn, with ash and oak present to a lesser extent. This LWS is located on Newlands Lane, east of Stockwell Heath, partially within the land required for the Proposed Scheme; and
- Lount Farm LWS, covering an area of approximately 14.2ha, is designated for its marshy grassland. The 10.8ha northern component of this LWS is located partially within the land required for the Proposed Scheme, to the east of Moreton Grange. Part of the LWS is also within the Colwich to Yarlet area (CA2).

8.3.8 There are nine Biodiversity Alert Sites (BAS), of potential relevance to the assessment in the Fradley to Colton area, each of which is of district/borough value. They are:

- Fradley Wood BAS, covering an area of approximately 29.2ha, includes Fradley Gorse, Brokendown Wood and a secondary woodland adjacent to the banks of the Trent and Mersey Canal. These woodland blocks include both coniferous and broadleaved plantation. Large areas of woodland have been felled and the land returned to agriculture or left fallow. This BAS is located south-west of Kingfisher Holiday Park, Fradley, partially within the land required for the Proposed Scheme;
- Riley Hill BAS, covering an area of approximately 5.7 ha, comprises a large pool and a narrow band of broad-leaved woodland also known as Shaw Lane Gap Wood. It is surrounded by a field of intensively managed improved pasture, with some small broad-leaved woods adjoining the field. This BAS is located adjacent to Shaw Lane, Rileyhill, partially within the land required for the Proposed Scheme;
- Crawley Lane (Hedge) BAS is a hedgerow approximately 316m in length. The BAS is located south of Kings Bromley, partially within the land required for the Proposed Scheme;
- Pipe Wood Lane BAS is a hedgerow approximately 398m in length. It is valued in particular for its large number of species (13) in the hedgerow canopy and its good structure. The hedgerow has four standard trees along its length and two young trees. There is also a small bank. This BAS is located on Pipe Wood Lane, south of Blithbury, within the land required for the Proposed Scheme;
- Long Mets Lane BAS is a hedgerow approximately 260m in length with standard trees along its length. This BAS is located east of Newlands Lane, south of Stockwell Heath, partially within the land required for the Proposed Scheme;
- Finners Hill Hedgerows BAS comprises hedgerows approximately 677m in length in total, with standard trees. Each hedgerow is valued for their large number of species (16) in the hedgerow canopy, their good height and structure. This BAS is located on Newlands Lane, south of Stockwell Heath, partially within the land required for the Proposed Scheme;

- Moor Lane, Colton Hedge BAS, is a hedgerow approximately 903m in length, with standard trees. It is valued in particular for its large number of species (15) in the hedgerow canopy and its good structure. This BAS is located west of Stockwell Heath, partially within the land required for the Proposed Scheme;
- Stockwell Heath Pond BAS, covering an area of approximately 0.2ha, is a small village pool with a wide range of aquatic and submerged plant species, many of which may have been planted. This BAS is located in the centre of Stockwell Heath, adjacent to the land required for the Proposed Scheme; and
- Sheracop Lane (Hedge) BAS is a hedgerow approximately 441m in length. It is valued for its large diversity of species (12) in the hedgerow canopy and its good structure. This BAS is located east of Colton Road, south of Admaston, immediately adjacent to the land required for the Proposed Scheme.

8.3.9 There are a total of six AWI sites of potential relevance to the assessment in the Fradley to Colton area, all of which are of county value. Three of these AWI sites are also LWS as described above. The other three are:

- Little Lyntus Wood AWI site, covering an area of approximately 1.5ha, supports lowland mixed deciduous woodland. It is located west of Fradley Business Park, Fradley, within the land required for the Proposed Scheme;
- Hanchwood House Wood AWI site, covering an area of approximately 1ha, is similar in its composition to John's Gorse LWS and was formerly part of this LWS designation. The AWI site is located north-east of Hanch, approximately 25m north-east of the land required for the Proposed Scheme; and
- Pipe Wood AWI site, covering an area of approximately 5.2ha, comprises ancient semi-natural woodland. It is located on Pipe Wood Lane, south of Blithbury, approximately 118m east of the land required for the Proposed Scheme.

8.3.10 On the basis of the heritage review undertaken by HS2 Ltd, Natural England has confirmed that one woodland of potential relevance to the assessment in the Fradley to Colton area, Westfield Covert, will be added to the AWI. Westfield Covert, covering an area of approximately 1.2ha, is located near Kings Bromley, partially within land required for habitat creation as part of the Proposed Scheme. This small woodland is considered to be of county value.

Habitats

8.3.11 The following habitat types which occur in the Fradley to Colton area are relevant to the assessment.

Woodland

8.3.12 Five woodlands listed on the AWI are within, partially within or adjacent to the land required for the Proposed Scheme. These woodlands are likely to qualify as lowland mixed deciduous woodland, which is a habitat of principal importance listed under the provisions of Section 41 of the Natural Environment and Rural Communities (NERC)

Act (2006⁹³) and a conservation priority of Staffordshire Biodiversity Action Plan (local BAP⁹⁴). These are:

- Little Lyntus, covering an area approximately 1.5ha, is a block of woodland within an arable field, which was surveyed to inform the assessment of HS2 Phase One⁹⁵. A number of ancient woodland indicator species were identified including: small-leaved lime; moschatel; wood anemone; pignut; yellow archangel; and dog's mercury. Ancient or veteran trees and evidence of past coppicing were also recorded, together with an old ditch bank. It is located east of Curborough, within the land required for the Proposed Scheme. The woodland habitats are of county value;
- Big Lyntus, covering an area of approximately 7ha, was surveyed to inform the assessment of HS2 Phase One⁹⁶. Within the northern part of the site there is ancient replanted woodland with a high canopy (up to 30m) dominated by semi-mature beech and Scots pine trees. A National Vegetation Classification (NVC⁹⁷) survey identified the beech woodland community W15 *Fagus sylvatica*-*Deschampsia flexuosa* woodland, which is lowland mixed deciduous woodland. Between the northern part of the woodland and a strip of semi-natural woodland on the southern boundary of the site is a more recent plantation dominated by pedunculate oak with occasional ash. The strip of ancient semi-natural woodland in the south of the site is structurally and botanically more diverse than the plantation areas. It is located east of Curborough, partially within the land required for the Proposed Scheme. These woodland habitats are of county value;
- John's Gorse, covering an area of approximately 2.7ha, is two areas of woodland, with an existing overhead power line passing between them. John's Gorse was surveyed to inform the assessment of HS2 Phase One⁹⁸. The site is split into two main areas, which are heavily grazed. The canopy of the northern area (John's Gorse) consists mainly of oak and some birch, now dying back, above a grassy field layer. The very sparse understorey contains hawthorn, holly and sweet chestnut. Fox Covert, the southern section of John's Gorse, appears to have once been much larger and has been reduced by felling and wayleave maintenance to accommodate the overhead power line. This woodland has been extensively planted with conifers, including Norway spruce, Scots pine and common larch. The canopy is open with relatively few mature broadleaved trees. Cherry and birch are present, but more than half the area consists of hawthorn and elder scrub, with some hazel. It is located

⁹³ Natural Environment and Rural Communities Act 2006 (2006 CHAPTER 16). Her Majesty's Stationery Office, London.

⁹⁴ Staffordshire Biodiversity Partnership. *Staffordshire Biodiversity Action Plan* [online]. Available at: <http://www.sbap.org.uk/>

⁹⁵ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442226/SES_and_AP2_ES_Volume_2_CFA22.pdf

⁹⁶ HS2 Ltd., (2013), *High Speed Rail (London-West Midlands) Community Forum Area Report CFA 22*. Available online at:

http://webarchive.nationalarchives.gov.uk/20140806172102/http://assets.dft.gov.uk/hs2-environmental-statement/volume-2/Vol2_CFA_22_Whittington_to_Handsacre.pdf

⁹⁷ NVC is a detailed survey and classification system that is used to compare plant communities within a range of defined community types.

⁹⁸ http://webarchive.nationalarchives.gov.uk/20140806172102/http://assets.dft.gov.uk/hs2-environmental-statement/volume-2/Vol2_CFA_22_Whittington_to_Handsacre.pdf

north of Hanch immediately adjacent to the land required for the Proposed Scheme, which passes between the two areas of woodland. The woodland habitats are of county value;

- Hanchwood House Wood covers an area of approximately 1ha, in proximity to John's Gorse LWS and AWI site. The woodland is located north-east of Hanch, approximately 25m north-east of the land required for the Proposed Scheme. The woodland habitats are of up to county value; and
- Cawarden Springs Wood, comprising an area of approximately of 3.7ha, is a remnant ancient semi-natural woodland. This site appears to comprise of part plantation and part more varied or younger canopy structure. This woodland is located north of Rugeley, immediately adjacent to the land required for the Proposed Scheme. The woodland habitats are of up to county value.

8.3.13 Westfield Covert is to be added to the AWI. It is lowland mixed deciduous woodland, a habitat of principal importance and a conservation priority of the local BAP. It covers an area of approximately 1.2ha with a small section (<0.1ha) within the Kings Bromley Pit LWS. This woodland is located near Kings Bromley, partially within land required for woodland habitat creation as part of the Proposed Scheme. This woodland is of up to county value.

8.3.14 There are 27 other woodlands that qualify or are likely to qualify as lowland mixed deciduous woodland, a habitat of principal importance. These are:

- Woodend Lock, covering an area of approximately 2ha, is a small deciduous wood located immediately adjacent to the land required for the Proposed Scheme, north of the Trent and Mersey Canal. The woodland canopy comprises mature common oak with alder abundant near the pond and on the brook margins. There is a well-developed shrub layer and a number of plants including yellow archangel and bluebell. This woodland is of district/borough value;
- Brokendown Wood, covering an area of approximately 3.9ha adjacent to the Trent and Mersey Canal. This woodland is part of Fradley Wood BAS and is located partially within the land required for the Proposed Scheme. This woodland is of district/borough value;
- Woodland east of Woodend Common Barn, covering an area of approximately 3.3ha, is located north of Curborough, partially within land required for the Proposed Scheme. This woodland is of up to district/borough value;
- Woodland west of Woodend Common Barn, covering an area of approximately 3.3ha, is located north of Curborough, partially within land required for the Proposed Scheme. This woodland is of up to district/borough value;
- Shaw Lane Gap Wood, covering an area of approximately 1.4ha forms part of Rileyhill BAS. This woodland is located at Rileyhill, partially within land required for the Proposed Scheme. This woodland is of up to district/borough value;

- New Plantation, covering an area of approximately 6.3ha, is located west of Rileyhill immediately adjacent to land required for the Proposed Scheme. This woodland is of up to district/borough value;
- Tomlinson's Spinney, covering an area of approximately 3.7ha, is a mature plantation with a relatively closed canopy, largely dominated by oak with beech. Holly is abundant in the understorey throughout, together with rhododendron. The field layer contains patchy dense bramble in places. This woodland is located to the west of the junction of Shaw Lane and the A513 Rugeley Road, near Kings Bromley, located within the land required for the Proposed Scheme. This woodland is of district/borough value; and
- a further 20 small woodlands (each <3.0ha and none within wildlife site designations) (including Rice's Spinney) occur within and adjacent to the land required for the Proposed Scheme, each of up to local/parish value.

Grassland

- 8.3.15 Semi-improved neutral grassland, covering an area of approximately 27.5ha, occurs alongside the River Trent within Trentside Meadows LWS. This habitat is likely to qualify as floodplain grazing marsh, a habitat of principal importance and a conservation priority of the local BAP. The species composition is characteristic of NVC MG5a *Cynosurus cristatus*-*Centaurea nigra* grassland *Lathyrus pratensis* sub-community. This LWS is located between the A513 Rugeley Road and the River Trent, east of Pipe Ridware, partially within the land required for the Proposed Scheme. This grassland is of county value.
- 8.3.16 Marshy grassland, covering an area of approximately 18.2ha, occurs alongside Moreton Brook within and adjacent to Lount Farm LWS. The species-rich marshy grassland is characteristic of NVC MG4 *Alopecurus pratensis*-*Sanguisorba officinalis* grassland. MG4 grassland is lowland meadow, a habitat of principal importance and a conservation priority of the local BAP. This lowland meadow is partially located within the land required for the Proposed Scheme. Species-rich MG4 grassland is uncommon and this habitat is of county value.
- 8.3.17 Species-poor semi-improved grassland covers an area of approximately 21.6ha throughout the Fradley to Colton area within the land required for the Proposed Scheme. Areas of species-poor semi-improved grassland are of local/parish value.

Arable/cultivated land

- 8.3.18 At Bentley Farm, south of Blithbury, some of the arable field margins have rare or declining arable weeds, including small bugloss and chamomile. This habitat is partially located within the land required for the Proposed Scheme and is of district/borough value.

Hedgerows

- 8.3.19 There are three LWS (Curborough House Hedgerows LWS; Pipe Wood Lane LWS; and Newlands Lane LWS) and five BAS (Crawley Lane (Hedge) BAS; Pipe Wood Lane BAS; Long Mets Lane BAS; Finners Hill Hedgerows BAS; and Moor Lane, Colton Hedge BAS) designated for their hedgerows that are within, partially within or adjacent to

the land required for the Proposed Scheme. These sites are primarily designated for species diversity, value of their structure and number of standard trees. The LWS are of county value and the BAS are of district/borough value.

8.3.20 In total, there is approximately 64.8km of hedgerow within the land required for the Proposed Scheme in the Fradley to Colton area. Hedgerow with at least 80% cover of native woody species is a habitat of principal importance. Hedgerows within the land required for the Proposed Scheme comprise approximately:

- 11.8km of native species-poor; and
- 53.0km of native species-rich, of which 13.0km are also classified as 'Important' according to the 'Wildlife and Landscape' criteria described in The Hedgerows Regulations 1997⁹⁹.
- Of the 64.8km of hedgerow a total of 37.5km of hedgerows have not been subject to survey. To accord with Phase 1 habitat descriptions these hedgerows are mapped as native species-rich on map series EC-02 and they are included as native species-rich in the list above. This is highly precautionary, and based on ratios from the surveyed hedgerows in this area, it is likely that part of the un-surveyed hedgerow network will be species-poor.

8.3.21 As part of the precautionary assessment, it is assumed that further important hedgerows will be found within land that was not surveyed, but which will be required for the Proposed Scheme. The hedgerows within the area also function as wildlife corridors. The hedgerow network as a whole is of county value.

Watercourses

8.3.22 The Trent and Mersey Canal, the River Trent, Pyford Brook, Bourne Brook, and Moreton Brook will be crossed by the route of the Proposed Scheme. The River Trent, Pyford Brook, Bourne Brook and Moreton Brook may qualify as habitats of principal importance and local BAP habitats. These watercourses and adjacent habitats are intrinsically important and provide corridors for wildlife dispersal, as such they are of up to county value.

8.3.23 Several smaller watercourses, including Crawley Brook, Ashby Sitch, Luth Burn, and tributaries associated with these watercourses will also be crossed by the route of the Proposed Scheme. These smaller watercourses are of up to district/borough value. The unnamed tributaries of these smaller watercourses are of up to local/parish value.

Water bodies

8.3.24 There are 58 ponds located within, or partially within, the land required for the Proposed Scheme, and a further 166 ponds within 250m of the land required for the Proposed Scheme. On a precautionary basis it is assumed that all ponds are habitats of principal importance or local BAP habitats and are of district/borough value unless surveys have shown that they are of local/parish value only.

⁹⁹ The Hedgerow Regulations 1997 (No. 1160). Her Majesty's Stationery Office, London.

Ancient and veteran trees

- 8.3.25 Ancient and veteran¹⁰⁰ trees with potential relevance to the assessment in the Fradley to Colton area have been considered.
- 8.3.26 There is one tree recorded on the ancient tree inventory within the land required for the Proposed Scheme. An ancient oak tree (Tree 111943¹⁰¹) is located on Newlands Lane, south of Stockwell Heath. This tree is of district/borough value.
- 8.3.27 On the basis of surveys undertaken there are three trees within the land required for the Proposed Scheme that are considered to be of a sufficient age and/or support features to indicate they are of veteran status. Each of the trees is considered to be of up to district/borough value. These are:
- a pedunculate oak located approximately 350m east of Pipe Lane and west of Dawson Lane, at Hadleygate, south of Blithbury;
 - a black poplar located on Newlands Lane, south of Blithbury; and
 - a pedunculate oak located north of Moreton Brook.

Protected and notable species

- 8.3.28 A summary of the likely value of protected and/or notable species of relevance to the assessment is provided in Table 13.

Table 13: Protected and notable species within the Fradley to Colton area

Resource/feature	Value	Receptor	Baseline and rationale for valuation
Fish	Up to national	Population of spined loach in the River Trent	Desk study data for the River Trent includes records of spined loach approximately 1.3km upstream of the land required for the Proposed Scheme. In the UK, spined loach is naturally restricted to only five east-flowing river systems, the Trent, Welland, Witham, Nene and Great Ouse. Spined Loach is an Annex 2 ¹⁰² species and a species of principal importance ¹⁰³ .
	Up to district/borough	Fish assemblage within the River Trent	Desk study data available for the River Trent approximately 1.2km upstream and 3km downstream of the land required for the Proposed Scheme indicates the presence of: pike; perch; three-spined stickleback; bullhead; European eel; roach; tiger trout (a sterile, non-native hybrid of brown and brook trout); chub bream; and barbell. It is assumed that these species could be present in the River Trent and tributaries in the vicinity of the land required for the Proposed Scheme. Bullhead is an Annex 2 species. European eel is a species of principal importance. They are widespread in suitable habitat in England.

¹⁰⁰ An ancient tree is one that has passed maturity and is old, or aged, in comparison with other trees of the same species. Veteran trees are younger than ancient trees, but have features found on ancient trees such as decay in the trunk, branches and/or roots. Ancient and veteran trees are included on the Ancient Tree Inventory.

¹⁰¹ The Woodland Trust. Available at: <http://www.ancient-tree-hunt.org.uk/recording/tree.htm?tree=6bf6237c-442e-4ad2-950e-2dd1255ea39c>

¹⁰² Annex 2 of the EU's Habitats Directive (1992) lists priority species whose conservation requires the designation of Special Areas of Conservation.

¹⁰³ Natural Environment and Rural Communities Act 2006. Available at: <http://www.legislation.gov.uk/ukpga/2006/16/section/41>

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
	Up to district/borough	Fish assemblages within Bourne Brook	Desk study data indicate the presence of bullhead within Bourne Brook approximately 2km downstream of the land required for the Proposed Scheme. Incidental records of bullhead in two locations in Bourne Brook at Riley hill support desk study evidence and confirm the continued presence of the species in this watercourse.
	Up to district/borough	Fish assemblages within Moreton Brook	Moreton Brook has good fish habitat and there are incidental observations from field surveys of bullhead at Upper Moreton within and adjacent to land required for the Proposed Scheme.
	Local/parish	Fish assemblages within Crawley Brook	Field surveys identified the presence of three-spined stickleback within Crawley Brook, within the land required for the Proposed Scheme. The presence of this species is indicative of 'fair' biological water quality.
Bats	Regional	Bat assemblage associated with habitats near Pipe Wood and land to the south and east of Blithbury	<p>Field surveys recorded the presence of a noctule maternity roost in a tree to the west of Pipe Wood approximately 14m from the land required for the Proposed Scheme. A brown long-eared bat maternity roost was recorded in a building at Bentley Farm, approximately 50m from the land required for the Proposed Scheme.</p> <p>Field surveys recorded Nathusius' pipistrelle in low numbers to the west of Pipe Wood outside of the land required for the Proposed Scheme. Brown long-eared bats were recorded in relatively high numbers near Pipe Wood in June and July.</p> <p>The established hedgerow network throughout this area maintains good connections to some of the larger surrounding woodlands such as Pipe Wood. Bats were recorded commuting towards and away from Pipe Wood along hedgerows with connectivity to Pipe Wood.</p> <p>The habitats near to Pipe Wood were used infrequently by foraging bats, with occasional feeding activity in and around the small pond bounded by trees within the land required for the Proposed Scheme. Species included common pipistrelles, brown long-eared bat, noctule and Myotis species.</p> <p>Noctule are a species of principal of importance, a conservation priority of the local BAP and are considered to be 'rarer' bats in England¹⁰⁴. Maternity roosts of rarer bats should be considered of regional value. Nathusius' pipistrelle is considered to be widespread but rare in the UK.</p> <p>Brown long eared is a bat species of principal of importance. Common pipistrelle is also a species of principal importance and a conservation priority of the local BAP.</p>
	Regional	Bat assemblage associated with habitats at and around Spencer's Plantation	<p>Field surveys recorded a Brandt's bat maternity roost in a building south of Spencer's Plantation, which lies adjacent to the land required for the Proposed Scheme and a Myotis species roost and two unconfirmed species roosts in trees near Spencer's plantation, all of which are within the land required for the Proposed Scheme.</p> <p>Field surveys indicate Spencer's Plantation supported low levels of foraging Myotis species and noctule, with</p>

¹⁰⁴ Wray, S. Wells, D. Long, E. & Mitchell-Jones, T. (2010). *Valuing Bats in Ecological Impact Assessment*, In-Practice, 23-25. Chartered Institute of Ecology and Environmental Management, Winchester.

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
			<p>evidence of commuting into the wood by these species from the north and west.</p> <p>Foraging common and soprano pipistrelles were frequently recorded along hedgerows connected to Spencer's Plantation. The hedgerows are both within and adjacent to the land required for the Proposed Scheme.</p> <p>The pond to the east of Spencer's Plantation also provided foraging habitat for these species and the plantation itself supported low levels of foraging brown long-eared bat and soprano pipistrelle. The pond is adjacent to the land required for the Proposed Scheme.</p> <p>Brandt's bats are considered to be a rarer species and are a species of principal of importance and a conservation priority of the local BAP. The presence of maternity roosts is important to the continued breeding success and thus the conservation status of this species.</p> <p>Soprano pipistrelle is a species of principal of importance and a conservation priority of the local BAP.</p>
	Up to regional	Bat assemblage associated with habitats at Moreton Brook and Lount Farm	<p>Field surveys recorded a maternity roost of unknown species in a tree within the land required for the Proposed Scheme. The potential for a maternity colony of rarer bats to be present in this tree cannot be excluded.</p> <p>Land around Moreton Brook and Lount Farm supports agricultural fields with tree-lined hedgerows, which were used by commuting bats including common and soprano pipistrelle, serotine, noctule and brown long-eared bat in low numbers. This area is both within and adjacent to the land required for the Proposed Scheme.</p> <p>The area supported an assemblage containing rarer species including serotine and Myotis species for which low levels of foraging activity were recorded.</p> <p>Serotine bats are a species of principal of importance and a conservation priority of the local BAP.</p>
	County	Bat assemblage using the Trent and Mersey Canal, adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood) and Cranberry Wood as an occasional foraging area	<p>Field surveys undertaken as part of the Environmental Impact Assessment (EIA) for HS2 Phase One¹⁰⁵ recorded roosting Daubenton's bat, Natterer's bat, soprano pipistrelle, noctule and brown long-eared bat in Ravenshaw Wood, Black Slough and the Slaish, which is approximately 160m south-west from the land required for the Proposed Scheme, and Fradley Wood, which is adjacent to the land required for the Proposed Scheme</p> <p>HS2 Phase One surveys identified commuting routes along the Trent and Mersey Canal and the canal was identified as an important commuting corridor for several species, in particular Daubenton's bat and soprano pipistrelle.</p> <p>Data from HS2 Phase One identified core foraging habitat in Ravenshaw Wood, Black Slough and the Slaish and occasional foraging in areas south of Cranberry.</p> <p>Daubenton's and Natterer's bats are species of principal importance and a conservation priority of the local BAP.</p>
	County	Bat assemblage commuting and foraging in habitat south of Kings	<p>A brown long-eared maternity roost was recorded in buildings during field surveys near Shaw Lane Farm, within the land required for the Proposed Scheme. A brown long-eared maternity roost and a brown long-eared feeding</p>

¹⁰⁵ HS2 Ltd., (2015), High Speed Rail (London-West Midlands) Volume 5: Technical appendices and map books. Available online at: <https://www.gov.uk/government/collections/supplementary-environmental-statement-and-additional-provision-2-environmental-statement-supplementary-environmental-information#volume-5:-technical-appendices-and-map-books>

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
		Bromley Pits (including Rileyhill, woodlands near Shaw Lane, Tomlinson's Spinney, land around Kings Bromley Marina and at Westfield Covert)	<p>roost were recorded in buildings south of Tomlinson's Spinney adjacent to the land required for the Proposed Scheme. A likely day/summer roost of soprano pipistrelles was recorded in a tree, approximately 11m north-east of the land required for the Proposed Scheme, north-east of Trentside Meadows LWS.</p> <p>Field surveys indicate high levels of common and soprano pipistrelle activity, particularly associated with woodland at Shaw Lane, both within and adjacent to the land required for the Proposed Scheme. Occasional passes of rarer species, including Myotis species and noctule were recorded.</p>
	County	Bat assemblage using the River Trent, Trentside Meadows LWS and land around Pipe Ridware	<p>Field surveys confirmed a residential building in Pipe Ridware supported a common and soprano pipistrelle roost located adjacent to the land required for the Proposed Scheme.</p> <p>Field surveys also recorded commuting bats using hedgerows and the bankside vegetation along the River Trent to navigate to foraging habitats both within and adjacent to the land required for the Proposed Scheme.</p> <p>Low to moderate foraging activity was recorded during surveys near Trentside Meadows LWS, adjacent to the River Trent. Moderate levels of common and soprano pipistrelle were noted foraging alongside the River Trent, with occasional brown long-eared, noctule, Leisler's bat and serotine.</p> <p>Leisler's bats are considered to be an un-common species¹⁰⁶.</p>
	Up to county	Bat assemblage using land west of Blithbury	<p>Field surveys identified four summer roosts of common species including common pipistrelle, brown long eared and unknown species, west of Blithbury. Of these one is within the land required for the Proposed Scheme, two are adjacent to the land required for the Proposed Scheme, and one is approximately 100m from the land required for the Proposed Scheme.</p> <p>The habitats are common and widespread in the landscape and comparable to those in adjacent areas. Subsequently, it is assumed that the bat assemblage is dominated by common species with occasional passes of rarer species, similar to the bat assemblage using the River Trent, Trentside Meadows LWS and land around Pipe Ridware.</p>
	County	Lesser horseshoe bat species commuting along the River Trent	<p>Field surveys recorded a lesser horseshoe bat in the Colwich to Yarlet area (CA2) on a static detector adjacent to Hoo Mill, Ingestre near the River Trent within the land required for the Proposed Scheme. This rare bat could utilise the River Trent as a commuting corridor from maternity sites to hibernation sites in low numbers.</p> <p>While this species has not been recorded in the Colwich to Yarlet area, on a precautionary basis it cannot be excluded from occasionally using the River Trent as a commuting route.</p> <p>Lesser horseshoe bat is an Annex 2 species, which is nationally scarce and a species of principle importance.</p>
	Local/parish	Bat assemblage roosting in	Field surveys at a residential building at Hamley House Farm, west of Stockwell Heath, identified a day roost of brown long-eared bats and Pipistrellus species and is

¹⁰⁶ Bat Conservation Trust (2014). *The State of the UK's bats: National Bat Monitoring Programme Population Trends 2014*. BCT, London.

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
		buildings around Stockwell Heath	<p>located adjacent to the land required for the Proposed Scheme.</p> <p>Emergence surveys identified two buildings south-west of Stockwell Heath with soprano pipistrelle roosts, located approximately 6m and 46m from the land required for the Proposed Scheme.</p> <p>The nearest roost record from desk study records was a common pipistrelle roost located approximately 25m to the north-west of the land required for the Proposed Scheme in a building in Stockwell Heath.</p>
Amphibians	County	A meta-population ¹⁰⁷ (AMP 30 identified by HS2 Phase One) of great crested newt in a network of four ponds at Fradley Wood	<p>A medium meta-population of great crested newt was identified across four ponds, which includes a medium population identified through desk study records at two ponds. Field surveys recorded positive eDNA¹⁰⁸ field study results for great crested newt in 2015 for one pond. These ponds sit within a larger network of four ponds, which are located between approximately 20m and 360m from the land required for the Proposed Scheme.</p> <p>Great crested newt is an Annex 2 species, a species of principal importance, and a conservation priority of the local BAP.</p>
	Up to county	A meta-population (AMP 31 identified by HS2 Phase One) of great crested newt in a network of eight ponds, west of Fradley Lock (north and south of the Trent and Mersey Canal)	An assumed medium meta-population of great crested newt was recorded, which includes a small population in one pond identified through desk study records. This pond sits within a larger network of eight ponds, which are located within and up to approximately 200m from land required for the Proposed Scheme.
	County	A meta-population (AMP 32 identified by HS2 Phase One) of great crested newt in a network of seven ponds, near Hanch Reservoir	A medium meta-population of great crested newt was recorded, which includes a medium population in one pond identified through desk study records. Field surveys also recorded positive eDNA results in another pond. These two ponds sit within a larger network of seven ponds, which are located within and up to approximately 420m from land required for the Proposed Scheme.
	Up to county	A meta-population (AMP 1.1) of great crested newt in a network of three ponds near Kings Bromley, south of the River Trent	Field surveys recorded an assumed medium meta-population of great crested newt, which includes a population identified through positive eDNA results from one pond, which lies within the land required for the Proposed Scheme. The other two ponds are located up to approximately 60m from the land required for the Proposed Scheme.
	Up to county	A meta-population (AMP 1.2) of great crested newt in a network of nine ponds between	Field surveys recorded an assumed medium meta-population of great crested newts, which includes a small population in one pond, which sits within a larger network of nine ponds. Two of the nine ponds lie within the land required for the Proposed Scheme, the other ponds are

¹⁰⁷ A metapopulation is a group of spatially separated populations which interact. Metapopulations are described in BID-EC-007-000, Ecological baseline data - amphibian and pond surveys.

¹⁰⁸ Survey method to sample great crested newt environmental deoxyribonucleic acid (eDNA): <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects#survey-methods>

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
		Rugeley and Blithbury	located up to approximately 250m from the land required from the Proposed Scheme.
	Up to county	A meta-population (AMP 1.3) of great crested newt in a network of 26 ponds near Hill Ridware and to the south of Colton, north-east of Rugeley	An assumed medium meta-population of great crested newts was identified through desk study records of a small population recorded at one pond, which sits within a larger network of 26 ponds that are connected by suitable habitat, despite the presence of a minor road. Eight of the 26 ponds lie within the land required for the Proposed Scheme, the others are located up to approximately 230m from the land required for the Proposed Scheme.
	County	A meta-population (AMP1.4) of great crested newt in a network of 16 ponds located adjacent to the B5013 Uttoxeter Road, Colton Road south-west of Admaston	A medium meta-population of great crested newt was identified. Field surveys recorded a medium population in two of the ponds. Small populations of great crested newts were also recorded in three additional ponds. These ponds sit within a wider network of 16 ponds that are located within and up to approximately 290m from land required for the Proposed Scheme.
	Up to county	Populations of great crested newt within un-surveyed ponds within the Fradley to Colton area	Ponds that have not been surveyed are assumed to support breeding populations of great crested newt of medium size class.
	Local/parish	Populations of other amphibian species including palmate newt, smooth newt, common toad and common frog within the Fradley to Colton area	These common amphibian species have been identified within ponds throughout the Fradley to Colton area during field surveys both within and outside of the land required for the Proposed Scheme and are assumed to be present within the ponds that have not yet been surveyed. Woodland, rough grassland and hedgerow habitats are likely to be used by these species during their terrestrial phase for foraging, dispersal and shelter. Each of these species is common and widespread throughout the UK. Common toad is a species of principal importance.
Birds	County	Barn owl pair around Trentside Meadows LWS, land south-east of Pipe Ridware and Pipe Ridware Church	A barn owl was recorded at a nest box during field surveys alongside the River Trent at Trentside Meadows LWS, located approximately 25m from the land required for the Proposed Scheme. In addition, a number of potential nest/roost sites have been identified in this area including an owl nest box on a tree at Pipe Ridware Church, which are each assumed to be used by up to one breeding pair of barn owl. Barn owl is a conservation priority of the local BAP.
	Up to county	Barn owl pair around Bentley Hall Farm, Hadley Gate, south of Blithbury and land around Rosewood Farm, west of Blithbury	A barn owl roost was recorded during field surveys in a tree west of Hadley Gate and north of Blithbury Road within the land required for the Proposed Scheme. Barn owls are also known to be present around Bentley Hall Farm, but none were seen during the field survey. Other potential barn owl nest/roost sites were identified in the trunk cavities in black poplar trees and a nest box in a barn west of Blithbury.
	Up to county	Barn owl pair around Moreton Meadows, Lount	A number of potential nest/roost sites have been identified in this area during field survey including a trunk cavity in a pedunculate oak within the land required for the Proposed

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
		Farm and Upper Moreton Farm, north-east of Bishton.	Scheme. Barn owl sightings were reported at Moreton Meadows during field surveys, but no other evidence of barn owl presence was recorded at or near the potential barn owl nest sites during the field survey.
	Local/parish	Breeding bird assemblage at Pipe Ridware floodplain	Field surveys recorded a total of 20 bird species on the Pipe Ridware floodplain both within and adjacent to the land required for the Proposed Scheme. The species recorded are considered to be common and widespread and characteristic of farmland habitats. No large or important populations were recorded. The breeding bird assemblage comprises five species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	Breeding bird assemblage at Moreton Meadows	Field surveys recorded a total of 30 bird species at Moreton Meadows both within and adjacent to the land required for the Proposed Scheme which included three Red List ¹⁰⁹ species. The species recorded are considered to be common and widespread and characteristic of farmland habitats. No large or important populations were recorded. The breeding bird assemblage comprises five species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	Winter bird assemblage at Pipe Ridware Floodplain	Field surveys recorded a total of 47 bird species on the Pipe Ridware floodplain both within and adjacent to the land required for the Proposed Scheme which included 11 Red List species. The species recorded are considered to be common and widespread in the habitat types surveyed. No large or important populations were recorded. The wintering bird assemblage comprises 12 species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	Winter bird assemblage at Moreton Meadows, north-east of Bishton	Field surveys recorded a total of 33 bird species at Moreton Meadows north-east of Bishton both within and adjacent to the land required for the Proposed Scheme which included six Red List species. The species recorded are considered to be common and widespread in the habitat types surveyed. No large or important populations were recorded. The wintering bird assemblage comprises five species of principal importance and/or conservation priorities of the local BAP.
Water vole	County	Water vole population at Moreton Brook near Lount Farm LWS	Field surveys recorded evidence of water vole within the Colton to Yarlet area (CA2) both within and adjacent to the land required for the Proposed Scheme. Suitable habitat is also present in the Fradley to Colton area. Water vole is a species of principal importance and a conservation priority of the local BAP. Water voles are in decline in Staffordshire and remaining water vole populations in Staffordshire are limited.
	Up to county	Water vole population at Trentside Meadows LWS	Field surveys recorded a potential water vole sighting at Trentside Meadows LWS, approximately 15m from the land required for the Proposed Scheme.

¹⁰⁹ International Union for Conservation of Nature and Natural Resources Red List of Threatened Species. Available at: <http://www.iucnredlist.org/>

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
Vascular plants	County	Black poplar south-west of Blithbury Road	Field surveys recorded a native black poplar within the land required for the Proposed Scheme. This species is listed as least concern on the Vascular Plant Red Data List for Great Britain ¹¹⁰ .
	County	Field woundwort north of Quinton's Orchard	A desk study record was identified for field woundwort from an arable field north of Quinton's Orchard within the land required for the Proposed Scheme. This species is listed as county rare on the Staffordshire Flora Checklist 2017 ¹¹¹ .
	County	Bog pimpernel in field margins west of the B5014 Uttoxeter Road	Field surveys recorded bog pimpernel within the land required for the Proposed Scheme. This species is listed as county rare on the Staffordshire Flora Checklist 2017.
	District/borough	Corn marigold at Kings Bromley Lane	Desk study record of corn marigold at Kings Bromley Lane, from within the land required for the Proposed Scheme. This species is listed as uncommon on the Staffordshire Flora Checklist 2017.
	Local/parish	Bluebell near Trentside Meadows LWS and within Hurst Wood	Desk study records of bluebell were identified near Trentside Meadows LWS and field surveys found bluebell within Hurst Wood. Both locations are within the land required for the Proposed Scheme. Bluebells are widely distributed and listed as very common on the Staffordshire Flora Checklist 2017.
Otter	District/borough	Population of otter using the major and minor watercourses in the Fradley to Colton area	Field surveys undertaken for HS2 Phase One found evidence of otter in the Trent and Mersey Canal and Bourne Brook. Field surveys undertaken for the Proposed Scheme recorded evidence of otter at Pyford Brook, along the Bourne Brook and at Moreton Brook, all within the land required for the Proposed Scheme. Desk study records for otter were reported from the Trent and Mersey Canal at Handsacre within 1.2km of the land required for the Proposed Scheme. A number of desk study records also reported otter along the River Trent and Moreton Brook. Given the availability of suitable habitat, it is assumed that otters are using these watercourses and other watercourses and water bodies within the Fradley to Colton area for foraging, breeding and dispersal. Otter is an Annex 2 species, a species of principal importance, and a conservation priority of the local BAP.
Harvest mouse	District/borough	Population of harvest mouse at Trentside Meadows LWS	Staffordshire Wildlife Trust list Trentside Meadows LWS as a key site for harvest mouse. The site is partially located within the land required for the Proposed Scheme. Harvest mouse is a species of principal importance.
	Up to local/parish	Potential populations using suitable habitats present in the Fradley to Colton area	Although no confirmed evidence of this species has been observed during field surveys, it is possible that populations of harvest mouse are present in hedgerows, arable land, areas of taller grassland and woodland edge habitats throughout the Fradley to Colton area.

¹¹⁰ The Joint Nature Conservation Committee Vascular Plant Red Data List for Great Britain. Available at: <http://jncc.defra.gov.uk/page-3354>

¹¹¹ A Checklist of the Flora of Staffordshire Revised 2017, available at <http://bsbi.org/staffordshire>

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
Aquatic macro-invertebrates	District/borough	Aquatic macro-invertebrates in Bourne Brook	The aquatic invertebrate survey at Bourne Brook recorded a moderate diversity of macro-invertebrate taxa. The brook is located approximately 224m north-west of the land required for the Proposed Scheme. Overall the watercourse has a 'moderate' Community Conservation Index (CCI) score, which indicates that the community may be considered to enrich the local stretch of the watercourse, and includes a 'regionally notable' species of conservation interest: the caddisfly <i>Brachycentrus subnubilis</i> . 'Regionally notable' species are those that occur in more than 100 10km squares but are uncommon in some regions.
	District/borough	Aquatic macro-invertebrates in the Crawley Brook	The aquatic invertebrate survey at Crawley Brook, west of Shaw Lane, recorded a moderate diversity of macro-invertebrate taxa. The brook is located within the land required for the Proposed Scheme Overall the watercourse has a 'moderate' CCI score, and includes a 'regionally notable' species of conservation interest: the flatworm <i>Planaria torva</i> .
Badger	Local/parish	At least nine social groups at undisclosed locations in the Fradley to Colton area	A common and widespread species recorded during field surveys in the Fradley to Colton area. Five badger main setts have been recorded during field surveys within the land required for the Proposed Scheme. A further two main setts have been recorded within 30m of the land required for the Proposed Scheme, and a further two main setts have been recorded between 30 and 100m of the land required for the Proposed Scheme.
Polecat	Local/parish	Potential populations using suitable habitats present in the Fradley to Colton area	Desk study records of Polecat were identified, most recently around Ravenshaw Wood, Black Slough and Slaish approximately 160m south-west from the land required for the Proposed Scheme. This site is woodland which suggests the likely presence of this species in the Fradley to Colton area. Polecat is relatively widely distributed in Staffordshire. Suitable habitat is present within the network of farmland with hedgerows and small woodlands throughout the Fradley to Colton area. Polecat is a species of principal importance.
European hedgehog	Up to local/parish	Potential populations using suitable habitats present in the Fradley to Colton area	There are no desk study records of European hedgehog within Fradley to Colton area. This species is widely distributed throughout the UK and is likely to be present in suitable habitats throughout Fradley to Colton area including woodland, hedgerows, grassland, scrub and gardens. European hedgehog is a species of principal importance.
Brown hare	Local/parish	Potential populations using suitable habitats present in the Fradley to Colton area	There are desk study records of brown hare reported from Fradley to Colton area within and adjacent to the land required for the Proposed Scheme. Brown hare is likely to be present in areas of open arable and grassland habitats throughout the Fradley to Colton area. Brown hare is a species of principal importance and a conservation priority of the local BAP.
Reptiles	Up to local/parish	Potential small populations of common reptiles in the Fradley to Colton area	No reptiles were found during field surveys at eight sites. Suitable habitat that was not surveyed was generally constrained to field margins, edges of woodland and scrub habitat or isolated small patches of overgrown grassland. These habitats are within a generally intensively farmed landscape, offering limited opportunities for reptiles. It is, therefore, assumed that any reptiles located within the

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Resource/feature	Value	Receptor	Baseline and rationale for valuation
			land required for the Proposed Scheme in the Fradley to Colton area are present in low numbers. Grass snake, slow-worm and common lizard are all species of principal importance. Grass snake is also a conservation priority of the local BAP.
Terrestrial invertebrates	Local/parish	Invertebrate assemblages at Trentside Meadows LWS	Field surveys at Trentside Meadows LWS recorded 104 terrestrial invertebrate species, all of which were common and widespread, and typical of the habitat types present. The site is partially located within the land required for the Proposed Scheme. There are no desk records of any species of principal importance from Trentside Meadows LWS.
Hazel dormouse	Negligible	Potential populations using suitable woody habitats in the Fradley to Colton area	No evidence has been found for the presence of hazel dormouse during field surveys of woodland and hedgerows at Cranberry Wood, woodland south-east of Shaw Lane, land north-east of Moreton Brook, land south-west of Trentside Meadows LWS, south-east of B5013 Uttoxeter Road, adjacent to Pipe Wood, and at Hurst Wood. There were no desk study records of hazel dormouse in the Fradley to Colton area. Whilst it was not possible to complete all surveys for hazel dormouse in Fradley to Colton area, given the lack of evidence and the fact no desk study records were reported, it is considered unlikely that any populations exist within the land required for the Proposed Scheme.
White-clawed crayfish	Negligible	Potential populations using watercourses in the Fradley to Colton area	There are no records within the last 10 years of white-clawed crayfish in any of the watercourses in the Fradley to Colton area. Field surveys found limited suitability for the species, and did not record the presence of any white-clawed crayfish. Due to the declining status of the white-clawed crayfish within Staffordshire, and the increasing prevalence of signal crayfish, it is assumed that native white-clawed crayfish are absent from the Fradley to Colton area.

Future baseline

Construction (2020)

- 8.3.29 Volume 5: Appendix CT-004-000 provides details of the developments in the Fradley to Colton area that are assumed to have been implemented by 2020.
- 8.3.30 HS2 Phase One will be under construction by 2020, which will alter the future baseline conditions for the Proposed Scheme. This will be through the presence of construction equipment (e.g. cranes, vehicles) as well as movement, lights and noise associated with construction and the emerging final form of the Phase One scheme itself. This has the potential to affect ecological receptors that fall within the study area of the Proposed Scheme. This is considered in the cumulative assessment of the construction phase of the Proposed Scheme.
- 8.3.31 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for ecological receptors.

Operation (2027)

- 8.3.32 Volume 5: Appendix CT-004-000 provides details of the developments in the Fradley to Colton area that are assumed to have been implemented by 2027.
- 8.3.33 The presence of HS2 Phase One during operation as well as noise and movement from trains running along it will alter the future baseline conditions for the Proposed Scheme. This has the potential to affect ecological receptors that fall within study area of the Proposed Scheme. This is considered in the cumulative assessment of the operation phase of the Proposed Scheme.
- 8.3.34 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for ecological receptors.

8.4 Effects arising during construction

Avoidance and mitigation measures

- 8.4.1 The following measures have been included as part of the design of the Proposed Scheme (additional to the landscape planting as shown on the Map Series CT-o6 along the route of the Proposed Scheme, which will be largely a mixture of woodland/scrub and grassland), and will contribute towards limiting effects on habitat and species:
- provision of the Pyford Brook viaduct, River Trent viaduct, Kings Bromley viaduct and Moreton Brook viaduct will avoid direct effects on the Pyford Brook, River Trent, Bourne Brook and Moreton Brook respectively and allow free passage for wildlife beneath them;
 - refinement of the location of two balancing ponds and associated access to avoid the loss of an area of existing woodland and ponds to the south-west of Pyford Brook viaduct and the need for the access track to cross the Pyford Brook;
 - refinement of the area of the borrow pit, located either side of Crawley Lane, to avoid impacts on Ashby Sitch and associated habitat and reduce loss of woodland at Rice's Spinney;
 - refinement of the area of the borrow pit, located adjacent to the realigned Shaw Lane, to avoid loss of woodland at New Plantation Woodland; and
 - reduction in the land required for the Proposed Scheme adjacent to the River Trent viaduct to reduce impact to Trentside Meadows LWS and Cawarden Springs Wood LWS.
- 8.4.2 The assessment assumes implementation of the measures set out within the draft Code of Construction Practice¹¹² (CoCP) which includes sensitive construction practices and the preparation of habitat management plans.

¹¹² Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- 8.4.3 Section 9 of the draft CoCP requires contractors to implement a range of measures to protect ecological receptors including the following:
- manage impacts from construction, including the timing of works, on designated sites, protected and notable species and other features of ecological importance such as ancient woodlands and watercourses;
 - reduce habitat loss by keeping the working area to the reasonable minimum;
 - reinstatement of areas of temporary habitat loss;
 - restoration and replacement planting;
 - management measures for potential ecological impacts to control dust, water quality and flow, noise and vibration, and lighting;
 - provision of a watching brief, where relevant;
 - relocation or translocation of species, soil and/or plant material, as appropriate;
 - consultation with Natural England, the Environment Agency, local wildlife trusts and relevant planning authorities prior to and during construction; and
 - compliance with all wildlife licencing requirements, including those for protected and invasive species and designated sites.

Assessment of impacts and effects

- 8.4.4 Effects arising during construction that are significant at the district/borough level or above are described below. Effects on ecological features of significance at the local/parish level are listed in Volume 5 Appendix: EC-016-001.

Designated sites

- 8.4.5 Blithfield Reservoir SSSI will not be directly affected by the construction of the Proposed Scheme. The closest point of the construction to the SSSI will be on and adjacent to the existing B5013 Uttoxeter Road, where there will be temporary utility works. The SSSI is designated for its bird interest, which during winter can use the surrounding agricultural land. It is unlikely that the bird assemblages from Blithfield Reservoir will be adversely affected by the temporary utilities works on and adjacent to the B5013 Uttoxeter Road, as there is a hill ridge between this area and the reservoir. No indirect effects of the Proposed Scheme on the designating features of this SSSI are anticipated.
- 8.4.6 Big Lyntus LWS and Little Lyntus Wood AWI site are within, and Curborough House hedgerows LWS is adjacent to, land required for rail systems work associated with the connection of power between the Proposed Scheme and Hs2 Phase One. These works will not result in significant effects upon Big Lyntus LWS, Little Lyntus Wood AWI or Curborough House hedgerows LWS.
- 8.4.7 A temporary water supply connection to Pyford Brook viaduct satellite compound will result in the permanent loss of approximately 0.6ha (7%) of canal bank and canal habitat within Kings Bromley Wharf to Fradley Junction, Coventry Canal LWS. The

loss of this habitat will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.

- 8.4.8 Construction of the River Trent viaduct will result in the permanent loss of approximately 4.9ha (18%) of floodplain grazing marsh within Trentside Meadows LWS. The permanent loss of this habitat will result in a permanent adverse effect on the structure and function of the site that is significant at the county level.
- 8.4.9 Construction of an access road from Pipe Lane to the Mavesyn Ridware Footpath 38 accommodation overbridge will result in the permanent loss of approximately 40m (5%) of a central section of the hedgerow within Pipe Wood Lane LWS. The loss of this habitat and reduction in connectivity along the hedgerow will result in a permanent adverse effect on the structure and function of the site that is significant at the county level.
- 8.4.10 Construction of Newlands Lane overbridge will result in the permanent loss of approximately 25m (2%) of the southern end of the hedgerow within Newlands Lane LWS. The permanent loss of this habitat will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.
- 8.4.11 On a precautionary basis, works associated with the underground diversion of an existing 132kV power line will result in the permanent loss of approximately 3.3ha (23%) of lowland meadow within Lount Farm Meadow LWS in the Fradley to Colton area. Lowland meadow will also be lost from Lount Farm Meadows LWS in the Colwich to Yarlet area (CA2), and the combined loss from this site is 7.7ha (54%). This will result in a permanent adverse effect on the structure and function of the site that is significant at the county level.
- 8.4.12 Works associated with the raising of a National Grid 400kV overhead power line has the potential to result in the permanent loss of up to 0.3ha (5%) of woodland within Riley Hill BAS. The permanent loss of this habitat will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.
- 8.4.13 Works associated with the raising of a National Grid 400kV overhead power line has the potential to result in the loss of up to 164m (52%) of hedgerow within Crawley Lane (Hedge) BAS. The loss of this habitat and reduction in connectivity along the hedgerow will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.
- 8.4.14 The realignment of Newlands Lane and construction of the Newlands Lane auto-transformer feeder station will result in the permanent loss of approximately 30m (12%) of the western end of a hedgerow within Long Mets Lane (Hedge) BAS. The loss of this habitat will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.
- 8.4.15 Construction of Stockwell Heath embankment will result in the permanent loss of approximately 482m (71%) of hedgerow at Finners Hill Hedgerows BAS. The loss of this habitat and reduction in connectivity along the hedgerow will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.

- 8.4.16 Construction of the Stockwell Heath embankment and excavation of a balancing pond will result in the permanent loss of approximately 500m (55%) of Moor Lane, Colton Hedge BAS. The loss of this habitat and loss of connectivity along the hedgerow will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.

Habitats

Woodland

- 8.4.17 There are no significant effects on ancient woodland within the Fradley to Colton area. There are a number of lowland mixed deciduous woodlands that will be affected by the Proposed Scheme.
- 8.4.18 Construction of the Pyford North embankment will result in the permanent loss of approximately 2.4ha (73%) of semi-mature broadleaved woodland east of Woodend Common Barn. The loss of this woodland will result in a permanent adverse effect that is significant at up to district/borough level.
- 8.4.19 Construction works associated with raising of the National Grid 400kV overhead lines will result in the loss of up to 0.3ha (21%) of Shaw Lane Gap Wood, located north of Kings Bromley Wharf. The loss of this woodland will result in a permanent adverse effect that is significant at up to district/borough level.
- 8.4.20 Construction of the Bourne embankment will result in the permanent loss of approximately 3.7ha (100%) of woodland within Tomlinson's Spinney. The loss of this woodland will result in a permanent adverse effect that is significant at the district/borough level.

Grassland

- 8.4.21 Construction of the River Trent viaduct will result in the permanent loss of approximately 4.1ha (18%) of floodplain grazing marsh at Trentside Meadows LWS. The loss of this grassland habitat will result in a permanent adverse effect that is significant at up to county level.
- 8.4.22 Works associated with the underground diversion of an existing 132kV power line will result in the permanent loss of approximately 3.3ha (18%) of the lowland meadow habitat adjacent to Moreton Brook. This is a permanent adverse effect on lowland meadow habitat that is significant at county level.

Hedgerows

- 8.4.23 On a precautionary basis, it is assumed that all hedgerows (approximately 64.8km) within the land required to construct the Proposed Scheme in the Fradley to Colton area will be permanently lost and the remaining hedgerow network fragmented. This includes the native species-rich hedgerows at three LWS and five BAS hedgerows. This total, however, includes some hedgerows that are likely to be retained, such as those located within land required for overhead line diversions/realignments and those located within land required for the creation of woodland and grassland habitat. The combined loss and severance of hedgerows within the land required for the Proposed Scheme will have a permanent adverse effect that is significant at county level.

Watercourses

- 8.4.24 The route of the Proposed Scheme will cross the River Trent and Pyford Brook on viaduct and no significant effects to these watercourses are anticipated. The route of the Proposed Scheme will also cross the Trent and Mersey Canal (Kings Bromley Wharf to Fradley Junction, Coventry Canal LWS), Bourne Brook and Moreton Brook on viaduct. The likely significant effects on these waterways are set out below.
- 8.4.25 The construction of a temporary water supply connection to Pyford Brook viaduct satellite compound will result in the permanent loss of approximately 0.6ha of canal bank and canal habitat of the Trent and Mersey Canal. (This equates to 7% of canal bank and canal habitat within Kings Bromley Wharf to Fradley Junction, Coventry Canal LWS.) The loss of this habitat will result in a permanent adverse effect on the structure and function of the canal (and LWS) that is significant at the district/borough level.
- 8.4.26 The provision of a culvert for the realigned A515 Lichfield Road will result in the permanent loss of a small section of the Bourne Brook. The permanent loss of a section of Bourne Brook and the direct effects in channel during construction will result in permanent adverse effect that is significant at up to district/borough level. The realignment of the A515 Lichfield Road will result in an existing culvert, where Bourne Brook passes under the existing A515 Lichfield Road, being removed and the watercourse in this location re-naturalised. The re-naturalising of a section of Bourne Brook will result in a permanent beneficial effect that will be significant at up to district/borough level.
- 8.4.27 Moreton Brook will be realigned around the Moreton Brook viaduct, which will result in the permanent loss of a small section of watercourse. The loss of a small section of Moreton Brook and the direct effects in channel during construction will result in permanent adverse effect that is significant at up to district/borough level.
- 8.4.28 A series of smaller watercourses, including tributaries of Moreton Brook, will also be permanently diverted, realigned or culverted for the Proposed Scheme, severing the habitat corridors that follow these watercourses. This habitat loss and fragmentation will result in a permanent adverse effect that is significant at up to district/borough level.

Water bodies

- 8.4.29 On a precautionary basis, it is assumed that all 58 ponds located within the land required for the Proposed Scheme in the Fradley to Colton area will be permanently lost. This total, however, includes some ponds that are likely to be retained, such as those located within land required for overhead line diversions/realignments and those located within land required for the creation of woodland and grassland habitat. Where survey has not been possible, a precautionary approach to the assessment has been applied. The loss of ponds within the land required for the Proposed Scheme could lead to a permanent adverse effect on the conservation status of water bodies that will be significant, in each case, at up to district/borough level.

Ancient and veteran trees

8.4.30 It is assumed that four ancient or veteran trees recorded within the land required for the Proposed Scheme in the Fradley to Colton area will be permanently lost. Ancient and veteran trees are irreplaceable resources and their potential loss will result in a permanent adverse effect that is significant at district/borough level in each case. Where reasonably practicable, measures will be taken to protect and retain ancient and veteran trees within and adjacent to the proposed works area to reduce the number that will be impacted. On a precautionary basis, ancient or veteran trees are assumed to be lost as a result of:

- widening works associated with the construction traffic route along Newlands Lane will result in the loss of an ancient oak tree on Newlands Lane, south of Stockwell Heath;
- works associated with the diversion of Hadley Gate Lane will result in the loss of a veteran pedunculate oak located west of Dawson Lane, at Hadleygate;
- works associated with the Blithbury Central cutting will result in the loss of a veteran black poplar located on Newlands Lane south of Blithbury; and
- works associated with the Moreton South embankment will result in the loss of a veteran pedunculate oak located north of Moreton Brook.

Species

Fish

8.4.31 The nationally important spined loach population within the River Trent and the assemblage of other fish species within the River Trent, Pyford Brook and Moreton Brook will not be directly affected by the Proposed Scheme. Any indirect effects will be controlled through implementation of measures in the draft CoCP and the effects will not be significant.

Bats

8.4.32 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts is considered to have the potential to result in adverse effects on the bat populations or assemblages during construction. However, the point at which such impacts are considered likely to result in adverse significant effects on the conservation status of the population concerned will differ depending on the status of the species concerned.

8.4.33 The impact of disturbance on bat populations will generally be localised and limited to the period of construction. Bats utilising retained habitats may be subject to irregular and localised disturbance from lighting, noise and movement during the construction period where works in autumn, winter and spring may be carried out for short periods after dusk or prior to dawn. These impacts would only temporarily deter bats from using foraging and commuting habitats and the implementation measures that are described in the draft CoCP will reduce potential disturbance affects to a level that is not significant.

- 8.4.34 Construction will affect the noctule population, which is a component species of the bat assemblage associated with habitats near Pipe Wood and land to the south and east of Blithbury. Construction of Blithbury South cutting could result in the disturbance of a noctule maternity tree roost to the west of Pipe Wood, which is located approximately 14m from the land required for the Proposed Scheme. The proximity of construction activities to this roost and the resulting level of noise and vibration is likely to result in it becoming unviable for continued use. Noctules commonly fly above the tree canopy level and have been recorded commuting and foraging in areas away from the land required for the Proposed Scheme. As such, the loss and fragmentation of habitats in this area is unlikely to result in any additional effects on this noctule population. As maternity roosts are important to the continued breeding success of bat populations, the loss of a maternity roost will result in a permanent adverse effect on the noctule population in the assemblage associated with habitats near Pipe Wood and land to the south and east of Blithbury, which will be significant at the regional level.
- 8.4.35 Construction of Moreton South embankment will result in the loss of a Brandt's maternity roost, which is located immediately adjacent to the land required for the Proposed Scheme in a building south of Spencer's Plantation. Construction of the Moreton South embankment will also result in the partial loss of Spencer's Plantation, which is used as a resource for foraging and commuting bats. The partial loss of this woodland foraging habitat will result in temporary disturbance to the bat assemblage, however, it is likely that all component species will disperse to, and forage within, the surrounding woodland including the woodland block approximately 240m east of Spencer's Plantation. As maternity roosts are important to the continued breeding success of bat populations, the direct loss of a Brandt's maternity roost will result in a permanent adverse effect on the Brandt's bat population linked to the bat assemblage associated with habitats near Spencer's Plantation, which will be significant at the regional level.
- 8.4.36 Construction of the Moreton South embankment and the Moreton Brook viaduct will result in the loss/disturbance of a maternity roost of an unknown species, which is assumed to be a rarer bat species forming part of the bat assemblage associated with habitats at Moreton Brook and Lount Farm. Construction of Moreton South embankment and Moreton Brook viaduct will also result in habitat loss around Moreton Brook and Lount Farm, including hedgerows and grassland, which are used as a resource for foraging and commuting bats. The partial loss of this area of foraging habitat will result in temporary disturbance of bat populations up to county level. However, it is likely that all component species will disperse to, and forage within, the abundant similar habitat that surrounds this area. As maternity roosts are important to the continued breeding success of bat populations, the direct loss of a maternity roost of unknown species will result in a permanent adverse effect on the bat assemblage at Moreton Brook and Lount Farm, which will be significant at up to regional level.
- 8.4.37 Construction will affect the bat assemblage associated with habitat south of Kings Bromley Pits. Specifically, the realignment of Shaw Lane under the Bourne Brook viaduct will result in the disturbance of a brown long-eared maternity roost in buildings near Shaw Lane Farm, which is located adjacent to the land required for the Proposed Scheme. Construction of the Bourne embankment and the Bourne

embankment pre-cast yard and pre-cast laydown yard and their associated access roads will result in the disturbance of two brown long-eared roosts (one of which is a maternity roost and a day/summer roost) located adjacent to land required for the Proposed Scheme. The proximity of construction activities to these roosts and the resulting levels of noise and vibration is likely to result in them becoming unviable for continued use. Construction of the Kings Bromley viaduct will result in the loss of a non-breeding roost of soprano pipistrelle bats recorded in a tree in Tomlinson's Spinney. Construction of the Kings Bromley viaduct, the River Trent viaduct, the Bourne embankment and the Pyford North embankment will result in the loss and fragmentation of woodland, watercourses and hedgerows south of Kings Bromley Pits (including Rileyhill, woodlands near Shaw Lane, Tomlinson's Spinney, land around Kings Bromley Marina and at Westfield Covert), which are used as a resource for foraging and commuting bats. The direct loss of these roosts and the loss and fragmentation of foraging and commuting habitat will result in a permanent adverse effect on the assemblage of bats south of Kings Bromley Pits, which will be significant at the county level.

- 8.4.38 Habitats around the River Trent and Trentside Meadows LWS including the river, woodlands, hedgerows and grassland are used as a foraging and commuting resource by an assemblage of bats. The use of these areas is predominantly by common bat species with occasional passes of rarer species including a single recorded pass of lesser-horseshoe bat. Construction of the River Trent viaduct and the resultant partial loss of foraging habitat has potential to result in temporary disturbance to the bat assemblage. However, given the abundance of similar habitat in the surrounding area, it is likely that all component species will disperse to, and forage within, these areas during construction. Therefore, it is unlikely there will be a significant adverse effect on the assemblage of bats, including Lesser Horseshoe, using the River Trent, Trentside Meadows and land around Pipe Ridware.
- 8.4.39 Loss of other suitable habitats within the land required for the Proposed Scheme may require some bats to travel further, and expend more energy during day to day foraging and movement throughout their home range for the duration of construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations or assemblages concerned to result in a permanent adverse effect on their conservation status.

Amphibians

- 8.4.40 A meta-population of great-crested newts (AMP 31) has been identified across a network of eight ponds on land to the west of Fradley Lock (north and south of the Trent and Mersey Canal). Construction of the Pyford North and Pyford South embankments and associated infrastructure will result in the isolation of one pond, which has not been confirmed as supporting a population of great crested newt, as well as the loss of grassland and hedgerows that offer terrestrial habitat opportunities for great crested newt foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population on land to the west of Fradley Lock, which will be significant at up to county level.
- 8.4.41 A meta-population of great-crested newts (AMP 1.2) has been identified across a network of nine ponds on land between Rugeley and Blithbury. Construction of the Blithbury Road overbridge and B5014 Uttoxeter Road overbridge and associated

infrastructure will result in the loss of two ponds, neither of which have been confirmed as supporting great crested newt populations, as well as grassland and hedgerows that offer terrestrial habitat opportunities for great crested newt foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population between Rugeley and Blithbury, which will be significant at up to county level.

- 8.4.42 A meta-population of great-crested newts (AMP 1.3) has been identified across a network of 26 ponds on land near Hill Ridware and to the south of Colton, north-east of Rugeley. Construction of the 132kV power line from Rugeley Power Station to the Newlands Lane auto-transformer feeder station will result in the loss of eight ponds, none of which have been confirmed as supporting great crested newt populations, as well as grassland and hedgerows that offer terrestrial habitat opportunities for great crested newt foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population near Hill Ridware and to the south of Colton, which will be significant at up to county level.
- 8.4.43 A meta-population of great-crested newts (AMP 1.4) has been identified across a network of 16 ponds on land adjacent to the B5013 Uttoxeter Road, south-west of Admaston. Construction of the B5013 Uttoxeter Road re-alignment will result in the loss of four ponds, one of which has been confirmed as supporting a population of great crested newt, as well as grassland and hedgerows that offer terrestrial habitat opportunities for great crested newt foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population on land adjacent to the B5013 Uttoxeter Road, south-west of Admaston, which will be significant at county level.
- 8.4.44 Of the 58 ponds within the land required for the Proposed Scheme within the Fradley to Colton area, six ponds have been assessed as unsuitable for great crested newts, four have been accessible for presence/absence survey, and of these, two have been confirmed as supporting great crested newts. In the absence of survey information, the remaining 48 ponds are assumed to support populations of great crested newts. This is highly precautionary and it is likely that a proportion of the un-surveyed ponds do not support great crested newt populations. The loss of any ponds supporting great crested newts would result in a permanent adverse effect on amphibian populations that will be, in each case, significant at up to county level.

Birds

- 8.4.45 Construction of the River Trent viaduct, excavation of a borrow pit, and establishment of the Pipe Ridware embankment satellite compound and River Trent viaduct satellite compound will result in the loss of barn owl foraging habitat in the form of large areas of arable fields, semi-improved and improved fields and associated field margins that are of value to the barn owl population identified around Trentside Meadows LWS and south-east of Pipe Ridware and Pipe Ridware Church. Given the large area of habitat to be lost and territorial nature of barn owl there is a permanent adverse effect, which will be significant at the county level.
- 8.4.46 Construction of Blithbury Central cutting, establishment of Blithbury Central cutting satellite compound, realignment of Blithbury Road and the presence of temporary material stockpiles will result in the permanent loss of barn owl foraging habitat in the

form of arable fields, semi-improved and improved fields and associated field margin. A roost site in a tree west of Hadley Gate and north of Blithbury Road will also be lost. Foraging habitat and the roost site are of value to the barn owl population identified at Bentley Hall Farm, Hadley Gate, south of Blithbury and land around Rosewood Farm, west of Blithbury. This loss represents a permanent adverse effect on the barn owl population identified between at Bentley Hall Farm, Hadley Gate, south of Blithbury and land around Rosewood Farm, west of Blithbury, which will be significant at up to county level

- 8.4.47 Construction of Moreton South embankment and establishment of the Moreton Brook viaduct satellite compound and works associated with the underground diversion of an existing 132kV power line will result in the loss of potential barn owl foraging habitats in the form of lowland meadows of improved, semi-improved and marshy grassland, associated field margins and hedgerows. Potential nesting sites within and on nest boxes on mature trees will also be lost. Foraging habitat and the potential nesting sites are of value to the barn owl population identified at Moreton Meadows, Lount Farm and Upper Moreton Farm, north-east of Bishton. This loss represents a permanent adverse effect on the barn owl population identified utilising the agricultural land around Moreton Meadows, Lount Farm and Upper Moreton Farm, north-east of Bishton, which will be significant at up to county level.

Vascular plants

- 8.4.48 A number of vascular plants will be affected during construction. Construction of the B5014 Uttoxeter Road overbridge will result in the loss of black poplar from land south-west of Blithbury Road and the loss of bog pimpernel from field margins west of the B5014 Uttoxeter Road. Construction of the Mavesyn Ridware temporary diversion associated with the Blithbury south cutting will result in the loss of field woundwort from land north of Quinton's Orchard. The loss of these species would be significant, in each case at the county level.

Other mitigation measures

- 8.4.49 This section describes other mitigation measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement.

Habitats

Woodland

- 8.4.50 The Proposed Scheme will result in the combined loss of approximately 6.9ha of lowland mixed deciduous woodland in the Fradley to Colton area at woodland east of Woodend Common Barn, Shaw Lane Gap Wood (within Riley Hill BAS), and Tomlinson's Spinney, each of which is of significant at the district/borough level.
- 8.4.51 There is a further loss and fragmentation from 19 other small woodlands across the Fradley to Colton area, including loss of approximately 8.2ha of lowland mixed deciduous woodland and 4.6ha of other woodland habitat, as reported within the register of local/parish effects (Volume 5: Appendix EC-016-001). The combined loss and fragmentation of woodland habitats from these woodlands is significant at the district/borough level.

- 8.4.52 In accordance with the Ecological Principles of Mitigation in the SMR Addendum a route-wide, integrated strategic approach has been developed to compensate for loss of woodland. The woodland habitat creation in this area is intended to fulfil the objective of no net loss as far as possible in the local area as well as to ensure that the populations of protected and notable species including bats are maintained. With these objectives in mind, where reasonably practicable, the locations of woodland habitat creation have been selected so as to increase the size of existing higher quality habitat and to increase connectivity.
- 8.4.53 Within the Fradley to Colton area, approximately 40.6ha of woodland habitat creation will be undertaken at locations including the following:
- approximately 3.0ha of woodland habitat creation to the north of Bourne embankment, to increase the area of woodland at Westfield Covert and to connect the ancient woodland to other semi-natural habitats surrounding Kings Bromley Gravel Pits;
 - approximately 1.1ha of woodland habitat creation adjacent to Cawarden Springs Wood AWI site, to increase the area of woodland at Cawarden Springs and to enhance ecological connectivity between the ancient woodland and an unnamed woodland to the north;
 - approximately 4.9ha of woodland habitat creation along Pyford Brook watercourse and linking to further planting areas either side of the Pyford South embankment, which will enhance local ecological connectivity. In particular, this will compensate for the loss of approximately 2.4ha of semi-mature broadleaved woodland at the woodland east of Woodend Common Barn;
 - approximately 2.9ha of woodland habitat creation along Ashby Sitch watercourse, which will enhance local ecological connectivity. In particular, this will compensate for losses of approximately 0.3ha of Shaw Lane Gap Wood (within Riley Hill BAS), located north of Kings Bromley Wharf; and
 - approximately 3.3ha of woodland habitat creation adjacent to the north of Tomlinson's Spinney, which will enhance ecological connectivity to Westfield Covert. In particular, this will help to compensate for the loss of approximately 3.7ha of woodland within Tomlinson's Spinney.
- 8.4.54 The target habitat type for woodland planting is lowland mixed deciduous woodland habitat of principal importance. The new areas of woodland habitat will connect and help maintain the integrity of remaining areas of woodland. A temporary adverse effect is expected until these woodland areas have become established, after which there will be a permanent beneficial effect on lowland mixed deciduous woodland that is significant at district/borough level.
- 8.4.55 In addition, there will be further areas of landscape planting of native broadleaved woodland, which will also contribute to habitat creation.

Grassland

- 8.4.56 The Proposed Scheme will result in the loss of approximately 4.9ha of floodplain grazing marsh at Trentside Meadows LWS, and 3.3ha of lowland meadow habitat in and adjacent to Lount Farm LWS within the Fradley to Colton area, each of which is significant at the county level. There is a combined loss of approximately 11.7 ha of lowland meadow habitat in and adjacent to Lount Farm LWS across the Fradley to Colton and Colwich to Yarlet (CA2) areas.
- 8.4.57 There is a further loss of approximately 21.6ha of semi-improved grassland within the Fradley to Colton area, including loss of approximately 0.6ha of lowland meadow, as reported within the register of local/parish effects (Volume 5: Appendix EC-016-001). The combined loss of semi-improved grassland from these areas is significant at the district/borough level.
- 8.4.58 In accordance with the Ecological Principles of Mitigation in the SMR Addendum, a route-wide, integrated strategic approach has been developed to compensate for loss of grassland. The grassland habitat creation in this area is intended to fulfil the objective of no net loss as far as possible in the local area as well as to ensure that the populations of protected and notable species including great crested newts and barn owls are maintained. With these objectives in mind, where reasonable practicable, the locations of grassland habitat creation have been selected so as to increase the size of existing higher quality habitat and to increase connectivity.
- 8.4.59 Within the Fradley to Colton area, grassland habitat creation will be undertaken at locations including the following:
- approximately 13.6ha of species-rich grassland will be created in adjacent areas and approximately 0.8ha and 0.2ha of wet grassland habitat adjacent to River Trent and River Trent tributary will be reinstated and enhanced. In particular, this will compensate for losses of 4.9ha of floodplain grazing marsh at Trentside Meadows LWS;
 - approximately 3.3ha of lowland meadow at Lount Farm LWS will be restored and enhanced on the west side of Moreton Brook. In particular, this will compensate for the loss of approximately 3.3ha of lowland meadow at Lount Farm LWS within the Fradley to Colton area, which is affected by works associated with the underground diversion of an existing 132kV power line. In addition, approximately 2.7ha of species-rich grassland will be created on land to the east side of Moreton Brook, to partly compensate for the further loss of 8.4ha of lowland meadow within and adjacent to Lount Farm LWS in the Colwich to Yarlet area (4.4ha of which is within the LWS); and
 - additional grassland habitat creation areas at Pyford Brook viaduct, Ashby Sitch culvert, River Trent viaduct, at Mavesyn Ridware, and at Stockwell Heath.
- 8.4.60 At locations where the Proposed Scheme will cross watercourses on viaducts, the value of the ecological corridors will be enhanced through creation of marshy grassland habitat.

- 8.4.61 The target habitat type for grassland habitat creation is lowland meadow or floodplain grazing marsh habitat of principal importance, depending on location. A temporary adverse effect upon grassland habitats within the Fradley to Colton area is expected until grassland creation areas have become established, after which these measures will reduce the cumulative effect on grassland to a level that is not significant.

Hedgerows

- 8.4.62 New hedgerows will be planted as replacement for those lost as a result of the Proposed Scheme. Where practicable, the hedgerows to be lost at Crawley Lane (Hedge) BAS and Finners Hill Hedgerows BAS will be translocated to the nearest suitable habitat creation areas. Approximately 52.4km of new hedgerows will be planted, including to enhance connectivity to Pipe Wood Lane Hedgerow LWS and Newlands Lane LWS, and to compensate for short sections lost from other hedgerow BAS. The species composition of hedgerow planting will be characteristic of the surrounding area. This represents a net loss in hedgerow of approximately 12.4km after mitigation, which represents a permanent adverse effect that is significant at the county level. However, opportunities will be sought to retain or replace hedgerows within the land required for the Proposed Scheme for temporary works only. Reinstatement of existing hedgerows within the land required for temporary works would provide approximately 28.8km of hedgerow in addition to the mitigation described.

Watercourses

- 8.4.63 Approximately 0.6ha of canal bank and canal habitat will be re-instated and the establishment of marginal vegetation will be promoted to compensate for the loss of 0.6ha of canal bank and canal habitat at the Trent and Mersey Canal. (This equates to re-instatement of the 7% of canal bank and canal habitat within Kings Bromley Wharf to Fradley Junction, Coventry Canal LWS that was lost.) Once the vegetation has developed the adverse effect on this watercourse will be reduced to a level that is not significant.
- 8.4.64 Where smaller watercourses are diverted, the channel will be naturalised where possible with a profile to promote the establishment of marginal vegetation and pools. Once the vegetation has developed the adverse effect on these watercourses will be reduced to a level that is not significant.

Water bodies

- 8.4.65 At least one pond will be created for every pond lost within the Proposed Scheme. New ponds will be established in accordance with the Ecological Principles of Mitigation in the SMR Addendum. Once established, it is anticipated that any adverse effect on pond habitats will be reduced to a level that is not significant.

Ancient and veteran trees

- 8.4.66 Where practicable measures will be taken to protect the four impacted ancient or veteran trees. Where loss is unavoidable, the trees will be soft felled and sections placed within retained habitats to provide a continued deadwood resource. Ancient and veteran trees are irreplaceable and the loss of each of these trees represents a residual adverse effect that is significant at the district/borough level.

Species

Bats

- 8.4.67 To replace roosts that will be lost to construction, artificial roosting provision will be provided across the Proposed Scheme, in accordance with the Ecological Principles of Mitigation within the SMR Addendum. The habitat creation measures detailed above for mitigation of habitat loss, including creation of areas of grassland, hedgerows, new ponds, and semi-natural woodland, will compensate for those bat foraging habitats lost within the land required for the Proposed Scheme as detailed below.
- 8.4.68 The loss of a noctule maternity roost, which is a component species of the bat assemblage associated with habitats near Pipe Wood and land to the south and east of Blithbury will be addressed through the provision of a suitable replacement roost within areas of new woodland planting to the west of Pipe Lane. Following the implementation of these measures, the effects on the noctule population will be reduced to a level that is not significant.
- 8.4.69 The loss of a Brandt's maternity roost and foraging / commuting habitat used by the bat assemblage associated with habitats around Spencer's Plantation will be addressed by provision of suitable replacement roosts within woodland planting north of the Moreton South embankment and within the wetland planting in fields alongside Moreton Brook. Following the implementation of these measures, the effects on the bat assemblage associated with habitats at Spencer's Plantation will be reduced to a level that is not significant. The partial loss of Spencer's Plantation foraging resource at Moreton South embankment will be addressed through the provision of suitable replacement foraging habitat, comprising woodland and wetland planting that will be situated north-west of Spencer's Plantation improving connectivity to the woodland block to the north-west and away from the Proposed Scheme. Following the implementation of these measures, the effects on the bat assemblage associated with habitats at Spencer's Plantation will be reduced to a level that is not significant.
- 8.4.70 The loss/disturbance of a maternity roost of unknown (assumed to be rarer) bat species associated with the bat assemblage using habitats at Moreton Brook and Lount Farm will be addressed through the provision of a suitable replacement roost within an area of new woodland planting as close to the roost being lost as possible. Following the implementation of these measures, the effects on the bat assemblage associated with habitats at Moreton Brook and Lount Farm will be reduced to a level that is not significant.
- 8.4.71 The disturbance to and likely loss of two brown long-eared maternity roosts and a summer roost for the same species, and the direct loss of a non-breeding roost for soprano pipistrelle bats as well as the loss and fragmentation of foraging habitat associated with the assemblage of bats using habitat south of Kings Bromley Pits will be addressed through the provision of suitable replacement roosting and foraging habitat. Replacement roost habitat and foraging provision will be provided within woodland planting at Westfield Covert south of Kings Bromley marina, and south of the A513 Rugeley Road and wetland planting that will be provided east of the Bourne embankment, under the Kings Bromley viaduct. Hedgerow planting will also provide further connectivity to New Plantation to the south of the retained part of

Tomlinson's Spinney. Following the implementation of these measures, the effects on the bat assemblage associated with habitat south of Kings Bromley Pits will be reduced to a level that is not significant.

Amphibians

- 8.4.72 Provision of ponds, species-rich neutral grassland and broadleaved woodland will be designed to compensate for the loss of breeding sites, foraging habitat and places of shelter used by great crested newts and other amphibian species. Compensation will be provided within the ecological habitat creation areas near Pyford Brook, near Westfield Covert and Kings Bromley Marina, near Quinton's Orchard, between Stoneyford Lane and Hadley Gate and near Hurst Wood. Ponds, grassland and woodland will be established in accordance with the Ecological Principles of Mitigation within the SMR Addendum. Following implementation, the adverse effects on the amphibian populations in the Fradley to Colton area will be reduced to a level that is not significant. HS2 Ltd will continue to survey ponds for great crested newt populations, where it is confirmed that populations are absent then pond and terrestrial habitat provision will be re-assessed.

Birds

- 8.4.73 Habitat creation measures to address the adverse effects on barn owl in the Fradley to Colton area will include the provision of grassland and hedgerow habitat creation adjacent to Trentside Meadows LWS and along the River Trent, woodland and hedgerow planting adjacent to the realigned Blithbury Road, wetland habitat creation along Moreton Brook, and woodland and hedgerow planting linking Moreton Brook to Spencer's Plantation and further existing woodland blocks to the east. These habitat creation measures will provide foraging and nesting opportunities for barn owl populations in the Fradley to Colton area. Once the habitats have become established, the adverse effect on barn owl populations resulting from the loss of foraging habitat and potential nesting sites in the Fradley to Colton area will be reduced to a level that is not significant.

Vascular plants

- 8.4.74 To address the adverse effect on vascular plants, black poplar will be included in areas of new woodland planting throughout the Fradley to Colton area. Where appropriate, bog pimpernel and field woundwort will be translocated to suitable areas of new planting that form part of the wider habitat creation measures. New areas of habitat planting will also include these species where the conditions are suitable. Following the implementation of these measures, the adverse effects on the populations of black poplar, bog pimpernel and field woundwort will be reduced to a level that is not significant.

Badger

- 8.4.75 Although there will be no significant effects on badger populations in this area, mitigation measures to address the potential disturbance of badgers will be provided in accordance with the Ecological Principles of Mitigation within the SMR Addendum. This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

- 8.4.76 This section describes anticipated significant residual ecological effects during construction, taking into account the mitigation and compensation proposed.
- 8.4.77 Extensive new woodland planting at several sites within the Fradley to Colton area will increase the area of broadleaved woodland and enhance woodland connectivity. This will result in a permanent beneficial residual effect on lowland mixed deciduous woodland habitat that is significant at district/borough level.
- 8.4.78 On a precautionary basis, it is assumed that there is a net loss in hedgerow of approximately 12.4km, which will result in a permanent adverse residual effect that is significant at the county level. However, restoration of land required only for the construction of the Proposed Scheme to its current use, offers potential for reinstatement of a further 28.8km of existing hedgerow. The provision of the majority of this reinstated hedgerow would reduce the residual effect to a level that is not significant.
- 8.4.79 The assumed loss of one ancient and three veteran trees will result in a permanent adverse residual effect that is significant at district borough/level in each case.

Cumulative effects

The Proposed Scheme and HS2 Phase One

- 8.4.80 The cumulative effects on ecological receptors during construction of the Proposed Scheme and HS2 Phase One are reported below.

Fradley Wood BAS

- 8.4.81 Fradley Wood BAS, covering an area of approximately 29.2ha, is located across the interface between the Proposed Scheme and HS2 Phase One. The construction of HS2 Phase One will result in the loss of approximately 3.7ha (13%) of Fradley Wood BAS¹¹³, a site now determined to be of district/borough value¹¹⁴. An area of Brokendown Wood, a coniferous woodland (pine plantation) and part of Fradley Wood BAS, will be lost during construction of HS2 Phase One. Fradley Gorse, a deciduous woodland, and open habitats within the wider areas of Fradley Wood are also part of Fradley Wood BAS and will be lost during construction. The permanent loss of this habitat is not considered to result in a significant effect on the structure and function of the site.
- 8.4.82 Approximately 3.2ha (11%) of Fradley Wood BAS is located within the land required for the Proposed Scheme. The land to the south-east of the Trent and Mersey Canal is required for rail systems work associated with the connection of power between the Proposed Scheme and Hs2 Phase One. To the north-west of the Trent and Mersey Canal, the construction of the Proposed Scheme will result in the loss of a further, approximately 0.5ha (2%), of Fradley Wood BAS, in the form of woodland within

¹¹³ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442226/SES_and_AP2_ES_Volume_2_CFA22.pdf

¹¹⁴ In the Phase One Environmental Statement (ES) and Supplementary Environmental Statement (SES) Fradley Wood BAS was considered to be of county/metropolitan value. Consultation with Staffordshire Wildlife Trust as part of the Proposed Scheme has determined that Fradley Wood BAS is of district borough value.

Brokendown Wood. The permanent loss of this habitat will result in a permanent adverse effect on the structure and function of the site at the local/parish level, which is not significant.

- 8.4.83 The combination of the permanent loss of 4.2ha (14%) of Fradley Wood BAS will result in a permanent adverse effect on the structure and function of the site that is significant at the district/borough level.

Brokendown Wood

- 8.4.84 Brokendown Wood, covering an area of approximately 3.9ha, forms part of Fradley Wood BAS and is located across the interface between the Proposed Scheme and HS2 Phase One. Construction of HS2 Phase One will result in the loss of approximately 1.5ha (38%) of woodland within Brokendown Wood. The majority of the habitat that will be lost is coniferous woodland (pine plantation). There will be fragmentation of the woodland with a small section isolated to the west of the Phase One Manchester spur (the connection with the Proposed Scheme), although the majority of remaining woodland will be on the eastern side of the spur. The permanent loss of woodland will result in a permanent adverse effect that is significant at the district/borough level. Woodland planting to compensate for the loss of woodland will be provided which, once established, will reduce the effect to a level that is not significant.
- 8.4.85 Approximately 0.5ha (13%) of the Brokendown Wood is located within the land required for the Proposed Scheme. Construction of the Proposed Scheme will result in the loss of approximately 0.5ha of Brokendown Wood, adjacent to the area to be lost as a result of HS2 Phase One. The permanent loss of woodland will result in a permanent adverse effect that is significant at the district/borough level. To compensate for the loss of this woodland within the Proposed Scheme woodland planting will be provided as part of the Proposed Scheme, including along the Pyford Brook and west of Wood End Common, which once established will reduce the effect to a level that is not significant.
- 8.4.86 The combination of the permanent loss of 2ha (51%) of woodland will result in a permanent adverse effect that will remain significant at the district/borough, which following establishment of mitigation will not be significant.

Bat assemblage using the Trent and Mersey Canal and adjacent woodlands

- 8.4.87 A bat assemblage using the Trent and Mersey Canal and adjacent woodlands is known to forage in woodland within the land required for the Proposed Scheme and HS2 Phase One. The cumulative effect of the Proposed Scheme and HS2 Phase One will result in the loss of foraging habitat and potential fragmentation of remaining habitats (Ravenshaw Wood, Black Slough, the Slaish, Fradley Wood and Cranberry Wood) and will increase the geographic extent of temporary disturbance associated with both schemes. However, it is likely that all component species will disperse to, and forage within, the abundant surrounding woodland including areas of existing and planted woodland and therefore the cumulative effect is considered to be not significant. Woodland and wetland planting to be provided as part of the Proposed Scheme, including along the Pyford Brook and west of Wood End Common, will increase the extent of available foraging and commuting habitat available to this bat assemblage.

Barn owls

- 8.4.88 Construction of HS2 Phase One will result in the loss of some of the foraging area comprising arable and grass farmland of the territory of a barn owl pair, near Kings Bromley Wharf¹¹⁵. However, evidence shows that the barn owl only occasionally use this area and nest further afield. Therefore, the permanent loss of this area of arable and grass farmland is not considered to result in a significant effect on the barn owl population identified.
- 8.4.89 Works to raise the National Grid 400kV overhead power line, near Kings Bromley Wharf will result in disturbance and temporary loss of foraging area of arable and grass farmland of the territory of the same barn owl pair, near Kings Bromley Wharf. For the same reasons identified in Phase One the permanent loss of this area of arable and grass farmland is not considered to result in a significant effect on the barn owl population identified. The cumulative effect of the Proposed Scheme and HS2 Phase One of increased disturbance and territory loss will not result in a cumulative significant effect.

Impact of the Proposed Scheme on HS2 Phase One

- 8.4.90 The construction of the Proposed Scheme will result in an area of approximately 1ha of replacement broadleaved woodland habitat and scrub planting proposed as part of HS2 Phase One not being planted. The purpose of this woodland habitat and scrub planting was primarily to mark the terminal point of the Phase One route and to integrate the scheme into the surrounding landscape. The Proposed Scheme includes woodland, grassland and wetland planting along the Pyford Brook to replace the planting that will no longer be provided as part of HS2 Phase One. There are no new or different significant effects as a result of this change.

Phase 2a and other committed developments

- 8.4.91 No cumulative effects on ecology receptors have been identified from other committed developments in the Fradley to Colton area.

8.5 Effects arising from operation

Avoidance and mitigation measures

- 8.5.1 Within this section of the Proposed Scheme the following elements of the design will avoid or reduce impacts on features of ecological value during operation:
- Pyford Brook viaduct, Kings Bromley viaduct, River Trent viaduct and Moreton Brook viaduct will provide ecological connectivity under the route of the Proposed Scheme to adjacent habitats. Ecological connectivity beneath the route of the Proposed Scheme will be maintained for a combined length of 3.3km of viaducts in the Fradley to Colton area. This will reduce habitat fragmentation and barrier effects, allowing free passage of wildlife at these locations;

¹¹⁵ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442226/SES_and_AP2_ES_Volume_2_CFA22.pdf

- three overbridges will maintain farm access and/or public access on footpaths or bridleways across the route of the Proposed Scheme. These structures will be of a sufficient size to also allow for the passage of a range of wildlife species, and their primary purpose will not discourage use by most wildlife species. These overbridges will reduce barrier effects by facilitating wildlife movement across the Proposed Scheme; and
- where the route of the Proposed Scheme crosses a watercourse a culvert or dry tunnel will be provided to allow passage of for mammal such as otter and water vole.

Assessment of impacts and effects

- 8.5.2 Significant effects arising during operation at the district/ borough level or above are described below. Significant effects on ecological features at the local/parish level are listed in Volume 5 Appendix: EC-016-001.

Species

Bats

- 8.5.3 The operation of the Proposed Scheme has the potential to result in a variety of impacts on bat populations including those as a result of collision with passing trains, turbulence and noise. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the population concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the Proposed Scheme on each of these receptors.
- 8.5.4 Due to the large areas over which bats forage it is likely that any loss of, or displacement from, suitable foraging habitat in the vicinity of the Proposed Scheme will in itself amount to only a small proportion of the wider available resource. However, the impact of any such disturbance or displacement could be greatly increased if bats are hampered in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.
- 8.5.5 Noise, vibration and lighting associated with passing trains have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise on bats caused by passing trains is limited. Research suggests that gleaning bats, such as brown long-eared, will have reduced foraging success within areas where there is persistent noise from busy roads¹¹⁶. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.
- 8.5.6 Where the route of the Proposed Scheme bisects, or is located in proximity to existing features known to be utilised regularly by foraging or commuting bats, there is an increased risk that bats could be killed or injured as a result of collisions with passing trains or associated turbulence. The significance of any such effect will be dependent

¹¹⁶ Schaub, A., Ostwald, J. & Simeers, B.M. (2008). Foraging bats avoid noise. *Journal of Experimental Biology*, **211**, 3174-3180.

on both the flight height range of the species and the vertical alignment of the Proposed Scheme (i.e. whether the railway is in cutting, at grade or on embankment) at the point the impact occurs.

- 8.5.7 Woodland and wet grassland habitat creation along the Pyford Brook will connect to the area of woodland known as Wood End Wood, and on to the Trent and Mersey Canal and other woodlands including Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood, encouraging bats to utilise the foraging habitats in this location. Bats flying north-east towards the Proposed Scheme will be encouraged, by this planting, to cross beneath the route of the Proposed Scheme at Pyford Brook viaduct. Grassland and wet grassland habitat creation and hedgerow planting along the Bourne Brook will connect to habitats along Shaw Lane and Common Lane connecting foraging habitats in this location. Bats flying north towards the Proposed Scheme will be encouraged, by this planting, to cross beneath the route of the Proposed Scheme at Kings Bromley viaduct.
- 8.5.8 Grassland and hedgerow habitat creation alongside the River Trent and other smaller watercourses in this area will provide connectivity to Trentside Meadows and Pipe Lane and to habitats to the south and west, and habitats associated with Kings Bromley Marina and Westfield. This planting will connect foraging habitats throughout this location. Bats flying north or south towards the Proposed Scheme will be encouraged, by this planting, to cross beneath the route of the Proposed Scheme at River Trent viaduct. Wetland habitat creation along the Moreton Brook and woodland and hedgerow planting between the Moreton Brook and Spencer's Plantation will provide connectivity and foraging habitat along the Moreton Brook and westwards to Spencer's Plantation and the woodland blocks beyond. Bats flying north or south towards the Proposed Scheme will be encouraged, by this wetland planting, to cross beneath the route of the Proposed Scheme at Moreton Brook viaduct.
- 8.5.9 Although it is possible that there may be infrequent incidental mortality of individual bats, due to the avoidance measures described above and the availability of alternative foraging and commuting habitat on either side of the Proposed Scheme, this is unlikely to result in a significant adverse effect on the conservation status of the bat assemblages present in the Fradley to Colton area.

Birds

- 8.5.10 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls hunt low over the rough grassland habitats that are associated with railway embankments and are slow moving and therefore subject to likely collision with high speed trains. Three pairs of barn owls breeding in the vicinity of the Proposed Scheme will be affected at: Trentside Meadows, at land south-east of Pipe Ridware, and Pipe Ridware Church; Bentley Hall Farm, Hadley Gate, south of Blithbury and land around Rosewood Farm west of Blithbury; and Moreton Meadows, Lount Farm and Upper Moreton Farm north-east of Bishton. Research undertaken by the British Trust for Ornithology on behalf of HS2 Ltd suggests that there may be effects on barn owls up

to 3km away¹¹⁷. This means that more barn owls are likely to be affected than those in the vicinity of the Proposed Scheme identified above. This would result in a permanent residual adverse effect that will be significant at the county level.

Other mitigation measures

- 8.5.11 HS2 Ltd will seek to identify opportunities to provide barn owl nesting boxes and enhance barn owl habitat at least 3km from the Proposed Scheme in consultation with local landowners. A barn owl action plan will be prepared to identify the measures that can be implemented to help offset the effects. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

- 8.5.12 The mitigation, compensation and enhancement measures described above are likely to reduce the residual ecological effects during operation to a level that is not significant, except for barn owl. Collision with trains is likely to result in the loss of barn owls that nest within 3km of the route resulting in a residual significant effect at the county level. However, provided the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

Cumulative effects

The Proposed Scheme and HS2 Phase One

- 8.5.13 Collision with trains during the operation of HS2 Phase One is likely to result in the permanent loss of a pair of barn owls using the territory south-east of Handsacre, near Kings Bromley. This permanent loss will be significant at the county/metropolitan level.
- 8.5.14 Other known barn owl pairs that would be affected by operation of the Proposed Scheme are not affected by the operation of HS2 Phase One and therefore there will be no significant cumulative effect on these pairs.

Phase 2a and other committed developments

- 8.5.15 No cumulative effects on ecology receptors have been identified from other committed developments in the Fradley to Colton area.

Monitoring

- 8.5.16 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 8.5.17 There are no area-specific requirements for monitoring ecology and biodiversity effects or mitigation during the operation of the Proposed Scheme in the Fradley to Colton area.

¹¹⁷ Pringle, H., Siriwardena, G. & Toms, M. (2016) *Informing best practice for mitigation and enhancement measures for Barn Owls*. British Trust for Ornithology, Thetford.

9 Health

9.1 Introduction

- 9.1.1 This section identifies the communities within the Fradley to Colton area that will be subject to impacts associated with the Proposed Scheme and reports changes that are considered to be potentially important for the health and wellbeing of people within these communities, where these effects are considered to be consequential.
- 9.1.2 Engagement with key public health bodies has been undertaken to inform the health assessment process. The assessment also draws on health related information and views expressed in consultation responses from Staffordshire County Council (SCC), the local parish councils of Colton, Fradley and Streethay, and Kings Bromley and the Colton Ramblers.
- 9.1.3 This section deals specifically with impacts at a local level within the Fradley to Colton area. Health effects across the Proposed Scheme as a whole are assessed in Section 8 of Volume 3: Route-wide effects.
- 9.1.4 Further details of the health assessment, including the application of assessment criteria supporting the conclusions presented in this section are contained in Volume 5: Appendix HE-001-001, Health assessment matrix.
- 9.1.5 Maps showing the location of the key environmental features (Map Series CT-10), construction features (Map Series CT-05), and key operational features (Map Series CT-06) of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 9.1.6 In addition, the community health profile for the Fradley to Colton area is set out in Background Information and Data (BID)¹¹⁸ (BID-HE-002-001).

9.2 Scope, assumptions and limitations

- 9.2.1 The scope, assumptions and limitations for the health assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)¹¹⁹.
- 9.2.2 As set out in the SMR, the health assessment is based on a broader understanding of health, consistent with the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity'¹²⁰. An individual's health is mostly determined by genetics and lifestyle factors, but for a large enough population many other factors, or 'health determinants', are known to be important, and these factors may be affected by the Proposed Scheme.
- 9.2.3 The assessment has considered the impacts of the Proposed Scheme on a range of environmental and socio-economic 'health determinants', which could result in adverse or beneficial effects on health and wellbeing. This process is documented in the health assessment matrices in Volume 5: Appendix HE-001-003. Based on this a

¹¹⁸ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2

¹¹⁹ Volume 5: Appendix CT-001-000, Environmental Impact Assessment Scope and Methodology Report.

¹²⁰ World Health Organization, 1948: Constitution of the World Health Organization Basic Documents, 45th edition supplement. Available online at: www.who.int/governance/eb/who_constitution_en.pdf

professional judgement has been made to identify those effects on population health and wellbeing that are sufficiently important to report within the health assessment sections found in this report and Volume 3: Route-wide assessment.

- 9.2.4 The health determinants of relevance to the assessment within the Fradley to Colton area are:
- impacts during construction (temporary and permanent):
 - neighbourhood quality;
 - access to services, health and social care;
 - access to green space, recreation and physical activity; and
 - social capital; and
 - impacts during operation (permanent):
 - neighbourhood quality; and
 - access to services, health and social care.
- 9.2.5 The geographic extent of the health assessment covers those areas where impacts on health determinants are predicted to occur.
- 9.2.6 The health assessment methodology is based, in part, on a review of published evidence showing how impacts on health determinants are linked to health 'outcomes' (i.e. effects) in a large enough population. The evidence varies in its strength; for example, the evidence linking physical activity to health outcomes is strong, whereas the evidence linking social capital with health outcomes is moderate. The strength of evidence does not necessarily determine the importance of a health effect, but is an indication of the level of certainty in the assessment. Additionally, there is greater certainty in the prediction of an impact on a health determinant than the consequent effect on health.
- 9.2.7 There is no established or widely accepted framework for assessing the significant health effects of a development proposal. The SMR sets out a methodology for describing the impacts on health determinants in terms of the magnitude and duration of the change and the extent of the population exposed to this change. It also draws attention to the strength of evidence that links a change in health determinant with health effects. This framework permits the assessment to describe the impacts on determinants in a largely qualitative manner, with some structure to the relative scale of these impacts to give a sense of the importance of the potential health effects. However, this does not provide a clear basis for drawing conclusions as to whether a health effect is likely to be 'significant'.

9.3 Environmental baseline

Existing baseline

Demographic and health profile of the Fradley to Colton area

- 9.3.1 The Fradley to Colton area covers approximately 13.5km of the Proposed Scheme within the local authority areas of Lichfield District Council (LDC) and SCC. The route

will run through mainly rural areas comprising lowland and settled river landscapes with agriculture being the main land use. The Proposed Scheme will pass close to the settlements of Kings Bromley, Pipe Ridware, Blithbury and Colton. Other residential areas include Fradley, Hill Ridware, Hamstall Ridware and Stockwell Heath. The boundary between HS2 Phase One and the Proposed Scheme forms the southern boundary of this section, which extends north to Colwich.

- 9.3.2 The larger settlements of Handsacre and Armitage and the towns of Rugeley and Lichfield lie to the south of the Proposed Scheme. The Proposed Scheme will cross the A515 Lichfield Road and the A513 Rugeley Road as well as numerous rural roads linking the rural community to services and facilities in these larger settlements.
- 9.3.3 The wards¹²¹ directly affected by the Proposed Scheme in the Fradley to Colton area have a relatively small total population, commensurate with the rural nature of the land use. Data provided by the Office of National Statistics¹²² and the Association of Public Health Observatories¹²³ show that this population is, by comparison with national (England) averages, generally in good health and experiences low levels of deprivation.
- 9.3.4 The population as a whole is considered to be more resilient than the national average, with regard to changes in the relevant health determinants, and with relatively few vulnerabilities. One vulnerability in this population is a slightly higher than average proportion of older people (the 65-84 years category). Another is that the population is more deprived than the national average with regard to the indicator of 'barriers to affordable housing and social services'. In part, this reflects the rural nature of the area and the distance people have to travel to access services including medical facilities, shops and recreational facilities.
- 9.3.5 The available data permit a profile to be made of the whole population in the Fradley to Colton area and provides detail down to ward level. The description of the whole population, and the populations within wards, does not exclude the possibility that there will be some individuals or small groups of people who do not conform to the overall profile. Detailed community profile data are presented in Background Information and Data: BID-HE-002-001, Community health profile.
- 9.3.6 For the purposes of the health assessment, the Fradley to Colton area is divided into the communities described below.

Description of communities in the Fradley to Colton area

Kings Bromley and surrounds

- 9.3.7 This area includes the southernmost part of the route of the Proposed Scheme, where it will connect with HS2 Phase One, north-east of Fradley, and the surrounding farmland. It comprises scattered farms and dwellings in the rural areas around the community of Kings Bromley, a village of approximately 420 residential properties. The village is located approximately 1km north-east of the Proposed Scheme, with

¹²¹ Electoral wards are the spatial units used to elect local government councillors.

¹²² The Office of National Statistics (ONS) provides spatial data on levels of deprivation, using indicators of: 'multiple deprivation', 'employment', 'education', 'barriers to housing and social services', 'crime' and 'living environment'. These data are available by Lower Super Output area.

¹²³ Public Health Observatories (PHOs) are part of Public Health England. They produce information, data and intelligence on people's health and health care for practitioners, commissioners, policy makers and the wider community. Available online at <http://www.apho.org.uk/>

community facilities located off the A515 Lichfield Road, Alrewas Road or Manor Road. These include Richard Crosse Church of England (CofE) Primary School, Kings Bromley Care Home, a public house, All Saints Church and the village hall. To the south of Kings Bromley, alongside the A515 Lichfield Road, are a number of properties including Rileyhill Farm, Pool Farm and Wharf Farm. Further south is the Kings Bromley Marina, which offers temporary moorings for recreational narrow boat users. Alongside Common Lane there are two properties and a cattery and on Shaw Lane, near to the junction with A513 Rugeley Road, is Shaw Lane Farm. To the southeast of Kings Bromley are the Manor Park Sailing Club and fishing lakes. Kings Bromley Cricket Club and is located south of Kings Bromley. The Wat Mahathat Buddhist Monastery and Hillcrest Oaklands College are located to the east of Kings Bromley.

- 9.3.8 The Proposed Scheme crosses the Trentside Meadows local wildlife site, owned and run by the Conservation, Horticulture, Agriculture for the Disabled Society (CHADS) registered charity, which aims to combine the conservation of flora and fauna with the access needs of the less able. The site provides activities such as nature walks, and also includes grazing land, which generates income for the charity. The CHADS Four Seasons Nature Study Centre lies to the south-east of Kings Bromley, south of the A513 Rugeley Road, in proximity to the Proposed Scheme. The Centre has facilities for year-round activities including ponds, woodlands, open spaces, gardens and function rooms. It is available for functions and is used by local groups for activities such as yoga. Both sites are used by school groups and wildlife groups for educational purposes. Vulnerable groups using the sites include people with conditions such as arthritis, multiple sclerosis, mental health issues, learning difficulties, Autism Spectrum Disorder (ASD) and older people. The sites are in a rural setting, although subject to road noise from the A513 Rugeley Road.
- 9.3.9 Kings Bromley Footpaths 12, 0.390 and 1 will be intersected by the Proposed Scheme in this area.

Blithbury and surrounds

- 9.3.10 This area includes the hamlet of Pipe Ridware, comprising of eight dwellings, and the village of Blithbury comprising approximately 25 residential properties. Blithbury is located approximately 500m to the north-east of the Proposed Scheme and includes a public house, Reindeer Lodge which is a working reindeer farm and Rugeley School, a specialist residential school for children with ASD. Along Pipe Lane, between Pipe Ridware and Blithbury there are five scattered individual residential properties. Further properties are located south of Blithbury, along B5014 Uttoxeter Road, including Dimble Cottage, Newhouse Farm, Swan Cottage and Rosewood Farm. Alongside Hadley Gate and Stonyford Gate are further small clusters of dwellings and farms.

Colton and surrounds

- 9.3.11 This area includes the village of Colton and the hamlet of Stockwell Heath, containing 220 and 10 residential properties respectively, which are located on either side of the Proposed Scheme. Colton provides the majority of services for Stockwell Heath including St Mary the Virgin CofE church and St Mary's CofE Primary School. The two settlements are linked via Moor Lane and Newlands Lane. This area also includes

scattered residential properties along the B5013 Uttoxeter Road, including Hamley Heath Farm, and along Blithbury Road.

- 9.3.12 There are a number of promoted footpaths within the vicinity of the Proposed Scheme, which provide access to the countryside. These include the Trent and Mersey Canal walk, the Staffordshire Cakes and Ale Trail, the Rugeley to Colton Circular Walk (including Colton Footpaths 31, 32, 50, 52 and 70, parts of Newlands Lane and parts of Moor Lane), and The Way for the Millennium (including Mavesyn Ridware Footpath 30, Hamstall Ridware Footpath 3 and School Lane).

Future baseline

- 9.3.13 A future baseline profile of the Fradley to Colton area has been established to forecast the changing demographic characteristics and potential health needs of local communities. The population of the LDC area is projected to increase by 5% between 2024 and 2024 with significant growth in people aged 65 and over (23%) and in particular those aged 85 and over (74%)¹²⁴. The projected ageing population may put pressure on certain areas of the health service, for example, prevalence of dementia in the LDC area is forecast to increase from 1,530 cases in 2015 to 2,720 by 2030¹²⁵. Furthermore, the size of the 16-64 year old population in the LDC area by 2025 is expected to decrease by 1.3%¹²⁶. A detailed review of future baseline data is presented in Background Information and Data: BID-HE-002-001, Community health profile.

Construction (2020)

- 9.3.14 Volume 5: Appendix CT-004-000¹²⁷ provides details of committed developments in the Fradley to Colton area that are assumed to have been implemented by 2020.
- 9.3.15 The committed developments that materially affect the baseline conditions in this area and which form part of the future baseline assessment of the effects during construction and operation are listed in Table 14.

Table 14: Committed developments relevant to health

Map book Reference ¹²⁸	Planning reference	Description
CA1/34	14/00683/OUTM	Outline permission for 16 dwellings
CA1/33	Core Policy 6: Housing Delivery	Allocation to provide up to 1,130 dwellings and associated social, green and physical infrastructure.

Operation (2027)

- 9.3.16 Volume 5: Appendix CT-004-000 provides details of committed developments in the Fradley to Colton area that are assumed to have been implemented by 2027.

¹²⁴ Staffordshire County Council; A Focus on Lichfield 2015, 2015; <https://lichfielddc.gov.uk/Council/Performance-efficiency/Downloads/Focus-on-Lichfield-evidence-base.PDF>.

¹²⁵ Staffordshire Partnership; Staffordshire Joint Strategic Needs Assessment, 2013; <https://www.staffordshirepartnership.org.uk/Health-and-Wellbeing-Board/Staffordshire-E-JSNA-2013-FINAL.pdf>.

¹²⁶ Staffordshire Observatory; Locality Profiles, 2016; <https://www.staffordshireobservatory.org.uk/publications/thestaffordsharestory/LocalityProfiles.aspx#.WOqjwo1Mpx;>

¹²⁷ Volume 5: Appendix CT-004-000 Committed Developments.

¹²⁸ Volume 5 Map Book: Maps CT-13-101 to CT-13-105A-L1.

- 9.3.17 No further committed developments have been identified in this area that will alter the baseline conditions in 2027 for health receptors.

9.4 Effects arising during construction

Avoidance and mitigation measures

- 9.4.1 Consideration of potential health issues is an integral part of the planning and design of the Proposed Scheme, alongside consideration of other environmental, community and economic issues. Adverse impacts on health determinants have been reduced insofar as reasonably practicable through mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people.
- 9.4.2 The mitigation measures incorporated into the design of the Proposed Scheme in the Fradley to Colton area include:
- reducing the loss of property and community assets, insofar as reasonably practicable, through design of the route of the Proposed Scheme. For example, land required for the Bourne embankment satellite compound has been sited to reduce isolation impacts on a residential property to the south of the A513 Rugeley Road;
 - maintaining accesses across the route of the Proposed Scheme, including: to Newlands Lane (via the Newlands Lane underbridge and Newlands Lane overbridge); to the B5013 Uttoxeter Road (via the B5013 Uttoxeter Road underbridge); to Blithbury Road (via the Blithbury Road overbridge); to the agricultural property and fields at Manor Farm (via the Manor Farm overbridge); across Hurst Wood (via the Colton Footpath 73 accommodation overbridge); and from Quinton's Orchard to Pipe Wood Lane (via the Mavesyn Ridware Footpath 38 accommodation overbridge). Agricultural access to fields underneath the Pyford Brook viaduct will also be maintained; and
 - temporary and permanent diversions of roads and public rights of way (PRoW) to maintain access between communities (for example, the realignment of Shaw Lane instead of its permanent closure), and so far as reasonably practicable, to maintain the PRoW network.
- 9.4.3 HS2 Ltd will require its contractors to comply with the environmental management regime for the Proposed Scheme, which will include the Code of Construction Practice (CoCP), which provides a generic basis for route-wide construction and environmental management.
- 9.4.4 The CoCP will be the means of controlling the construction works associated with the Proposed Scheme to ensure that the effects of the works upon people and the natural environment are reduced or avoided so far as reasonably practicable.
- 9.4.5 The CoCP will require the nominated undertaker and its contractors to: produce and implement a community engagement framework and provide appropriately experienced community relations personnel to implement the framework; provide appropriate information; and to be the first point of contact to resolve community issues. The nominated undertaker will take reasonable steps to engage with the community, focusing on those who may be affected by construction impacts,

including local residents, businesses, landowners and community resources, and the specific needs of protected groups (as defined in the Equality Act 2010).

Assessment of impacts and effects

Neighbourhood quality

- 9.4.6 The term 'neighbourhood quality' is used in this assessment to describe a combination of factors that have the potential to affect residents' experience of and feelings about their local environment. If these factors are altered to a sufficient degree, there will be effects on mental health and wellbeing. The Proposed Scheme may affect the quality of neighbourhoods through environmental changes resulting from the presence of construction sites, construction activities and construction traffic on local roads. This section assesses how changes to neighbourhood quality may influence people's level of satisfaction with their local environment and perceptions about issues such as personal safety and security.
- 9.4.7 A review of published research evidence linking neighbourhood quality with health and wellbeing can be found in Volume 5: Appendix HE-003-000¹²⁹. The evidence linking the individual aspects of neighbourhood quality with health outcomes ranges from moderate to strong. Environmental effects of the Proposed Scheme related to this section are assessed in Section 5, Air quality, Section 11, Landscape and visual, Section 13, Sound, noise and vibration and Section 14, Traffic and transport.
- 9.4.8 The assessment of neighbourhood quality is guided by the findings from other assessments, but does not rely on significance thresholds used in these assessments since these do not relate specifically to health. Instead it assesses qualitatively how the Proposed Scheme is likely to alter local amenity and perceptions about neighbourhood quality, and consequently may affect health and wellbeing.
- 9.4.9 A review of the pathways through which the construction of the Proposed Scheme may impact on neighbourhood quality, and the potential for health effects, is documented in Volume 5: Appendix HE-001-001. The air quality assessment shows that, following mitigation, impacts on air quality (including dust) resulting from the construction and operation of the Proposed Scheme will be very small and are not expected to affect health and wellbeing adversely, air quality impacts are not considered to contribute to any impacts on neighbourhood quality in this area.
- 9.4.10 The assessment has, therefore, considered temporary and, where applicable, permanent impacts including:
- noise emissions, affecting local amenity;
 - visual impacts affecting residents' satisfaction with their living environment and 'sense of place'; and
 - construction traffic on local roads, causing disturbance and concerns about safety.

¹²⁹ Volume 5: Appendix HE-003-000, Route-wide commentary on health evidence base.

- 9.4.11 The construction of the Proposed Scheme will have temporary and permanent impacts on neighbourhood quality in areas close to construction sites, including at Kings Bromley, Pipe Ridware, Blithbury, Stockwell Heath and Colton. Impacts on neighbourhood quality have the potential to affect the wellbeing of residents adversely during the construction phase, by giving rise to negative feelings in relation to quality of life and the local environment, and potentially changing behaviours, such as deterring the use of outdoor space.
- 9.4.12 The construction of the Pyford North embankment and the Kings Bromley viaduct will be visible from several residential properties along Common Lane and approximately 10 properties south of Kings Bromley. Construction works will also be visible along local roads including Common Lane, Shaw Lane, the A513 Rugeley Road and the A515 Lichfield Road. Views of the construction works from Kings Bromley village will largely be screened by vegetation however. Construction noise from these works will be noticeable in outdoor areas at Kings Bromley Care Home and along the A513 Rugeley Road and Shaw Lane. Construction traffic, including heavy goods vehicles (HGV), will be present on the A515 Lichfield Road and the A513 Rugeley Road. Residents living on the south side of Kings Bromley are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse.
- 9.4.13 At Pipe Ridware, the construction of the Pipe Ridware embankment and associated construction traffic along the site haul route to the north of Pipe Ridware will be visible from street level and gardens of properties at the north end of Pipe Ridware and along Pipe Lane. Construction traffic, including HGVs, will be present on School Lane during site setup. Construction noise from site establishment, utilities and viaduct construction will be noticeable throughout the hamlet. Residents living in Pipe Ridware are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the hamlet and in reducing the sense of its rural character and tranquillity.
- 9.4.14 HGVs will be present along the B5014 Ridware Road/Uttoxeter Road, passing through the village of Hill Ridware to the south of Pipe Ridware. For residents of Hill Ridware, this may give rise to concerns associated with road safety, and affect the perception of neighbourhood quality in the village.
- 9.4.15 Construction of the Blithbury cutting, the Blithbury Road overbridge, and construction traffic along the site haul route will be visible from street level and gardens on Hadley Gate Lane. HGVs will also be present on the B5014 Uttoxeter Road and Blithbury Road. Residents living in Marston are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse. The presence of construction traffic on local roads is also likely to give rise to concerns about road safety, which may contribute to perceptions of reduced neighbourhood quality.
- 9.4.16 In Stockwell Heath and Colton, the works to construct Stockwell Heath embankment, and vehicles moving along the site haul routes, will be visible from street level and outdoor areas. This will include private gardens, and the public open space around Stockwell Heath duck pond. The construction works will take place in proximity to residential properties in Stockwell Heath. The realignment of Newlands Lane and the

Moor Lane diversion, coupled with the construction of the embankment, will create a visual and psychological barrier between Colton and Stockwell Heath. Residents living in these villages are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, in terms of diminishing the amenity of the area, reducing the sense of its rural character and tranquillity and creating a feeling of separation between the settlements.

Access to services, health and social care

- 9.4.17 There is strong evidence linking access to healthcare facilities with health outcomes, and there is also weak to moderate evidence to suggest that transport problems are a key barrier to people's ability to access these services. There is moderate evidence to suggest that access to shops and other local services can affect health. This is based on a range of factors affecting quality of life, and includes issues such as reducing feelings of isolation and enabling participation in society, as well as accessing basic needs such as food shopping. A review of published research evidence linking access to services, health and social care with health and wellbeing can be found in Volume 5: Appendix HE-003-000.
- 9.4.18 A review of the pathways through which the construction of the Proposed Scheme may impact on access to services, health and social care, and the potential for health effects, is documented in Volume 5: Appendix HE-001-001. This has identified temporary and permanent impacts on services provided by the CHADS charity at Trentside Meadows.
- 9.4.19 Services at Trentside Meadows will be impacted by the construction of the Trent viaduct. During construction, approximately 32% of Trentside Meadows will be either included within the land required for construction, or isolated from the rest of the site by the construction works. Activities on the remainder of the site will be restricted by construction impacts, such as visual intrusion. This will limit the use of this land for the outdoor activities run by CHADS. The loss of grazing land will also result in a loss of income for the charity, which may affect its ability to maintain this and other sites. The charity will be compensated for this loss of income in accordance with the Compensation Code. Furthermore, activities that take place within the area of Trentside Meadows lost due to the Proposed Scheme could be accommodated within other parts of the site during the construction period.
- 9.4.20 The Four Seasons site will be affected during construction, by noise, visual intrusion and disruption caused by the construction of the River Trent viaduct. This will reduce its value for therapeutic outdoor activities. Any reduction in the range and quality of activities available at the CHADS sites is likely to result in a loss of opportunities for vulnerable and less able people to engage in activities that are beneficial for their education, health and wellbeing.
- 9.4.21 HS2 Ltd will continue to engage with CHADS to develop a mitigation strategy that will reduce or avoid impacts on vulnerable users and support the long-term viability of the charity.

Access to green space, recreation and physical activity

- 9.4.22 There is moderate evidence to show that access to green space contributes to good mental health. There is also moderate evidence that environmental factors such as

access to high quality green space, safety and amenity, can influence participation in physical activity. Physical activity is strongly linked to health outcomes. A review of published research evidence linking access to green space, recreation and physical activity with health and wellbeing can be found in Volume 5: Appendix HE-003-000.

- 9.4.23 A review of the pathways through which the construction of the Proposed Scheme may impact on levels of access to green space and physical activity, and the potential for health effects, is documented in Volume 5: Appendix HE-001-001, Health assessment matrix. This has identified the following impacts:
- impacts on PRow, including temporary closures, diversions and loss of amenity, which may deter the use of these routes by walkers, cyclists and equestrians; and
 - the presence of construction traffic, including HGVs, on the local road network, which may deter their use by walkers, cyclists and equestrians.
- 9.4.24 Impacts on access to green space for vulnerable users of Trentside Meadows are assessed under access to services, above.
- 9.4.25 The route of the Proposed Scheme will intersect 12 PRow in the Fradley to Colton area, and construction will take place in proximity to a further 11 PRow. Surveys undertaken to inform the traffic and transport assessment (Section 14, Traffic and transport) showed that there were fewer than 10 people a day recorded on most of the PRow in the area. The route with the greatest usage was Mavesyn Ridware Footpath 40 with 29 users observed during the survey day. With the exception of Mavesyn Ridware Footpath 8, the changes in travel distance on the PRow realignments or diversion are less than 500m. The amenity and recreational value of these footpath networks will be adversely affected during construction, which is likely to deter their use, reducing levels of physical activity and associated health and wellbeing benefits.
- 9.4.26 Construction traffic will mainly use the site haul routes along the Proposed Scheme alignment. However, some construction traffic, including HGVs, will be present on local roads within the Fradley to Colton area. Section 14, Traffic and transport has identified the potential for construction traffic to obstruct or deter pedestrians, cyclists and equestrians at 13 locations on 11 roads in the vicinity of the Proposed Scheme in this area. The presence of HGVs is likely to deter some non-motorised users from using the affected routes. In the case of recreational users, it is considered that alternative routes will be available. However, for those using these routes for active travel to work or to access shops and services, there is the possibility that people will choose instead to travel by car, temporarily reducing levels of physical activity and associated health and wellbeing benefits.

Social capital

- 9.4.27 The connections between individuals within communities, and the increased likelihood that arises through these networks for individuals to feel valued, to feel a sense of belonging, to have companionship and to support each other, is important for health and wellbeing. A measure of the effectiveness of these connections within communities is termed 'social capital' and is a recognised determinant of health. The Office for National Statistics defines social capital as follows:

- 9.4.28 'In general terms, social capital represents social connections and all the benefits they generate. Social capital is also associated with civic participation, civic-minded attitudes and values which are important for people to cooperate, such as tolerance or trust.'¹³⁰
- 9.4.29 A review of published research evidence linking social capital with health and wellbeing can be found in Volume 5: Appendix HE-003-000. There is moderate evidence for a link between social capital and health and wellbeing outcomes. A decrease in social capital has the potential to reduce the beneficial health effects that are gained through social contact and support, social participation, reciprocity and trust. Adverse effects on health from changes in social capital could be experienced as a reduction in wellbeing or as physiological effects on the body's hormonal and immune systems, with increased susceptibility to mental and physical illness.
- 9.4.30 A review of the pathways through which the construction of the Proposed Scheme may impact on levels of social capital, and the potential for health effects, is documented in Volume 5: Appendix HE-001-001. This has identified impacts associated with the temporary construction workforce.
- 9.4.31 The villages along the route support small, well-established communities. Feedback from community consultation indicates that people's levels of trust in their communities and community cohesion are strong. The size of the temporary construction workforce will be substantial relative to the size of these local communities. During the day, the workforce will be present on construction sites and compounds throughout the area, including satellite compounds in the vicinity of the villages of Pipe Ridware, Blithbury, Colton and Stockwell Heath. The daily average number of workers at each site will typically be around 30 to 40 with the exception of Blithbury North cutting satellite compound, which is expected to have a daily average of 70 workers. The duration of the works at each site will range from one to four years. The presence of construction workers is likely to be very noticeable, with construction vehicles using local roads to access compounds and workers using facilities such as shops, restaurants and public houses within local villages, particularly Kings Bromley.
- 9.4.32 It is well understood that the introduction of a temporary construction workforce into communities which have the characteristics identified above has the potential to alter people's perceptions about their communities and reduce levels of trust. Such a reduction in social capital has the potential to adversely affect wellbeing, and may influence behaviours that are beneficial to wellbeing such as the use of community facilities.
- 9.4.33 The draft CoCP¹³¹ includes a commitment to produce and implement a community engagement framework and provide appropriately experienced community relations personnel. HS2 Ltd will engage with local authorities and community representatives to identify measures aimed at fostering and maintaining good relationships between the workforce and local communities. Any measures identified will be included within the community engagement framework as appropriate.

¹³⁰ Office for National Statistics- Measuring Social Capital:
http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171766_371693.pdf

¹³¹ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- 9.4.34 There is also a potential for the presence of the temporary workforce to have a beneficial effect on local communities through increased use of local services and opportunities for social interaction.
- 9.4.35 The construction of the Stockwell Heath embankment between Colton and Stockwell Heath will create a physical barrier between these communities. Connectivity by car will be maintained via Newlands Lane while connectivity for pedestrians will be temporarily unavailable during the works to Newlands Lane. These communities are likely to experience a reduction in social capital as a result of the introduction of this barrier, which has the potential to affect the wellbeing of people in these communities adversely.

Other mitigation measures

- 9.4.36 HS2 Ltd will engage with local authorities and community representatives to identify measures aimed at fostering positive relationships between local communities and the temporary construction workforce. Any measures identified will be included within the community engagement framework as appropriate.
- 9.4.37 HS2 Ltd will continue to engage with CHADS to develop a mitigation strategy that will reduce or avoid impacts on vulnerable users and support the long-term viability of the charity.

Cumulative effects

- 9.4.38 No cumulative health effects have been identified in the Fradley to Colton area during construction of the Proposed Scheme.

9.5 Effects arising from operation

Avoidance and mitigation measures

- 9.5.1 Adverse impacts on health determinants have been reduced insofar as reasonably practicable through mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people. The mitigation measures incorporated into the design of the Proposed Scheme in the Fradley to Colton area include measures to integrate the Proposed Scheme into the landscape, to provide visual and noise screening, and maintain access including:
- noise fence barriers and landscape bunds to provide acoustic screening associated with Pyford North embankment, Kings Bromley viaduct, Stockwell Heath cutting, Moreton South embankment, Pipe Ridware embankment and River Trent viaduct to reduce noise impacts in Kings Bromley, Pipe Ridware, Stockwell Heath and Hamley Heath; and
 - earthworks to soften viaduct abutments and landscape earthworks, with planting, to integrate the Proposed Scheme into the surrounding landscape near the Blithbury South cutting to reduce potential impacts in Blithbury, along Blithbury North cutting to reduce potential impacts in Colton and along Stockwell Heath cutting and Moreton South embankment to reduce impacts in Stockwell Heath and Hamley Heath.

Assessment of impacts and effects

- 9.5.2 This section assesses the health effects of the operation of the Proposed Scheme on the health and wellbeing of communities. Permanent construction impacts on health determinants resulting from the construction of the Proposed Scheme are assessed as permanent construction impacts in Section 9.4.

Neighbourhood quality

- 9.5.3 Noise and visual impacts from passing trains will result in permanent operational impacts on neighbourhood quality in the communities in proximity to the Proposed Scheme, including Kings Bromley, Pipe Ridware, Blithbury, Rileyhill, Nethertown, Hadley Gate, Stockwell Heath and Colton. These operational impacts will be experienced alongside permanent construction impacts, including the presence of the railway infrastructure within the local landscape.
- 9.5.4 The trains running on Pyford North embankment and Kings Bromley viaduct will be visible from local roads and residential properties on Common Lane and south of Kings Bromley. Noise from passing trains will also be noticeable in these areas. Residents living on the south side of King's Bromley are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse.
- 9.5.5 Trains running on the Pipe Ridware embankment will be visible from street level and the gardens of properties at the north end of Pipe Ridware and along Pipe Lane. Existing long views to the north from Pipe Wood Lane will be shortened. Intermittent train noise will be noticeable throughout the hamlet. Residents living in Pipe Ridware are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the hamlet and in reducing the sense of its rural character and tranquillity.
- 9.5.6 The presence of trains on the Stockwell Heath embankment and intermittent noise from passing trains will be noticeable throughout Stockwell Heath and northern parts of Colton. Residents living in these communities are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, in terms of diminishing the amenity of the area, reducing the sense of its rural character and tranquillity and creating a feeling of separation between the settlements.
- 9.5.7 It is considered likely that the effects on wellbeing will lessen over time, as mitigation planting becomes established and as communities become accustomed to the presence of the Proposed Scheme.

Access to services, health and social care

- 9.5.8 The presence of trains on the River Trent viaduct across Trentside Meadows will result in permanent impacts on the noise and visual environment at some areas of the Four Seasons Nature Study Centre. This is likely to lead to reduced opportunities for vulnerable people to partake in outdoor activities that are beneficial for their education, health and wellbeing. Therefore, without mitigation, there may be a

reduction in the physical and mental wellbeing benefits associated with therapeutic outdoor activities for people with physical and learning disabilities.

- 9.5.9 HS2 Ltd will continue to engage with CHADS to develop a mitigation strategy that will reduce or avoid impacts on vulnerable users and support the long-term viability of the charity.

Other mitigation measures

- 9.5.10 HS2 Ltd will continue to liaise with CHADS to agree a mitigation strategy to compensate for impacts at the Four Seasons Nature Study Centre and support the long term viability of the charity.

Cumulative effects

- 9.5.11 No cumulative health effects have been identified.

Monitoring

- 9.5.12 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 9.5.13 No specific monitoring of health effects during the operation of the Proposed Scheme is proposed.

10 Land quality

10.1 Introduction

- 10.1.1 This section of the report presents the baseline conditions that exist along the Proposed Scheme in the Fradley to Colton study area in relation to land quality and reports the likely impacts and significant effects resulting from construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, from a scientific, historical, mineral exploitation or mineral resources point of view, including geological sites of special scientific interest (SSSI) and local geological sites (LGS), and areas of designated mineral resources. Consideration is also given to petroleum (gas) prospects and licencing. Mitigation measures are presented and any residual significant effects are summarised.
- 10.1.2 Engagement has been undertaken with the British Geological Survey (BGS), Staffordshire County Council (SCC), Lichfield District Council (LDC), the Environment Agency, the Food and Environment Research Agency and the Animal and Plant Health Agency. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, and obtain relevant baseline information.
- 10.1.3 Details of baseline information, conceptual site models (CSM) and risk assessments are outlined in Volume 5: Appendix LQ-001-001 and presented in Maps LQ-01-101 to LQ-01-105a (Volume 5: Land quality Map Book).
- 10.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 10.1.5 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 15, Water resources and flood risk. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3, Route-wide effects (Section 15).

10.2 Scope, assumptions and limitations

- 10.2.1 The scope, assumptions and limitations for the land quality assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)¹³², and Volume 5: Appendix LQ-001-001.
- 10.2.2 In accordance with the SMR, a risk based approach has been undertaken to identify contamination that may have an impact upon the construction of the Proposed Scheme. To support this, a desk based assessment has been undertaken for the study area, defined as the land required for the Proposed Scheme plus a 250m buffer from the edge of proposed construction activities. In the case of groundwater data, this is increased to 1km.
- 10.2.3 New and diverted utilities will be laid in the boundaries of existing highways within normal road construction layers and natural soils below or land close by. These have

¹³² Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report

been considered in the context of the CSM approach, and the lack of contact with nearby potentially contaminated sites, and the absence of sensitive receptors within the roadways reduces the risk of an impact occurring to very low levels. The impact of laying these new and diverted utilities has therefore been scoped out of the assessment as they are unlikely to cause any significant land quality effects.

- 10.2.4 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (e.g. contaminated soils may need to be removed or construction may alter existing contamination pathways). Each of these areas has been studied to evaluate the scale of potential impacts caused by existing contamination (if present) and what needs to be done to avoid significant consequences to people and the wider environment.
- 10.2.5 The location of the Proposed Scheme was viewed from points of public access initially. In addition, visits to some key sites have been undertaken to verify desktop information.
- 10.2.6 A CSM approach has been used to provide an understanding of the types of contaminants that may be present, the likely sources and/or pathways by which contamination can spread and the potential receptors (i.e. people and the wider environment) that could be affected. It indicates the types of impacts that existing contamination may be having at present and may have during and after construction.
- 10.2.7 The minerals assessment is based upon the minerals identified on published mineral plans, and existing planning or licensed areas. Any inference of the presence of mineral provided by geological maps/reports is excluded (except where these are covered by the Mineral Local Plan (MLP)).
- 10.2.8 The geo-conservation assessment is based upon local geological trust records.

10.3 Environmental baseline

Existing baseline

- 10.3.1 Baseline data has been collected from a range of sources including Ordnance Survey mapping, the BGS, Coal Authority, SCC, LDC, Public Health England, the Environment Agency, Natural England, Food and Environment Research Agency and the Animal and Plant Health Agency records, as well as web sources such as local geological trusts.
- 10.3.2 Unless otherwise stated, all features described in this section are presented in Maps LQ-01-101 to LQ-01-105a (Volume 5: Land quality Map Book).

Geology

- 10.3.3 This section describes the underlying ground conditions within the Fradley to Colton study area. Recent changes in lithostratigraphic classifications by the BGS have been incorporated where appropriate¹³³.

¹³³ British Geological Survey, (2014), *Lithostratigraphy of the Sherwood Sandstone*. Research Report RR/14/01. Available online at: <http://www.bgs.ac.uk/downloads/start.cfm?id=2904>

10.3.4 Table 15 provides a summary of the superficial and bedrock units underlying the Proposed Scheme from Fradley to Colton.

Table 15: Summary of the superficial and bedrock units underlying the Proposed Scheme from Fradley to Colton

Geology	Distribution	Formation description	Aquifer classification
Superficial			
Alluvium	Along the River Trent and tributaries	Clay, silt, sand and gravel	Secondary A
River Terrace Deposits	Along the River Trent valley	Sand and gravel	Secondary A
Glaciofluvial Sheet Deposits	Between Fradley Wood and Tuppenhurst	Sand and gravel	Secondary A
Glacial Till	Large outcrop between Hunger Hill, approximately 10m south-east of Woodhouse Farm, and Blithbury. Smaller isolated outcrops between in the vicinity of Colton and Rugeley.	Sandy silty clay	Secondary (Undifferentiated)
Bedrock			
Mercia Mudstone Group – Mudstone	Along the majority of the route of the Proposed Scheme	Red, less commonly green-grey mudstone and siltstone with some halite-bearing units, and presence of sandstone	Secondary B
Sherwood Sandstone Group ¹³⁴ - Helsby Sandstone Formation (Bromsgrove Sandstone Formation) ¹³⁵	Extends from the study area east of Woodhouse Farm to west of Rugeley.	Red, brown and grey sandstone, commonly pebbly or conglomeratic at the bases of beds, interbedded with red and brown siltstones and mudstones.	Principal
Sherwood Sandstone Group -Chester Formation (Kidderminster Formation)	To the south of the former Rugeley Power Station	Pebble conglomerate with a reddish brown sandy matrix and pebbles consisting of mainly brown or purple quartzite, with quartz conglomerate and vein quartz	Principal

Made ground

10.3.5 Made ground is a term used to denote man-made deposits such as landfill, spoil heaps or earthworks associated with construction or ground improvement. Such deposits may be poorly mapped and are often very variable in composition. Minor deposits of made ground may be encountered within this study area, for example where ponds, sand or marl pits have been backfilled. There is evidence of historical and authorised landfilling within this study area, which may comprise more significant deposits of made ground.

10.3.6 No known farm burial or pyre sites associated with the 2001 outbreak of foot and mouth disease have been identified within the Fradley to Colton study area. In all

¹³⁴ British Geological Survey (2014), Lithostratigraphy of the Sherwood Sandstone. Research Report RR/14/01. Available online at: <http://www.bgs.ac.uk/downloads/start.cfm?id=2904>

¹³⁵ Names in brackets refer to previous naming convention.

cases, records do not provide an exact location for the burial or pyre sites. Older unrecorded sites may be present from the 1967 outbreak.

Superficial geology

- 10.3.7 Extensive alluvial deposits of clay, silt, sand and gravel occur along the courses of streams and rivers in the study area. Alluvium is present in the study area associated with the River Trent and its tributaries in the vicinity of the Rugeley to Kings Bromley grid connection.
- 10.3.8 River Terrace Deposits comprising sand and gravel are present associated with the River Trent valley between Shaw Lane Farm and Pipe Ridware. River Terrace Deposits comprising sands and gravels, associated with the River Trent, are present beneath Rugeley Power Station.
- 10.3.9 Glaciofluvial Sheet Deposits comprising sand and gravel are present between Fradley Wood and Hanch Hall Farm, extending north westerly towards Handsacre. Some of the sands and gravels within the study area have been or are being worked for construction materials.
- 10.3.10 Glacial Till is present between Hunger Hill, approximately 10m south-east of Woodhouse Farm, and Blithbury. There are further isolated outcrops of Glacial Till located between Hadley Gate and Finners Hill, in the vicinity of Colton and Rugeley. These deposits comprise sandy and silty clay and have historically been extracted in marl pits, with the material being used as a soil improver for agriculture.

Bedrock geology

- 10.3.11 The bedrock geology in this study area comprises the Mercia Mudstone Group and the Sherwood Sandstone Group.
- 10.3.12 The majority of the Proposed Scheme within the study area is underlain by the Mercia Mudstone Group, which is present from Fradley to Woodhouse Farm; and then from Pipewood Cottage south of Blithbury, to Colton. The Mercia Mudstone Group is typically described as mudstone and siltstone with some halite-bearing units and sandstone.
- 10.3.13 Across the majority of the southern section of the Fradley to Colton study area, the Mercia Mudstone Group is present beneath the extensive superficial deposits. The Mercia Mudstone Group is at the surface in the northern section of the Proposed Scheme, from approximately Blithbury to Stockwell Heath. The total thickness of the Mercia Mudstone Group is estimated to be up to 280m.
- 10.3.14 Between Woodhouse Farm and Pipewood Cottage, the bedrock geology changes due to a series of geological faults. The Helsby Sandstone Formation (formerly the Bromsgrove Sandstone Formation) of the Sherwood Sandstone Group is present and extends from east of Woodhouse Farm to west of Rugeley.
- 10.3.15 The Helsby Sandstone Formation is described as reddish brown medium to fine grained sandstone with occasional marl pebble bands. The sandstone outcrops at the surface between Woodhouse Farm and Pipe Lane Farm.

10.3.16 The southern section of Rugeley Power Station (at the south-western end of the grid connection) is underlain by sandstones and conglomerates of the Chester Formation (formerly the Kidderminster Formation) of the Sherwood Sandstone Group.

10.3.17 The Chester Formation is described as pebble conglomerates and reddish brown sandstone.

Radon

10.3.18 Radon is a radioactive gas formed by the radioactive decay of naturally occurring uranium in rocks and soils. The Proposed Scheme in the vicinity of Stockwell Heath and Colton lies within a radon affected area, as defined on Public Health England's UK Radon online maps¹³⁶. The maps show that in this study area between 1 and 3% of homes have radon levels above the action level of 200Bq per cubic metre (Bq/m³) of air for residential properties.

10.3.19 For the remainder of the area between Fradley and Colton, less than 1% of homes are indicated to be above the radon action level.

Groundwater

10.3.20 Four categories of aquifer have been identified within the study area, as defined by the Environment Agency.

- the Sherwood Sandstone Group, comprising the Helsby and the Chester Formations is designated as a Principal aquifer;
- the Mercia Mudstone Group underlying the majority of the study area, has been designated as a Secondary B aquifer;
- River Terrace Deposits, Alluvium and the glaciofluvial sand and gravel are designated as Secondary A aquifers; and
- Glacial Till is designated as a Secondary undifferentiated aquifer.

10.3.21 The Environment Agency reports that there are nine groundwater abstraction licences located within 1km of the Proposed Scheme. Four of these are private potable water supplies which relate to a groundwater abstraction for public water supply (PWS) in the vicinity of Hanch Hall. The remainder are for general agricultural and industrial use.

10.3.22 There are two groundwater source protection zones (SPZ)¹³⁷ identified within 1km of the Proposed Scheme within the Fradley to Colton study area. The first is located at Seedy Mill Water Treatment Works, Hanch. This SPZ includes the Inner zone (SPZ₁), Outer zone (SPZ₂) and Total catchment (SPZ₃) within the study area. The second SPZ is located approximately 950m to the west of the land required for construction of the 132kV power line connection at the substation at Rugeley Power Station, with only the outer SPZ Total catchment (SPZ₃) falling within the study area.

¹³⁶ Public Health England; *UK Maps of Radon*. Available online at: www.ukradon.org/information/ukmaps,

¹³⁷ A groundwater SPZ is a defined area within which groundwater is extracted for potable water supply. The area is defined by the Environment Agency on the basis of the length of time taken for groundwater to migrate to the potable source.

- 10.3.23 Details of the licenced abstractions are provided in Section 15, Water resources and flood risk. It should be noted that all abstractions that are used directly or indirectly for human consumption are by default provided with SPZ. In such cases the abstraction point qualifies for a default 10m radius SPZ₁ and a default 250m radius for SPZ₂. There is no default zone 3 for total catchment with respect to this type of abstraction.
- 10.3.24 According to LDC records, there is one private groundwater abstraction that does not require a permit registered within the study area.
- 10.3.25 Further information on the groundwater in the Fradley to Colton study area is provided in Section 15, Water resources and flood risk.

Surface water

- 10.3.26 The River Trent and the Trent and Mersey Canal are the most significant watercourses within the study area. The River Trent will be crossed by the route of the Proposed Scheme to the south of Pipe Ridware. The Trent and Mersey Canal at Fradley Wood falls within the land required for construction. The 132kV power line from the substation at the former Rugeley Power Station will be ducted beneath the River Trent.
- 10.3.27 Pyford Brook, Bourne Brook and Moreton Brook will also be crossed by the route of the Proposed Scheme, as well as some unnamed tributaries and drains.
- 10.3.28 There are nine licensed surface water abstraction locations within the study area; two of these are located within the land required for the construction and operation of the Proposed Scheme. Three of the licensed surface water abstractions are located within the former Rugeley Power Station site. The majority of the remaining surface water abstractions are from the River Trent, and there is one abstraction from Moreton Brook. Locations of the surface water abstractions are provided in Volume 5: Appendix WR-003-001, Water Resources Assessment.
- 10.3.29 No private water supplies from surface water sources have been identified within the study area.
- 10.3.30 Further information on surface water in the Fradley to Colton study area is provided in Section 15, Water resources and flood risk.

Current and historical land use

- 10.3.31 Current potentially contaminative land uses within the study area include authorised landfills at Blackflatts Farm and Colton Hall Farm, former Rugeley Power Station, Kings Bromley Marina and marine service station, a vehicle depot, a graveyard, the WCML, a business park and industrial estate and several farms within the study area.
- 10.3.32 Historical land uses identified within the study area with the potential to have caused contamination include the former coal mining pit heads and spoil mounds, associated dismantled mineral railway, underground fuel/storage tanks and pipelines and a former filling station. There are several infilled extraction pits, flooded gravel workings, landfills and infilled water wells in the study area. The infilled pits and wells may have been filled with a variety of waste materials, but have not been licensed.

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10.3.33 Historical mapping also shows evidence of a potential refuse heap between Blithbury Village and Rake End. A site walkover undertaken in October 2016 indicated that the potential refuse heap comprised mainly of disused ceramic (from the nearby ceramic sanitary manufacture factory) materials and other miscellaneous sanitary wares.

10.3.34 Table 16 provides information on the landfill sites in the study area.

Table 16: Landfill sites located in the study area

Name and Study Area Reference ¹³⁸	Location	Description
Shaw Lane Landfill, Kings Bromley, Hanch Near Lichfield Staffordshire 1-123	Landfill is located immediately east of Shaw Lane, approximately 250m west of Bourne Brook and 250m north-west of Kings Bromley Wharf. Volume 5: Map LQ-01-102	The Environment Agency records that the historical landfill was licensed to have accepted commercial and household waste between December 1951 and December 1960.
Rileyhill Farm, Kings Bromley, Staffordshire 1-122	Landfill is located within the grounds of Shaw Lane Landfill. Volume 5: Map LQ-01-102	The Environment Agency records that the historical landfill was licensed to have accepted inert waste between February 1981 and June 1989.
Landfill Near Pipe Ridware, Lichfield, Staffordshire 1-31	Landfill is located on two separate sites, which are located approximately 400m and 700m south-east of Quinton's Orchard Farm respectively. Volume 5: Map LQ-01-103	The Environment Agency records the historical landfill as licensed to accept household waste from December 1963. No end date was recorded.
The Wharf Old Site, North of Pipe Ridware, Lichfield, Staffordshire 1-32	Landfill is located approximately 50m south of Goldhayfields Farm. The landfill is approximately 80m east of Pipe Wood Lane and Woodhouse Farm building. Volume 5: Map LQ-01-103	The Environment Agency records no further details available regarding the history of this landfill.
Woodhouse Farm, Blithbury, Rugeley, Staffordshire 1-35	Landfill is located immediately adjacent to The Wharf Old Site Landfill at its northern border and lies between Pipe Wood Lane and Wood House Farm building. Volume 5: Map LQ-01-103	The Environment Agency records indicate that the historical landfill was licensed to receive waste between January 1980 and December 1983. No further details on waste type were made available.
Marl Pit, Hall Farm, Pipe Ridware, Near Rugeley, Staffordshire 1-30	Landfill is located immediately east of The Wharf Old Site Landfill at approximately 320m east of Pipe Wood Lane. Volume 5: Map LQ-01-103	The Environment Agency records indicate that the historical landfill was licensed to receive inert and industrial waste between August 1985 and March 1986.
N& H Transport Blackflatts Farm, Stoneyford Lane, Ridware, Rugeley, Staffordshire, WS15 3HT 1-216	Landfill is located immediately west of Stonyford Lane and approximately 65m east of Blackflatts farm. Volume 5: Map LQ-01-103	Environment Agency records indicate the landfill to be an Authorised Landfill, operated by N & H Transport. The landfill status is currently given as 'Closure'. There are no records relating to the dates of operation. The landfill was licensed as an 'A04: Household, Commercial & Industrial Waste Landfill' site.
North of Colton Hall Farm, Blithbury Road, Near Rugeley, Staffordshire 1-247	Landfill is located immediately west of Blithbury Road and approximately 140m north-west	The Environment Agency records indicate that the historical landfill was licensed to receive inert and industrial waste between November 1979 and August 1982.

¹³⁸ The area reference is the unique identifying number for the site, shown on the Volume 5: Land quality Map Book

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Name and Study Area Reference ¹³⁸	Location	Description
	of Colton Hall Farm. Volume 5: Map LQ-01-104-L1	
Field No 7600, South of Colton Hall Farm, Blithbury Road, Colton, Rugeley, Staffordshire 1-248	The landfill is located approximately 220m east of Blithbury road and 175m south east of Colton Hall Farm. Volume 5: Map LQ-01-104-L1	The Environment Agency records indicate that the historical landfill was licensed to receive inert, commercial and industrial waste between January 1980 and May 1993.
N&H- Colton Hall Farm Landfill Site, Colton Hall Farm, Blithbury Road, Colton, Rugeley, Staffordshire, WS15 3HA 1-254	Landfill is located approximately 450m north of the former Rugeley Power Station, River Trent and the West Coast Mainline. Volume 5: Map LQ-01-104-L1,	Environment Agency records indicate the landfill to be operated by N&H Transport. There are no records relating to the operational dates. The landfill was licensed as an 'Ao6: Landfill taking other wastes' site described as construction, demolition and dredging waste. The status of this licence is given as 'Closure'.
Power Station Road, Rugeley, Staffordshire 1-250	Landfill is located between the northern section of the former Rugeley Power Station and the A51 Stafford Road. Volume 5: Map LQ-01-104-L1	The Environment Agency records the historical landfill as licensed to accept household waste from December 1960. No end date was recorded.
Landfill to the East of Power Station Road, Rugeley, Staffordshire 1-249	Landfill is located between the northern section of the former Rugeley Power Station and the A51. The landfill is situated immediately to the east of the Power Station Road landfill. Volume 5: Map LQ-01-104-L1	The Environment Agency records the historical landfill as licensed to accept household waste from December 1960. No end date was recorded.
Landfill site between Love Lane and Power Station Road, Rugeley, Staffordshire 1-251	Landfill is directly bound by Power Station Road to the north and Love Lane to the south. The former Rugeley Power Station railway lies directly east of the landfill. Volume 5: Map LQ-01-104-L1	The Environment Agency records the historical landfill as licensed to accept waste from December 1960. The site was recorded to have been operated by the National Coal Board. There are no further records.
Rugeley Power Station (1), East Of Rugeley, Rugeley, Staffordshire 1-252	Landfill is located at the former Rugeley Power Station. Volume 5: Map LQ-01-104-L1	The Environment Agency records this as an historical landfill. There are no further records.
Rugeley Power Station (2), Armitage Road, Brereton, Rugeley, Staffordshire 1-253	Landfill is located at the former Rugeley Power Station. Volume 5: Map LQ-01-104-L1	The Environment Agency records this as an historical landfill. There are no further records.
Works opposite Mineral Railway east of Rugeley, Staffordshire 1-253	Landfill is located at the former Rugeley Power Station. Volume 5: Map LQ-01-104-L1	The Environment Agency records this as an historical landfill. There are no further records.

- 10.3.35 Contaminants commonly associated with landfill sites could include metals, semi-metals, asbestos, organic and inorganic compounds. Landfills and infilled pits could also give rise to landfill gases such as methane or carbon dioxide and leachate.

Other regulatory data

- 10.3.36 The regulatory data reviewed includes pollution incidents (major, significant and minor categories), radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution

Prevention and Control licences (IPPC)). There was one major and two significant incidents reported over a 17 year period between 2000 and 2017.

- 10.3.37 There is one recorded major pollution incident to water (Category 1)¹³⁹, which occurred in 2001 immediately north of Rugeley Power Station and involved the release of sewage materials. There are two records of significant pollution incidents (Category 2) within the study area. The first occurred in June 2003, east of Hanch Reservoir at Hanch Hall; the pollutant was not recorded. The other incident occurred on 23 March 2009 and involved the release of agricultural materials and waste to water at Woodhouse Farm.
- 10.3.38 The Environment Agency reports that there are seven consented discharges to groundwater within the study area. Further details on the groundwater in the Fradley to Colton study area can be found in Section 15, Water resources and flood risk.
- 10.3.39 There are 20 discharge consents to surface water within the study area, none of which are within the area of land required for the Proposed Scheme. Details of these discharges are provided in Volume 5: Appendix WR-003-001¹⁴⁰.
- 10.3.40 There are no nationally significant ecological designations as defined in the land quality section of the SMR¹⁴¹ located within the study area.

Mining/mineral resources

- 10.3.41 SCC is responsible for the overall mineral and waste local plans for the county. The MLP for Staffordshire (2015 to 2030)¹⁴² was adopted in February 2017 and sets out the SCC policies aimed at controlling mineral related developments within Staffordshire up to the year 2030.
- 10.3.42 There are no proposed MLP allocations within the study area.
- 10.3.43 There is a mineral safeguarding area (MSA) within the Fradley to Colton area comprising superficial sand and gravel. The MSA, which covers the majority of the study area, will intersect the route of the Proposed Scheme between Fradley to Hunger Hill and from Rugeley to the village of Stockwell Heath.
- 10.3.44 There is a sand and gravel Area of Search¹⁴³ (Area of Search: West of A38) between Fradley Junction and Kings Bromley that overlaps with the Proposed Scheme.
- 10.3.45 There are no current licences for coal or coal bed methane exploitation, and no gas exploration licences.
- 10.3.46 Available records from the Coal Authority show that the route of the Proposed Scheme will pass through areas of recorded historical underground coal mining activities within a triangular area extending from Echills, Blithbury and Rugeley. In addition, abandoned underground roadways and mineral workings and pit heads, associated with coal mining, are also recorded from Pipe Ridware to Rugeley with

¹³⁹ Pollution incident records were obtained via <http://maps.environment-agency.gov.uk/wiyby>

¹⁴⁰ Volume 5: Appendix WR-002-001, Water resources assessment.

¹⁴¹ Sensitive ecological receptors are defined as national designations such as SSSIs.

¹⁴² Staffordshire County Council, (2015), Staffordshire County Council New Minerals Local Plan for Staffordshire 2015-2030. Final draft <https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/mineralsLocalPlan.aspx>

¹⁴³ Area of Search defined as "A broad area within which sites are sought for development, for example, for housing, mineral extraction, or renewable energy". https://www.planningportal.co.uk/directory_record/115/area_of_search

approximate depths of the workings ranging between 235m and 685m. Lea Hill Colliery was located at the former Rugeley Power Station. The MLP identifies the coal reserves as areas of hydrocarbons resources and potential sources of gas.

- 10.3.47 Mineral extraction, in the form of four borrow pits, will be required as part of the works for the Proposed Scheme in this study area. The borrow pits are required to meet the shortfall of granular fill required to construct the Proposed Scheme rail embankments and are to be located in proximity to the route of the Proposed Scheme to obtain sands and gravels of an appropriate quality (see Volume 1, Section 6).
- 10.3.48 All four of the borrow pits in the Fradley to Colton study area fall within the River Terrace Deposits designated as a MSA and will be located at:
- Kings Bromley South, located either side of Crawley Lane on the east and to the south of Ashby Sitch;
 - Kings Bromley North, located adjacent to the realigned A515 Lichfield Road;
 - Kings Bromley North, located adjacent to the realigned Shaw Lane; and
 - Blithbury, located adjacent to the realigned Shaw Lane Blithbury, located to the east of the River Trent viaduct.
- 10.3.49 The borrow pits will be operational during the construction phase of the Proposed Scheme. The estimated duration of use of the borrow pits is four years, which includes excavating and backfilling the borrow pits.
- 10.3.50 The Kings Bromley South borrow pit, located either side of Crawley Lane on the east and to the south of Ashby Sitch, also falls within the area identified in the MLP as the Area of Search.
- 10.3.51 The borrow pit sites have been derived from geotechnical desk study of mineral resources. Prior to construction of the Proposed Scheme, HS2 Ltd will undertake detailed ground investigations to help confirm the depth of granular deposits suitable for construction material, which will inform the surface area and depth of extraction required within each borrow pit site.

Geo-conservation resources

- 10.3.52 No geological SSSI or LGS have been identified within the study area. Therefore, no assessment of geo-conservation resources has been undertaken.

Receptors

- 10.3.53 The sensitive receptors that have been identified within the study area are summarised in Table 17. A definition of receptor sensitivity is given in the SMR.

Table 17: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents at existing properties, schools and study centres	High
		Workers and visitors at nearby facilities	Moderate
		Public using public rights of way (PRoW)	Low

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Issue	Receptor type	Receptor description	Receptor sensitivity
	Groundwater	Principal aquifer	High
		Secondary A aquifers	Moderate
		Secondary B aquifers and undifferentiated aquifers	Low to moderate
	Surface waters	River Trent, Pyford Brook, Bourne Brook and Moreton Brook	Moderate
		Trent and Mersey Canal	Low
	Built environment	Existing buried services	Low
Buildings and property		Low to high	
Impacts on mining/mineral and petroleum (gas) sites (severance and sterilisation)	Mining/mineral sites	Sand and gravel MSA	Moderate
		Coal deposits, (extent of hydrocarbons)	Low
		Sand and gravel Area of Search: West of A38	Low

Future baseline

Construction (2020)

- 10.3.54 Volume 5: Appendix CT-004-000¹⁴⁴ provides details of committed developments in the Fradley to Colton area that are assumed to have been implemented by 2020.
- 10.3.55 HS2 Phase One will introduce major railway infrastructure immediately south of the Proposed Scheme at Fradley Wood and will, therefore, materially alter the baseline conditions in 2020 for land quality. This has been considered in combination with the Proposed Scheme and reported under the assessment of cumulative effects during construction.
- 10.3.56 The committed developments that materially affect the baseline conditions for land quality in this area and form part of the future baseline assessment of the effects during construction and operation are listed in Table 18.

Table 18: Committed developments relevant to land quality

Map Book Reference ¹⁴⁵	Planning Reference	Description
CA1/36	14/01018/FULM	Residential development of 71 new homes, including 62 affordable homes.
CA1/43	CH/13/0293	Proposed haulage yard, erection of an industrial unit and associated parking.
CA1/32	L.10_10_856 W	Infill the B station borrow pit lake with 1.6 million tonnes of unsold PFA (pulverised fuel ash) and FBA (furnace bottom ash) derived from the operations of the Rugeley Power Station
CA1/54	13/00588/FUL	An earth banked slurry lagoon.

¹⁴⁴ Volume 5: Appendix CT-004-000 Committed Developments.

¹⁴⁵ Volume 5 Map Book: Maps CT-13-101 to CT-13-105a-L1.

Map Book Reference ¹⁴⁵	Planning Reference	Description
CA1/79	13/00410/FULM	A winter irrigation reservoir to hold 77,900 cubic metres of water.
CA1/88	14/00690/FUL	Agricultural building, silage storage area and workers dwelling.
CA1/19	Area of Search – West of the A38, along Trent Valley	Mineral area of search for sand and gravel.
CA1/33	Core Policy 6 and Policy East of Rugeley 1 East of Rugeley Strategic Development Allocation	Allocation to provide up to 1,130 dwellings and associated social, green and physical infrastructure.

Operation (2027)

10.3.57 Volume 5: Appendix CT-004-000 provides details of committed developments in the Fradley to Colton area that are assumed to have been implemented by 2027.

10.3.58 There are no further committed developments which will affect the baseline conditions during operation of the Proposed Scheme.

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The construction assessment takes into account the mitigation measures described in the draft Code of Construction Practice¹⁴⁶ (CoCP). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme and includes requirements to ensure the effective management and control of work in contaminated areas.

10.4.2 The requirements in the draft CoCP relating to work in contaminated areas will ensure the effective management and control of the work. These requirements include:

- methods to control noise, waste, dust, odour, gases and vapours (Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (Section 5);
- the management of human exposure for both construction workers and people living and working nearby (Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (Sections 7 and 15);
- management of any unexpected contamination found during construction (Section 11);
- a post-remediation permit to work system (Section 11);

¹⁴⁶ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- storage requirements for hazardous substances such as oil (Section 16);
- traffic management to ensure that there is a network of designated haul routes to reduce compaction/degradation of soils (Section 7);
- methods to monitor and manage flood risk and other extreme weather events that may affect land quality during construction (Section 5 and 16);
- methods to manage discovery of unknown animal burial pits (Section 6); and
- the excavation and restoration of borrow pits (Section 6, 7 and 12).

10.4.3 The draft CoCP will require that, prior to and during construction, a programme of further detailed investigations, which may include both desk based and site based work, takes place in order to confirm the full extent of areas of contamination. It also requires a risk assessment to be undertaken to determine what, if any, site specific remediation measures are required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants. The investigation and assessment of potentially contaminated sites will be undertaken in accordance with Environment Agency CLR11¹⁴⁷ and British Standards BS10175¹⁴⁸ and BS8576¹⁴⁹.

10.4.4 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. Where appropriate, this appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with the framework set out by the Sustainable Remediation Forum UK¹⁵⁰. The preferred option will then be developed into a remediation strategy.

10.4.5 Contaminated soils excavated within the site, where reasonably practicable, will be treated to remove or render any contamination inactive and reused within the Proposed Scheme where needed and suitable for use. Treatment techniques could include stabilisation, soil washing and bio-remediation. Contaminated soil removed off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and reuse) or to an appropriately permitted landfill.

Assessment of impacts and effects

10.4.6 Construction of the Proposed Scheme in this area will require earthworks, utility diversions, deep foundations, borrow pits, (involving temporary dewatering) and other activities, including the construction of the various viaducts and road infrastructure works. These aspects of the Proposed Scheme, along with other construction features, are shown on the Map Series CT-05 in Volume 2: CA1 Map Book.

Land contamination

10.4.7 In line with the assessment methodology, as set out in the SMR, an initial screening process has been undertaken to identify areas of current or historical contaminative

¹⁴⁷ Environment Agency, (2004), *CLR11 Model Procedures for the Management of Land Contamination*.

¹⁴⁸ British Standard, (2011), *BS10175+A1:2013 Investigation of Potentially Contaminated Sites*.

¹⁴⁹ British Standard, (2013) *BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)*.

¹⁵⁰ Sustainable Remediation Forum UK, (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. Sites that present a low risk have not been taken further in the assessment. Any moderate to high risk sites have been taken forward to more detailed risk assessments, in which the potential risks are assessed more fully. The majority of the areas that have undergone the more detailed risk assessments are historical or current landfills and infilled pits/ponds. All areas assessed are shown on Maps LQ-01-101 to LQ-01-105 (Volume 5: Land quality Map Book) and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

10.4.8 CSMs have been produced for those areas taken to detailed risk assessments. The following factors determine the need for detailed risk assessments:

- whether the site is located on or off the route of the Proposed Scheme or associated off line works;
- the vertical profile of the route;
- the presence of underlying sensitive groundwater aquifers (Principal or Secondary A or Secondary B) or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

10.4.9 Clusters of potentially contaminated sites of a similar nature have been grouped, and assessed together, where appropriate.

10.4.10 A simple summary of the baseline CSM is provided in Table 19. A more detailed assessment of baseline risk is provided in Volume 5: Appendix LQ-001-001. The potential impacts and baseline risks presented are those before any mitigation is applied. The assessed baseline risk is based on the information available at the time of the assessment. Where limited information is available, the assessment is based on precautionary, worst case assumptions and may therefore report a higher risk than that which actually exists. A screening assessment of the effects of contamination has been completed by comparing the detailed CSM developed for potential contaminated areas at baseline with construction and post-construction stages.

Table 19: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area reference ¹⁵¹	Area name	Human health risk	Groundwater risk	Surface water risk	Buildings risk
1-248, 1-22, 1-123, 1-252, 1-253, 1-31, 1-251, 1-249, 1-217, 1-247, 1-61, 1-250, 1-32	Field No 7600, South of Colton Hall Farm, Rileyhill Farm Landfill Site, Shaw Lane Landfill Site, Historic landfill at Rugeley Power Station (1), Historic landfill at Rugeley Power Station (2), Landfill Near Pipe Ridware, Landfill site between Love Lane and Power Station Road, Landfill to the east of	Very low to moderate	Moderate	Moderate/low	Moderate/low to moderate

¹⁵¹ Each potentially contaminated site is allocated a unique reference number (See Volume 5: Appendix LQ-001-001 and Land quality Map Book).

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Area reference ²⁵¹	Area name	Human health risk	Groundwater risk	Surface water risk	Buildings risk
	Power Station Road, N&H - Colton Hall Farm Landfill Site, North of Colton Hall Farm, Potential refuse heap, Power Station Road landfill, The Wharf Old Site				
1-239	Existing WCML railway	Very low	Moderate/low	Moderate/low	Very low to low
1- 244	Dismantled mineral railway line	Very low to moderate/ low	Low	Low	Very low
1- 240	Former Rugeley Power Station and fuel storage areas	Very low to moderate/low	Moderate	Moderate	Moderate/low to moderate
1-246	Coal mining pit heads and spoil mounds	Very low to moderate/low	Moderate	Moderate	Moderate/low to moderate
1-271, 1-289, 1-299, 1-294, 1-243, 1-293, 1-302, 1-270, 1-298, 1-275, 1-120, 1-276, 1-312, 1-292, 1-287, 1-98, 1-274, 1-135, 1-308, 1-86, 1-183, 1-297, 1-303, 1-317, 1-139, 1-307, 1-273, 1-295, 1-277, 1-9, 1-296, 1-171, 1-236, 1-280	Barn Farm Extension, Bentley Hall Farm, Bentley Hall Cottage, , Bromley Lane Farm, Cawarden Springs Farm, Church Farm, Colton Hall Farm, Common Farm, Eastfields Farm, Echills Farm Building, Flint's Barn, Glebe Farm, Gorse Farm, Hall Farm, Hamley Cottage Farm, Hamley House Farm, Hanch Hall Farm, Lodge Farm, Longley Barn, Lount Farm, New Barn, New Buildings Farm, New House Farm, Oak Farm, Pool Farm, Rosewood Farm, Shaw Barn, Shaw Lane Farm, Shawlane Farm, Wharf Farm, Wood End Barn, Woodshoot Farm, Old Wood Farm, Old Wood Farm No. 8	Low to moderate	Moderate	Moderate	Low to moderate/low
1-219	Blythe Garage Filling Station (obsolete)	Low to moderate/low	Moderate	Moderate /low	Very low to moderate /low
1-136	Vehicle depot at Gorse Lane, Fradley	Very low to moderate/low	Moderate	Moderate/low	Moderate/low to moderate
1- 11, 1-157	Kings Bromley Wharf and Marine Service Station	Low to moderate	Moderate/low	Moderate/low	Moderate/low
1- 28	St James Graveyard and Cemetery	Low to moderate	Moderate/low	Low	Very low to moderate/low

Area reference ^{25a}	Area name	Human health risk	Groundwater risk	Surface water risk	Buildings risk
1-42, 1-263, 1-264	Former infilled pits and quarries	Very low to moderate/low	Moderate/low	Low	Very low to moderate
1-314	Business park	Very low to moderate/low	Low	Low	Moderate/low to moderate

Temporary effects

- 10.4.11 In order to identify potential temporary effects, the baseline and construction CSM have been compared to determine the change in level of risk at receptors during the construction stage, and thus to define the level of effect at the construction stage.
- 10.4.12 Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be negligible even if the risk is deemed to be high. For example, this will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the area required for construction.
- 10.4.13 A worsening risk at construction stage compared to baseline will result in a negative effect, and conversely, an improvement will result in a positive effect. The assessment assumes that contamination will be controlled through the general measures in the CoCP.
- 10.4.14 All of the sites set out in Table 19 have been assessed for the change in impact associated with the construction stage of the work. The assessment has shown that whilst there are a number of minor adverse and beneficial impacts at the construction stage, none of these would be regarded as significant in line with the methodology set out in the SMR. The details of the full assessment are presented in Volume 5: Appendix LQ-001-001.
- 10.4.15 In the event that unexpected contamination is encountered during the construction of the route in this area, this will be assessed and remediated if required, as described in the draft CoCP resulting in an overall beneficial effect.
- 10.4.16 Construction compounds located in this study area will include the storage of potentially hazardous substances, such as fuels and lubricating oils and may also be used for temporary storage of potentially contaminated soils. Mitigation measures set out within the draft CoCP include management of risks from the storage of such materials.

Permanent effects

- 10.4.17 In order to identify potential permanent effects, a screening assessment has been undertaken comparing the baseline and post-construction CSM to assess the permanent (post-construction) effects.
- 10.4.18 All of the sites set out in Table 19 have been assessed for the change in impact associated with the post-construction (permanent) stage of the work. The assessment has shown that whilst there are a number of minor adverse and beneficial impacts at the post-construction stage, none of these would be regarded as significant in line

with the methodology set out in the SMR. The details of the full assessment are presented in Volume 5: Appendix LQ-001-001.

- 10.4.19 Additional site-specific permanent remediation measures, that could focus on source removal, pathway breakage or receptor protection, will be developed during the detailed design stage if required. These measures will ensure that risks to people and property from gas and vapours in the ground, the principal risk in this area, will be controlled to an acceptable level.

Mining/mineral resources

- 10.4.20 Construction of the Proposed Scheme has the potential to affect existing mineral resources and proposed areas of mineral exploitation. This could occur by sterilisation of the resource through direct excavation during construction of the Proposed Scheme or through temporary and/or permanent severance¹⁵² or isolation that may occur during the construction phase of the Proposed Scheme, possibly continuing through to its operation.
- 10.4.21 The route of the Proposed Scheme will cross an extensive MSA for sand and gravel extraction including an Area of Search at Kings Bromley (Volume 5: Maps LQ-01-001 to LQ-01-005a).

Temporary effects

- 10.4.22 Temporary effects may occur during initial excavation of the borrow pits where areas of potentially contaminated land have been identified. A small area of potentially contaminated land has been identified in the Kings Bromley South borrow pit. The site was a former quarry/pit which has subsequently been infilled and the quality of the infill material is unknown. There is potential for contamination to exist in the infill material. However, due to the relatively small size of the former quarry (less than 0.5 hectares) and the need to remove the infill material from site to access the mineral, the effect of such work is assessed to be minor, and therefore not significant.
- 10.4.23 Temporary adverse effects may occur where construction compounds are proposed within the MSA. In such cases, there will be a temporary sterilisation of the resource during construction works, but this is not considered to represent a significant effect and the resource will not be lost permanently.
- 10.4.24 The following compounds fall within the MSA:
- Pyford Brook viaduct satellite compound;
 - Pyford North embankment satellite compound;
 - Bourne embankment satellite compound;
 - River Trent viaduct satellite compound; and
 - Moreton Brook viaduct satellite compound

¹⁵² In this context, severance refers to the Proposed Scheme splitting an actual or proposed mining/mineral site into two or more areas, such that separate accesses would be required to work the whole site.

- 10.4.25 The temporary effects on the hydrological regimes, as a result of the borrow pit extraction, are uncertain at this stage. The need for secondary aquifer dewatering is assumed as a worst case, which may lead to localised and temporary disturbance of groundwater flow directions. Further details regarding the temporary groundwater effects are given in Section 15, Water resources and flood risk.

Permanent effects

- 10.4.26 The majority of effects on mining and mineral sites will be permanent.
- 10.4.27 Section 2.3 of this report sets out the details of the borrow pits in the Fradley to Colton area. The maximum excavation depth for the borrow pits will be up to 15.8m, comprising 0.8m of topsoil and subsoils and between 8m and 15m of sand and gravel extraction. The thickness of the available mineral resource is uncertain, however the maximum mineral depth has been derived from geotechnical desk study of mineral resources.
- 10.4.28 The area of each of the four borrow pits range between 12 and 35ha.
- 10.4.29 Excavation will be carried out in zones, until each zone is depleted. The exact size and number of zones will be assessed during detailed design.
- 10.4.30 Excavation of the borrow pits will avoid unnecessarily sterilising mineral deposits by excavating the sand and gravel to full depth unless there are environmental, engineering or construction constraints that prevent this. HS2 Ltd will seek to avoid sterilisation of mineral reserves wherever practicable.
- 10.4.31 Backfill material will arrive at the borrow pit location as soon as it becomes available. The borrow pits will be backfilled with natural, clean excavated material from other areas of the Proposed Scheme, and capped off with the previously excavated topsoil and subsoil. Generally, backfill will be placed and compacted in even layers where needed to mitigate differential settlement across the site.
- 10.4.32 The backfill for the borrow pits will be predominantly cohesive material (e.g. clay), and will include material derived from excavations within the Mercia Mudstone Group and the Glacial Till. The Mercia Mudstone Group contains evaporite minerals, mainly halite (sodium, chloride) and gypsum (hydrous calcium sulphate). The thicker halite beds in Staffordshire are at depths of 100m or more, and will not be encountered in excavation for cuttings, although it is possible that thinner layers may be encountered at shallower depths. In addition, gypsum is found in thin layers or veins throughout the Mercia Mudstone Group. These minerals can cause changes in groundwater quality when dissolution occurs. However, if present in relatively small quantities, and surrounded by low permeability compacted clays and mudstones, the potential for dissolution is small, and the potential effect on groundwater quality relatively minor, and not considered significant. If substantial horizons of halite are encountered in excavations, this will not be used for backfill in borrow pits.
- 10.4.33 Use of borrow pits is assessed as having a minor beneficial effect (Table 20), which is not significant, as it avoids depletion of local permitted reserves. It should be noted that extraction from below the structural footprint of the route of the Proposed Scheme will not occur, as the permanent railway will require good founding conditions. A plan will be discussed in advance of the construction works with the

landowner, SCC, and any other relevant parties to assist in achieving effective management of minerals within the affected location of the MSA.

- 10.4.34 There are no permitted mineral sites or MSAs for halite or gypsum in the Fradley to Colton study area¹⁵³.
- 10.4.35 The borrow pit sites are all currently in agricultural use. It is proposed to restore the land back to the current land use, post-excavation.
- 10.4.36 The effects of construction of the Proposed Scheme on the sand and gravel MSA will be permanent where underlain by the footprint of the permanent works, with a strip of mineral becoming sterilised. However, as a proportion of the total MSA in Staffordshire, this strip is less than 1% of the total, and the effect on the MSA is considered to be minor and therefore not significant. Mitigation measures (if any) would be discussed in advance of the works with the Mineral Planning Authority, SCC and the mineral owner.
- 10.4.37 The route of the Proposed Scheme will cross an area underlain by coal reserves of the South Staffordshire Coalfield. The MLP¹⁵³ identifies the deep coal areas as areas of hydrocarbons resources, specifically, potential sources of coal bed methane. Construction of the Proposed Scheme is unlikely to place a constraint on future exploitation of potential sources of coal bed methane.
- 10.4.38 Table 20 reports the assessment of permanent effects from construction on the mining and mineral resources identified.

Table 20: Summary of permanent effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance (Y/N)
Superficial sand and gravel	MSA	MSA for sand and gravel extraction, defined by SCC ¹⁵⁴ e.g. Kings Bromley	Medium	Minor	Negligible (N))
West of A38, along Trent Valley	Area of search within MSA	Sand and gravel extractions, defined by SCC ¹⁵⁵ .	Medium	Minor	Negligible (N))
Borrow pits	MSA	Four areas within MSA identified for extraction for use on Proposed Scheme	Medium	Positive	Minor beneficial (N)
South Staffordshire Coalfield, Lichfield District	Extent of hydrocarbons	Extent of hydrocarbon resource. Deep coal defined as between 50m and 1,200m by SCC	Low	Negligible	Negligible (N)

- 10.4.39 There will be negligible effects on the three mining, mineral and gas resources, which are not significant. There will be a minor beneficial significant effect on the existing

¹⁵³ Staffordshire County Council, (2015) *New Minerals Local Plan for Staffordshire 2015-2030*

¹⁵⁴ Staffordshire County Council. (2015) *The New Minerals Local Plan for Staffordshire 2015 to 2030*.

¹⁵⁵ Staffordshire County Council (2015) *Minerals Local Plan Area of Search for Sand and Gravel West of A38, Trent Valley, Inset MAP- 14*, Available online at: <https://apps2.staffordshire.gov.uk/WEB/OnTheMap/planning>

resource within the MSA resulting from the use of the borrow pits in the Fradley to Colton area, which is not significant.

Geo-conservation sites

- 10.4.40 No geo-conservation areas such as SSSI or LGS are present in the study area.

Other mitigation measures

- 10.4.41 At this stage, no additional measures are considered necessary to mitigate risks from land contamination during the construction stage beyond those that are set out in the draft CoCP and/or instigated as part of the site specific remediation strategies that will be developed at the detailed design stage, if required. These measures will ensure that risks to people, the environment and property from contaminants in the ground will be controlled, such that they will not be significant. For example, measures might include excavation and treatment of contaminated soils or controls to manage movement of landfill gas and leachate.

Summary of likely residual significant effects

- 10.4.42 Based on the information currently available and with the application of the mitigation measures detailed above, no likely significant residual effects are anticipated with respect to land quality.

Cumulative effects

- 10.4.43 HS2 Phase One includes mitigation measures¹⁵⁶ within the design to minimise temporary and permanent impacts on land quality. The interface between Phase One and the Proposed Scheme has been taken into consideration during the engineering design including the construction phasing for the Proposed Scheme. There will be no significant land quality-related effects identified arising from overlaps from simultaneous construction activities. There will be no significant cumulative effect on the identified receptors with regard to land quality, mineral resources and geo-conservation.
- 10.4.44 No significant cumulative temporary or permanent effects during construction with regard to land contamination, mineral resources or geo-conservation sites are anticipated from other identified committed developments.

10.5 Effects arising from operation

- 10.5.1 Users of the Proposed Scheme (i.e. rail passengers) are at all routine times within a controlled environment (i.e. within trains), and have therefore been scoped out of the assessment.

Avoidance and mitigation measures

- 10.5.2 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice. Spillage and pollution response

¹⁵⁶ HS2 Phase One London – West Midlands Environmental Statement, Volume 2: Community Forum Area Report CFA22, Whittington to Handsacre. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/397889/Vol2_CFA_22_Whittington_to_Handsacre.pdf

procedures similar to those to be outlined in the draft CoCP will be established for all high risk activities and employees will be trained in responding to such incidents.

Assessment of impacts and effects

- 10.5.3 The Proposed Scheme within this area will include two auto-transformer stations, located at Bourne Book and Pipe Ridware, and one auto-transformer feeder station located at Newlands Lane. There will be a substation at Rugeley which will connect to the auto-transformer feeder station at Newlands and there will be a package substation at Blithbury. An auto-transformer station, feeder stations and substations can in principle, be a source of contamination through accidental discharge or leaks of coolant. However, in common with other modern substations, secondary containment appropriate to the level of risk will be included in the installed design.
- 10.5.4 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, any such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

Other mitigation measures

- 10.5.5 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality in the study area.

Summary of likely residual significant effects

- 10.5.6 No significant residual effects are anticipated associated with operation of the Proposed Scheme.

Cumulative effects

- 10.5.7 HS2 Phase One includes mitigation measures³⁵⁷ within the design to minimise temporary and permanent impacts on land quality as a result of the operational phase. The interface between Phase One and the Proposed Scheme has been taken into consideration. The maintenance and operation of Phase One and the Proposed Scheme will be in accordance with environmental legislation and good practice. There will be no significant land quality-related effects identified arising from operation of both schemes.
- 10.5.8 No cumulative effects during operation on land quality receptors have been identified in the Fradley to Colton area.

Monitoring

- 10.5.9 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 10.5.10 Requirements for monitoring will be determined as part of the site investigation, treatment and validation of contamination on a site specific basis as part of the detailed design process. Monitoring requirements may include water quality, air quality and/or (landfill) gases, depending on the site being considered.

³⁵⁷ HS2 Phase One Draft Environmental Minimum Requirements Annex1: Draft Code of Construction Practice. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593592/Code_of_Construction_

11 Landscape and visual

11.1 Introduction

- 11.1.1 This section of the report presents the assessment of the likely significant landscape and visual effects within the Fradley to Colton area. It summarises the baseline conditions found within and around the route of the Proposed Scheme and describes the likely impacts and significant effects during construction and operation on landscape and visual receptors.
- 11.1.2 The operational assessment section refers not just to the running of the trains, vehicles on roads and any associated lighting but also the presence of the new permanent infrastructure associated with the Proposed Scheme.
- 11.1.3 Engagement with Staffordshire County Council (SCC), Lichfield District Council (LDC), the Cannock Chase Area of Outstanding Natural Beauty Unit, the Canal & River Trust, National Trust and Natural England has been undertaken. The purpose of this engagement has been to discuss the assessment methodology, extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages.
- 11.1.4 Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in the Volume 5: Landscape and Visual Map Book and Volume 5: Appendix LV-001-001, which comprises the following:
- Part 1 Engagement with technical stakeholders;
 - Part 2 Landscape character assessment;
 - Part 3 Visual assessment; and
 - Part 4 Assessment matrices.
- 11.1.5 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 11.1.6 The Volume 2: CA1 Map Book also includes Map Series LV-03 (Construction phase viewpoints), Map Series LV-04 (Operation phase viewpoints) and Map Series LV-01 (Verifiable photomontages), showing viewpoints that will be significantly affected.
- 11.1.7 A separate, but related, assessment of effects on historic landscape character and the setting of heritage assets is reported in Section 7, Cultural heritage.

11.2 Scope, assumptions and limitations

- 11.2.1 The scope, key assumptions and limitations for the landscape and visual impact assessment are set out in full in Volume 1 (Section 8), the Scope and Methodology Report (SMR)¹⁵⁸, and the SMR Addendum¹⁵⁹.
- 11.2.2 Winter surveys for the landscape and visual assessment were undertaken from January to March 2016 and February 2017 to inform the assessment. Summer field surveys, including photographic studies of landscape character areas (LCA) and visual assessment of viewpoints, were undertaken from July to September 2016. During the baseline survey, there were some areas which that were inaccessible (such as private land, commercial premises and residential buildings). In these instances, professional judgement has been used to approximate the likely views from these locations.
- 11.2.3 The extent of the study area has been informed by construction and operational phase zones of theoretical visibility (ZTV). The ZTV have been produced in line with the methodology described in the SMR and SMR Addendum, and are an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV, and professional judgement, during site visits, has been used to further refine the study area to focus on likely significant effects.
- 11.2.4 Tall construction plant (for example cranes and piling rigs) is excluded from the ZTV for the construction phase, as there is a great degree of variability in the extent and timeframes of the visibility of construction activity and plant. Overhead line equipment rarely gives rise to significant effects if it is the only element visible and has, therefore, been excluded from the ZTV to give a better indication of the possible spread of significant effects to aid the assessment. Overhead line equipment is described and taken into account in the assessment of effects on LCAs and visual receptors.
- 11.2.5 Landscape and visual receptors within approximately 500m of the Proposed Scheme have been assessed as part of the study area. Long distance views of up to 1km have been considered at settlement edges, such as at Handsacre, Kings Bromley and Nethertown.
- 11.2.6 Professional judgements on landscape value, susceptibility and sensitivity are described in full in the baseline descriptions in the proformas in Volume 5: Appendix LV-001-001, Part 2.

11.3 Environmental baseline

Existing baseline

Landscape baseline

- 11.3.1 The study area extends from Fradley Wood in the south to approximately 200m north-west of Moreton Brook. It encompasses alluvial lowland and settled river valley

¹⁵⁸ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

¹⁵⁹ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

landscapes, mostly dictated by the River Trent and the River Blithe and more elevated plateaus, such as at Admaston.

- 11.3.2 The land use is predominantly agricultural, often defined by intact, small-scale fields dating from later medieval period to mid 20th century and onwards, although there has been some loss of hedgerows due to 20th century agricultural intensification. The area is characterised by a dispersed settlement pattern, exemplified by historic rural villages such as Mavesyn Ridware and Colton. These villages are connected by a network of quiet rural lanes, often historic in nature including hollow ways at Newlands Lane that cross the study area. By contrast the larger villages of Hill Ridware, Hamstall Ridware and Handsacre are connected by highways such as B5014 Uttoxter Road. Arterial routes, such as the A515 Lichfield Road and A513 Rugeley Road cross the study area on a west to east orientation. The area also includes a section of the WCML as well as sections of Trent and Mersey Canal and a short section of the Coventry Canal to the south.
- 11.3.3 The LCAs have been determined as part of a holistic process of environmental characterisation, informed by the outcome from other topics including the historic landscape character and ecological assessments. Use has been made of published landscape character assessments, historic landscape characterisation (HLC) and a wide range of supporting GIS data, aerial photography and Ordnance Survey mapping, plus desk study and fieldwork. Landscape character assessments reviewed include the relevant National Landscape Character Areas¹⁶⁰ and the Staffordshire Landscape Guidelines¹⁶¹. More detail on the approach to the landscape characterisation is set out in the SMR Addendum.
- 11.3.4 For the purposes of this assessment, the study area for Fradley to Colton has been subdivided into eight LCAs. Full descriptions for all eight LCAs are contained within Volume 5: Appendix LV-001-001, Part 2.

Visual baseline

- 11.3.5 A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are numbered to identify their locations and are shown on the landscape character areas and viewpoint location maps (see Volume 2: CA1 Map Book, Map Series LV-03 and LV-04). They are described and assessed in full in the proformas in Volume 5: Part 3. In each case, the middle number (xxx.xx.xxx) identifies the type of receptor that is present in this area – 1: Protected views (none within this area), 2: Residential, 3: Recreational¹⁶², 4: Transport, 5: Hotels/healthcare and 6: Employment (none within this area).
- 11.3.6 No protected views have been identified within the study area. Residential views within the area are located at a number of settlement types: these comprise larger settlements of Kings Bromley, Handsacre, Hill Ridware and Colton; villages such as

¹⁶⁰ Natural England (2013, 2014), *National Character Area profiles*. Available online at: <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles>

¹⁶¹ Staffordshire County Council, Development Services Department (2000), *Planning for Landscape Change*. Available online at: <https://www.staffordshire.gov.uk/environment/eLand/planners-developers/landscape/NaturalEnvironmentLandscapeCharacterTypes.aspx>

¹⁶² Reference to specific civil parish numbers for footpaths is provided where available otherwise the adjacent road name is used as a reference to the footpath.

Pipe Ridware, smaller villages and hamlets such as Rileyhill, Nethertown, Stockwell Heath and numerous individual farmsteads.

- 11.3.7 Views from settlement edges are typically filtered and framed by intervening hedgerows, which combined with low lying and gently undulating landform, restricts open views to some degree.
- 11.3.8 A range of recreational views are located along the Kings Bromley Marina, Fradley Lock, and the Trent and Mersey Canal and its associated tow path. Two long distance footpaths, the Staffordshire Way and the Way for the Millennium long distance path, cross the study area from south-west to north-east.
- 11.3.9 Views from recreational areas and residences on elevated positions, include the settlement of Hamstall Ridware and the Staffordshire Way near Admaston; these provide long range and panoramic across the gently undulating agricultural land of the River Trent valley with a generally well defined field patterns.
- 11.3.10 Views from the majority of public rights of way (PRoW) in the area are lower lying and restricted by woodland and hedgerows. Users travelling on rural roads and lanes generally experience partially restricted views, due to mature roadside hedgerows and trees. However, lanes located on more elevated ground on the Trent Valley sides, such as Sherracop Lane and Newlands Lane, allow glimpsed long distance views across the valley. Views from motorists/road users travelling on the lower lying A515 Lichfield Road and the A513 Rugeley Road are generally restricted due to mature roadside hedgerows and woodland belts that form barriers that restrict views beyond the road corridor.
- 11.3.11 Views from the canal and the adjoining towpath are typically limited by canal side vegetation. The Alrewas Hayes Countryside Venue is the only hotel receptor in the Fradley to Colton area.

Future baseline

Construction (2020)

- 11.3.12 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2020.
- 11.3.13 HS2 Phase One will be under construction by 2020, which will alter the future baseline conditions for the Proposed Scheme. This will be through the construction of embankments (including Curborough Embankment and Pyford Brook East Embankment) and viaducts (including Trent and Mersey Canal North Viaduct and Trent and Mersey Canal East Viaduct) plus associated tall construction plant and traffic. This has the potential to affect landscape and visual receptors that fall within the study area of the Proposed Scheme. This is considered in the cumulative assessment of the construction phase of the Proposed Scheme, later in this section.
- 11.3.14 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for landscape and visual receptors.

Operation (2027)

- 11.3.15 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.

- 11.3.16 The combined effect of the presence of HS2 Phase One during operation, including the severance of field patterns and an increase in levels of intrusion from the new embankments and viaducts, will alter the future baseline conditions for the Proposed Scheme. This has the potential to affect landscape and visual receptors that fall within the study area of the Proposed Scheme. This is considered in the cumulative assessment of the operational phase of the Proposed Scheme, later in this section.
- 11.3.17 No further committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for landscape and visual receptors.

11.4 Temporary effects arising during construction

- 11.4.1 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible from many locations and will have the potential to give rise to significant temporary effects that cannot practicably be mitigated. Such effects are temporary and will vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main construction works will take place, including the establishment of compounds, main earthworks and structure works.
- 11.4.2 The effects associated with the peak construction stage in this area are generally considered to be medium-term, based on the indicative construction programme in Section 2.3. The peak civil engineering stage in this area will be undertaken between the start of 2021 and the end of 2024. Effects during other stages of works are likely to be less intensive due to less construction equipment being required at the time and a reduced intensity of construction activity.
- 11.4.3 Section 2.2 sets out the key permanent features of the Proposed Scheme and Section 2.3 describes the construction compounds and associated temporary works that have been considered in this assessment.

Avoidance and mitigation measures

- 11.4.4 Effects during the construction period may be reduced by establishing planting early in the construction programme. Advanced planting is proposed in a number of specific locations, including along Pyford Brook adjacent to the Pyford Brook viaduct, bounding the Blithbury Road realignment and along field boundaries in proximity to the power line between the Newlands Lane auto-transformer feeder station and the grid supply point at Rugeley substation. These mitigation measures will provide additional screening for receptors during construction (as well as beyond into operation), and will also help better integrate the Proposed Scheme into the landscape.
- 11.4.5 Measures that have been incorporated into Sections 12 and 14 of the draft Code of Construction Practice¹⁶³ (CoCP) to avoid or reduce landscape and visual effects, where reasonably practicable, during construction include the following:

¹⁶³ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- avoidance of unnecessary tree and vegetation removal, and protection of existing trees in accordance with BS 5837: Trees in relation to design, demolition and construction¹⁶⁴;
- use of well-maintained hoardings and fencing;
- prevention of damage to the landscape features adjacent to the construction sites due to movement of construction vehicles;
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses; and
- replacement of any trees intended to be retained which may die as a consequence of nearby construction works.

11.4.6 Implementation of these measures has been taken into account in the assessment of the construction effects.

Assessment of temporary impacts and effects

11.4.7 The most apparent changes to the landscape and to the views experienced by visual receptors during construction will relate to the presence of construction plant, compounds and soils and material storage and stockpiling. Key construction activities that will give rise to the most apparent changes to landscape and visual receptors are: the excavation of cuttings; erection of viaducts; construction of embankments; the removal of existing landscape elements including trees and hedgerows; and the closure and diversion of existing public highways and PRoW. Other key changes include: the construction of overbridges and underbridges, auto-transformer stations, an auto-transformer feeder station, and overhead power lines; the excavation of borrow pits; utility diversions; the presence of transfer nodes and pre-cast yards and demolitions of buildings and structures.

Landscape assessment

11.4.8 The following four LCAs will be significantly affected during construction. Full details of effects are described in Volume 5: Appendix LV-001-001.

Table 21: Summary description and judgement of effect for LCAs

Fradley Settled Heathlands	Medium susceptibility and medium sensitivity.
<p>Parts of the landscape will be directly impacted by construction of Pyford South embankment, the Pyford Brook viaduct and the Pyford North embankment within this LCA.</p> <p>The landscape will also be directly impacted by the removal of trees and hedgerows that will open up views towards construction works and the presence of earthworks and stockpiles and excavation of balancing ponds will introduce notable alterations to the existing flat landform. The presence of construction plant and movement of construction vehicles will also introduce considerable change in the landscape with few existing infrastructure influences, besides localised views of the Fradley Industrial Park. Together these elements will introduce a medium magnitude of change by virtue of localised alterations to the landform character and severance of landscape pattern.</p> <p>The partial felling of Tomlinson’s Spinney woodland and the removal of significant areas of hedgerows to allow for construction will open up views of works and will result in alteration to the wooded skyline character. Large scale infrastructure elements and intensive construction activity will be highly prominent within an agricultural landscape that is predominantly tranquil, and the construction of embankments and presence of material stockpiles will result in alterations to the landscape’s flat lowland landform character.</p>	

¹⁶⁴ BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations, 2012, British Standard.

Construction of the Proposed Scheme will result in a **medium magnitude of change and moderate adverse effect** on this LCA, which is significant.

Kings Bromley Terrace Alluvial Lowlands	Medium susceptibility and medium sensitivity
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Part of the landscape will be directly impacted by construction activity associated with the Pyford North embankment, Kings Bromley viaduct, the Bourne embankment, the southern end of the River Trent viaduct and the raising in height of the National Grid Transmission 400kV overhead power line within the LCA.

The landscape will also be impacted by the excavation and restoration of borrow pits along with the construction of embankments and presence of earthworks and stockpiles, that will introduce alterations to the existing flat landform. The presence of satellite compounds, stockpiles of materials, the partial felling of Tomlinson’s Spinney woodland and the removal of hedgerows, along with the movement of construction vehicles will also introduce considerable change in a rural and relatively tranquil landscape with few existing infrastructure influences.

Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect** on this LCA, which is significant.

Trent Riparian Alluvial Lowlands	Medium- high susceptibility and medium sensitivity
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Part of the landscape will be directly impacted by the construction of the River Trent viaduct (and associated views of cranes) and the Pipe Ridware embankment. The viaduct’s construction will be highly prominent and will introduce large elements that will be out of scale and character with the open lowland valley landscape that is sensitive to change.

The landscape will also be impacted by the excavation of a borrow pit to the north of Pipe Ridware, the closures and realignments of roads and presence of satellite compounds. These works will result in the removal of substantial areas of trees and hedgerows and the addition of earthworks and stockpiles associated with the borrow pit will introduce alterations to the existing flat landform. The high level of construction works will impact skyline character through the presence of cranes and influence levels of tranquillity.

Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect** on this LCA, which is significant.

Colton and Stockwell Heath Settled Farmlands	Medium- high susceptibility and medium sensitivity
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Parts of the landscape will be directly impacted by the presence of construction of the Pipe Ridware embankment, Blithbury South cutting, Blithbury Central cutting, Blithbury North cutting, Stockwell Heath embankment and Stockwell Heath cutting, that will cause severance to historic field pattern and will result in localised alterations to the distinctive undulating landform character.

The landscape will also be impacted by the realignment and diversion of roads, the construction of a power line between the Newlands Lane auto-transformer feeder station and the grid supply point at the Rugeley substation. These activities will result in detracting features dispersed within the LCA. Earthworks, material stockpiles and the excavation of cuttings and construction of embankments will introduce alterations to the existing undulating landform. The presence of equipment and movement of construction vehicles will also introduce considerable intrusion, particularly within more sheltered and smaller valleys such as Stockwell Heath.

Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect** on this LCA, which is significant.

Visual assessment

Introduction

- 11.4.9 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken for the winter period, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Visual receptors who will experience non-significant effects are reported in Volume 5: Appendix LV-001-001.
- 11.4.10 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with lower sensitivity will be lower than those reported.

Environmental Statement Volume 2: Community area 1, Fradley to Colton

- 11.4.11 The assessment has not identified any locations within this study area where additional lighting during continuous night working and/or overnight working during construction will result in significant visual effects at night.
- 11.4.12 Table 22 describes the construction phase significant visual effects, these are described in detail in Volume 5: Appendix LV-001-001 and Map Series LV-03 in the Volume 2: CA1 Map Book.

Table 22: Construction phase significant visual effects

View west from Shade House Lock, Trent and Mersey Canal (VP 001.03.001)

Users of the footpath at Fradley Junction will have mid-range views of the construction of the Pyford South embankment, Pyford Brook viaduct and Pyford North embankment. At peak construction there will be isolated views of cranes above the intervening woodland canopy. Construction activities will represent a change from the scenic nature of the view along the Trent and Mersey Canal.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View north east from the Trent and Mersey Canal at Woodend Lock (VP 001.03.014)

Users of footpaths will have mid-range views of the construction of the Pyford South embankment, the Pyford North embankment and the Pyford Brook viaduct.

These works in combination with the presence of Pyford Brook viaduct satellite compound, tall plant such as cranes, the stockpiling of materials and the movement of vehicles along the site haul route will be prominent. Construction of the Proposed Scheme will result in a notable change within the mid-ground of the view though this will be partly filtered by intervening canal side vegetation.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View west from Alrewas Hayes Hotel (VP 001.05.011)

Guests at the hotel will have mid-distance views of the construction of the Pyford Brook viaduct and the Pyford North embankment, partially obstructed by field boundary and waterside vegetation and woodland within the mid-ground. The lower elements of construction works, such as the movement of vehicles along the site haul route, will be screened by mature hedgerows and wooded field margins, guests will have close range views of the activities associated with the excavation of the borrow pit to the north west of Alrewas Hayes.

In addition, the construction of the Pyford Brook viaduct and Pyford North embankment will be visible in the mid-ground to background of the view, partially obscured by hedgerows, waterside vegetation and woodland within the mid-ground, but with associated tower cranes visible on the skyline. Whilst the lower elements of construction works, such as the movement of vehicles along the site haul route, will be screened by hedgerows and woodland within the mid-ground and background, higher activities such as the construction of the spans of the viaduct and the installation of overhead line equipment will be visible above the wooded skyline.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View south-west from The Old Farmhouse, Crawley Lane (VP 002.02.002)

The residents will have mid-range views of the construction of the Pyford North embankment, the southern end of the Kings Bromley viaduct and works involved in the raising of National Grid Electricity Transmission 400kV overhead power line, that crosses the view, will be highly visible. There will be some restricted views of the realignment of A515 Lichfield Road.

The waterside trees that line the Bourne Brook, in the mid to long distance view, will screen all but the upper elements of construction. However, beyond the line of trees to the north, open views of the construction of the Kings Bromley viaduct will be possible in the background, forming a new skyline for a section of the view.

The activities associated with the excavation of the Kings Bromley North borrow pit, located adjacent to the realigned A515 Lichfield Road, will be visible to the south-west in the mid-ground partially filtered by winter field boundary trees.

Residents will have filtered views due to the presence of garden and field boundary vegetation within the foreground. However, where views extend beyond this, construction works will be visible throughout the view.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

View from residences on Shaw Lane

VP 02.02.005

Residents will have close to mid-range views of the works involved in the construction of Pyford North embankment, Kings Bromley viaduct and Bourne embankment. The construction of the embankments and viaduct will result in a new skyline within the mid-ground. There will also be views of the realignment of the A515 Lichfield Road, the movement of vehicles along the site haul route and stockpiles of materials that will substantially change the rural character of the view.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

View east from Kings Bromley Footpath 0.390

(VP 002.03.010)

Users of the footpath will experience mid-range views of the works involved in the construction of Pyford North embankment, Kings Bromley viaduct and Bourne embankment. The construction of the embankments and viaduct will result in a new skyline within the mid-ground. There will be views of the realignment of the A515 Lichfield Road and the works involved with the raising in height of National Grid Electricity Transmission 400kV overhead power line and the movement of vehicles along the site haul route. Receptors will experience some filtered views of the activities associated within the excavation of Kings Bromley North borrow pit, located adjacent to the realigned Shaw Lane.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

View north from the Trent and Mersey canal

(VP 002.03.011)

Users of the footpath will have mid to long range views of the works involved with the construction of Pyford North embankment, Kings Bromley viaduct and the Bourne embankment.

The construction of the Kings Bromley viaduct and Pyford North embankment, including the use of tower cranes and movement of vehicles on site haul routes, will be visible on elevated land that forms the horizon of the view. The construction works involved in the realignment of the A515 Lichfield Road and the works associated with the excavation of a borrow pit at Kings Bromley North, located adjacent to the realigned Shaw Lane, will be visible to the north in the mid-ground. The construction works will be partially screened by canal side trees and scrub that line the canal in the foreground and by woodland in the mid-ground.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views south-west from A515 Lichfield Road

(VP 002.02.014)

Residents will have mid-range views of the construction of Kings Bromley viaduct, the Bourne embankment and the realignment of the A515 Lichfield Road, which will be partially screened by field boundary trees and trees lining Crawley Brook in the mid ground and by garden vegetation in the foreground. There will also be views of the temporary roundabout on A515 Lichfield Road and A513 Rugeley Road and the movement of construction traffic.

The activities involved with the excavation of the borrow pit at Kings Bromley North, located adjacent to the realigned A515 Lichfield Road, will form a noticeable change within a large area of the mid-ground.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views from residence and Kings Bromley 1 to the east of Handsacre

(VPs 003.02.010 and 003.03.002)

Residents and users of footpaths will have mid-range views of the construction of the River Trent viaduct, including the construction of piers and spans of the viaduct and the use of tower cranes above, through intervening woodland and field boundary hedgerows and trees in the mid-ground of the view. The River Trent viaduct satellite compound will be partially visible and will result in a noticeable alteration that is uncharacteristic of the view.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views south from Bromley Lane Farm

(VP 003.02.009)

Residents will have close to mid-range views of the construction of the River Trent viaduct, including the erection of piers, spans and the presence and movement of cranes. The River Trent viaduct satellite compound and site haul routes will also be visible in the mid-ground, along with the implementation of habitat creation in the foreground of the view. The construction works will result in a change partly filtered by intervening vegetation and built form. The residential receptor will have limited views of the construction work due to agricultural buildings within the foreground of the view, although views from upper floors will be likely to extend above intervening built form and vegetation.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views south west from recreational receptors on Hamstall Ridware Footpath 3

(VP 03.03.012)

Users of the footpath will experience close range views of the borrow pit, north-east of the River Trent viaduct, between the River Trent and Pipe Lane, which will result in the total removal of key landscape features within the view, such as the field and hedgerows within proximity to the footpath. There will also be mid-range views of the construction of the River Trent viaduct, including the erection of piers, spans and the presence and movement of construction vehicles and cranes, which will change the character of the skyline.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views from residences in Nethertown

(VPs 003.02.013 and 003.02.011)

Residents within Nethertown will have mid-long range views of the mid-upper elements of construction of the River Trent viaduct, including the erection of the spans and the piers of the viaduct and the use of tower cranes, and the Bourne Embankment.

There will be mid-range views of the activities associated with the excavation and restoration of the borrow pit at Blithbury to the east of the River Trent viaduct.

The construction of the Proposed Scheme will result in the addition of new features that are partially screened by hedgerows and by landform, as construction will be located at a lower elevation on the valley floor. However, the higher elements of the construction of the River Trent viaduct will be visible on the skyline.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 003.02.013 is illustrated on the photomontage shown in Figure LV-01-575 (Volume 5: Appendix LV-001-001).

Views south west from Hamstall Ridware Footpath 8

(VP 003.03.017)

Users of the footpath will have mid to long-range elevated views of the diversion of Pipe Lane and the construction of the River Trent viaduct and Pipe Ridware embankment.

The construction works will be visible as a series of components within the mid-ground across the view of the valley floor, partially obscured by intervening hedgerows and vegetation.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views east from Pipe Ridware

(VPs 003.03.024 and 003.02.018)

Users of the Mavesyn Ridware Footpath 28 and residents in Pipe Ridware will have mid-range views of the construction of Pipe Ridware embankment and the River Trent viaduct. There will be close range views of cranes, material stockpiles, movement of construction vehicles and the modifications. Construction activity will result in the addition of new features in the foreground and mid-ground of the view and will create a substantial change to the rural visual character, though partially screened by vegetation in the foreground.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views east from School Lane, Pipe Ridware

(VP 003.02.019)

Residents will have mid-range views of the construction of Pipe Ridware embankment and the River Trent viaduct, and associated views of cranes, material stockpiles and movement of construction vehicles. Construction activity will introduce new features in the mid-ground of the view, partially obstructed by garden vegetation in the foreground and mature field and roadside trees.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Mavesyn Ridware 34

(VP 004.03.005)

Users of the footpath will have mid-range elevated views across the valley to the construction of the Pipe Ridware embankment, Blithbury South cutting, Mavesyn Ridware Footpath 38 accommodation overbridge and the realignment of Pipe Lane. There will also be views of material stockpiles and movement of construction vehicles.

Mid-range views of the construction of the Proposed Scheme will be viewed in the context of agricultural buildings in Woodhouse Farm and Rugeley Power Station forming prominent features in the existing view, however construction works will be visible continuously across the view.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Mavesyn Ridware Footpath 8

(VPs 004.03.014, 004.03.015)

Users of the footpath will have close-range views of the construction of Pipe Ridware embankment, Blithbury South cutting and Mavesyn Ridware Footpath 38 accommodation overbridge. Material stockpiles will be visible in the foreground to the north of the route and site haul routes to the south. The construction works will introduce new features that will substantially change the views.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Colton Footpath 34 to the west of Newlands Lane

(VP 006.03.006)

Users of Colton Footpath 34 will have close to mid-range views of road realignment works at Newlands Lane and the construction of the Newlands Lane auto-transformer feeder station. Mid-range views will include the construction of Blithbury North cutting, Blithbury Central cutting and Newlands Lane overbridge.

There will also be views of the Newlands Lane auto-transformer feeder station satellite compound, Blithbury North cutting satellite compound, material stockpiles and the movement of vehicles along site haul routes.

The construction of the Proposed Scheme will result in a series of components that will be partially visible, mostly screened by vegetation and landform.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Residences and footpaths to west and south west of Colton

(VPs 005-02-017, 005-02-018, 005-02-019 and 006-02-034)

Residents will have mid-range views of the construction of the power line between the Newlands Lane auto-transformer feeder station and the Rugeley substation and the movement of construction vehicles along access routes.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views east from individual residences south of Colton

(VPs 005.02.006 and 005.02.009)

Residents will have mid-range views of the construction of the Blithbury Central cutting, Colton Footpath 73 overbridge, Blithbury Road overbridge and the realignment of Blithbury Road. It is also likely that there will be views of the tops of the construction works of the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation and material stockpiles. The movement of construction vehicles and planting of woodland and hedgerows will be visible along with the modification works to Hollow Lane and Blithbury Road.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 005.02.009 during peak construction phase is illustrated on the photomontage shown in Figure LV-01-578 (Volume 5: Appendix LV-001-001).

Views from Hill Top Farm

(VP 006.02.034)

Residents will have close-range views of the construction of the cable sealing end compound within the power line between the Newlands Lane auto-transformer feeder station and the Rugeley substation and views of the construction of three lines of wooden poles within the mid-ground.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Colton Footpaths 31 and 29 to east of Colton

(VPs 006.03.003 and 006.03.017)

Users of footpaths will have mid-range views of the construction of Blithbury North cutting, Stockwell Heath embankment, realignment of Newlands Lane, Newlands Lane overbridge and the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation. The Blithbury Crossovers satellite compound, material stockpiles and the movement of construction vehicles will also be visible.

The construction of the Proposed Scheme will be visible as a series of components that cross the view, partially obstructed by vegetation and landform.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Colton and Stockwell Heath

(VPs 006.02.014, 006.02.015 and 006.03.032)

Residents and users of footpaths will have mid-range views of the construction of Stockwell Heath embankment, Newlands Lane underbridge, balancing ponds and the diversion of Moor Lane. Materials stockpiles and the movement of vehicles along the site haul routes will also be visible.

Some elements will be obscured by woodland, hedgerows and trees within the mid to foreground and by field boundary vegetation, particularly within the summer months. The construction of the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation will be visible in long distance views to the south-east.

The construction of the Proposed Scheme will result in change that will alter landform and be out of keeping with the rural and small scale character of the landscape within the view.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Hamley House Farm and Dringle Cottage

(VPs, 006.02.013, 006.02.021)

Residents will have close-range views of the construction of Stockwell Heath embankment, Newlands Lane underbridge, balancing ponds and the diversion of Moor Lane. Materials stockpiles and the movement of vehicles along the Site haul routes will also be visible. The construction of the embankment will eventually form a new landform on the horizon as the height of the embankment increases, it will become a dominant feature within the view.

Some elements will be partially obscured by woodland, hedgerows and trees within the mid to foreground and by field boundary vegetation, particularly within the summer months.

The construction of the Proposed Scheme will result in change that will be continuously visible and which will alter landform and be out of character with the small scale and rural nature of the view.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views south-west from Colton Footpath 41 and residence to the north of Stockwell Heath

(VPs 006.02.011 and 06.03.012)

Residents and users of the footpath will have mid to long-range elevated views of the construction of Stockwell Heath embankment, Stockwell Heath cutting and Newlands Lane underbridge. Some lower elements will be partially obscured by the landform, wooded hedgerows in the foreground and woodland and roadside trees in the mid-ground, particularly within the summer months.

The Proposed Scheme will appear as a series of components partially obstructed by vegetation and landform. The Proposed Scheme will be less visible within the view when the route is in cutting.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Residences and road receptors in Admaston

(VPs 006.02.027, 006.04.002)

Residents will have close to mid-range views of the realignment of the B5013 Uttoxeter Road and mid to long range views of the construction of the B5013 Uttoxeter Road underbridge, Stockwell Heath cutting, Moreton South embankment and the balancing pond and associated access road. There will also be views of the Stockwell Heath satellite compound and material stockpiles. These new features in the view will result in notable change to the mid-ground of the view.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from residences in Hamley Heath

(VP 006.02.025)

Residents will have close range views of the construction of Stockwell Heath embankment, Stockwell Heath cutting, the realignment of B5013 Uttoxeter Road and the B5013 Uttoxeter Road underbridge. Large areas of material stockpiles will be visible in the fore-mid ground of the view.

Views of these features will be partially filtered by field boundary and roadside hedgerows within the mid-ground.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views from Oakfields Farm and Rectory Farm

(VPs 007.02.001 and 07.02.004)

Residents will have mid to long range elevated views of the construction of the Moreton Brook viaduct, Moreton South embankment and Moreton North embankment (in the Colwich to Yarlet area (CA2)). The presence of the Moreton Brook viaduct satellite compound will also be visible. Views will be filtered by intervening field boundary and roadside hedgerows, woodland and by undulating landform. However, views from upper floors of the property will be likely to extend further and will have a higher degree of visual change.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views north-east from footpaths to the west of Hamley Heath

(VPs 007.03.007 and 007.03.008)

Users of footpaths will have mid-range views of the construction of Moreton Brook viaduct, Moreton South embankment and Moreton North embankment (in the Colwich to Yarlet area (CA2)). Views will be partially filtered by intervening field boundary hedgerows, hedgerow trees and pond side trees in the foreground and mid-ground.

Construction of the Proposed Scheme will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Other mitigation measures

- 11.4.13 To further reduce the significant effects described above, consideration will be given during the detailed design stage to where planting can be established early in the construction programme, including early planting in ecological mitigation sites, which will have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors. Therefore, no other mitigation measures are considered practicable during construction.

Summary of likely residual significant effects

- 11.4.14 The temporary residual significant effects during construction remain as described above. These effects will be temporary and reversible in nature lasting only for the duration of the construction works. These residual effects will generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed from surrounding residents, and users of PRow and main roads within the study area.
- 11.4.15 The significant effects that will remain after implementation of construction phase mitigation are summarised below:
- major adverse significant effects in relation to three LCAs;
 - moderate adverse significant effects in relation to one LCA;
 - major adverse significant visual effects at eight residential viewpoint locations;
 - major adverse significant visual effects at five recreational viewpoint locations; and
 - moderate adverse significant visual effects at 17 residential viewpoint locations;
 - moderate adverse significant visual effects at 13 recreational viewpoint locations;
 - moderate adverse significant visual effects at one hotel viewpoint location; and
 - moderate adverse significant visual effects at one transport viewpoint location.

Cumulative effects

HS2 Phase One

- 11.4.16 The cumulative effects on landscape and visual receptors during construction of the Proposed Scheme and HS2 Phase One are detailed below.

Landscape cumulative effects

- 11.4.17 As reported in SES and AP2 ES (Volume 2 CFA22: Whittington to Handsacre)¹⁶⁵ the construction of HS2 Phase One will introduce change in the Settled Heathlands LCA as a result of the removal of vegetation, loss of agricultural land and the construction of large-scale earthworks and viaducts over the Trent and Mersey Canal, which will be out of character with the rural nature of the landscape. By virtue of these alterations to the landform character and severance of vegetation patterns this will result in a high magnitude of change and a major adverse effect, which is significant.

¹⁶⁵ HS2 Ltd., (2013), High Speed Rail (London-West Midlands) Volume 5, Technical Appendices, CFA22, Whittington to Handsacre, Landscape report (LV-001-022), Landscape and visual assessment. Available online at: <http://webarchive.nationalarchives.gov.uk/20140810181201/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/landscape/LV-001-022.pdf>

- 11.4.18 The construction of the Proposed Scheme will result in a medium magnitude of change and a moderate adverse effect upon the Settled Heathlands LCA, which is significant.
- 11.4.19 The combination of HS2 Phase One and the Proposed Scheme at construction will therefore result in a major adverse cumulative effect on the Settled Heathlands LCA, which is significant.

Visual cumulative effects

Viewpoint 360.3.001

- 11.4.20 The construction of the Manchester Spur of HS2 Phase One will result in a moderate adverse effect¹⁶⁶ on visual receptors at viewpoint 360.3.001, north east from the Trent and Mersey canal, close to Wood End Lock cottage (a viewpoint assessed in the HS2 Phase One assessment), which is significant (see HS2 Phase One SES and AP2 ES).
- 11.4.21 Footpath users will have mid-range views of the construction of the Proposed Scheme including the connection to HS2 Phase One (Manchester Spur), Pyford South embankment, Pyford Brook viaduct and Pyford North embankment that will result in a moderate adverse effect, which is significant.
- 11.4.22 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a moderate adverse cumulative effect at viewpoint 360.3.001, which is significant.

Viewpoint 361.2.002

- 11.4.23 The construction of HS2 Phase One will result in a major adverse visual effect¹⁶⁵ on visual receptors at viewpoint 361.2.002, view south-west from Cranberry residence near Fradley Junction (a viewpoint assessed in the HS2 Phase One assessment).
- 11.4.24 Footpath users will have close range views of the construction of the Proposed Scheme including the connection to HS2 Phase One (Manchester Spur), Pyford South embankment, Pyford Brook viaduct and Pyford North embankment resulting in major adverse effects.
- 11.4.25 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a major adverse cumulative effect at viewpoint 361.2.002, which is significant.

Viewpoint 359.2.003

- 11.4.26 The construction of Phase One will result in non-significant effects¹⁶⁷ on visual receptors at viewpoint 359.2.003 view south-west from Sandy Hill Farm near Hay End Lane (a viewpoint assessed in the HS2 Phase One assessment).
- 11.4.27 Footpath users will also have mid-range views of the construction of the Pyford South embankment, Pyford Brook viaduct and Pyford North embankment, though

¹⁶⁶ HS2 Ltd., (2013), High Speed Rail (London-West Midlands) Volume 5, Technical Appendices, CFA22, Whittington to Handsacre, Landscape report (LV-001-022), Landscape and visual assessment. Available online at: <http://webarchive.nationalarchives.gov.uk/20140810181201/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/landscape/LV-001-022.pdf>

¹⁶⁷ Ibid.

predominantly screened by intervening woodland. However, cranes will be perceptible above woodland canopy resulting in moderate adverse effects.

- 11.4.28 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a moderate adverse cumulative effect at viewpoint 359.2.003, which is significant.

Viewpoint 365.2.003

- 11.4.29 The construction of Phase One will result in non-significant visual effects on visual receptors at viewpoint 365.2.003 (a viewpoint assessed in the HS2 Phase One assessment). There will be visual effects during operation of Phase One that will remain at year 15.
- 11.4.30 Residents at this location (Rileyhill, Rose Cottage and Pool Cottage), will have close to mid-range views of the construction of the Proposed Scheme including the Pyford North embankment and the Kings Bromley viaduct, that will result in major adverse effects.
- 11.4.31 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a major adverse cumulative effect, which is significant.

Viewpoint 363.2.001

- 11.4.32 The construction of Phase One will result in a moderate adverse visual effect on visual receptors at viewpoint 363.2.001.
- 11.4.33 Residents at this location will have mid-range views of the construction of the Proposed Scheme including the Pyford Brook viaduct and Pyford North embankment that will result in moderate adverse effects.
- 11.4.34 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a major adverse cumulative effect, which is significant.

Viewpoint 001.03.014

- 11.4.35 Construction of the Proposed Scheme will result in moderate adverse visual effects at viewpoint 001.03.014 due to mid-ground views of construction works.
- 11.4.36 Footpath users will also have views of the construction of the Manchester Spur within HS2 Phase One and the connection to the Proposed Scheme, resulting in moderate adverse effects.
- 11.4.37 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a moderate adverse cumulative effect, which is significant.

Viewpoint 001.3.007

- 11.4.38 The construction of the Proposed Scheme will result in minor adverse visual effects at viewpoint 001.3.007, which will be non-significant.
- 11.4.39 Users of the footpath will also have partially screened views of HS2 Phase One, in particular the construction of Handsacre Link, including the Wood End Lane overbridge, the Curborough Brook viaduct and adjoining embankment in the mid-ground of the view, resulting in moderate adverse effects.

- 11.4.40 The combination of HS2 Phase One and the Proposed Scheme during construction will result in a moderate adverse cumulative effect, which is significant.

Other committed developments

- 11.4.41 No additional significant cumulative temporary or permanent effects during construction are anticipated.

11.5 Permanent effects arising from operation

- 11.5.1 The permanent features of the Proposed Scheme that have been taken into account in determining the effects arising during operation on landscape and visual receptors are presented in Section 2.2 of this report. Permanent changes within the landscape and views caused by the construction are assessed in this section.

Avoidance and mitigation measures

- 11.5.2 The operational assessment of impacts and effects is based on year 1 (2027), year 15 (2042) and year 60 (2087) of the Proposed Scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the operation of the Proposed Scheme. Measures that will be incorporated into the design of the Proposed Scheme include:

- design of earthworks to tie the engineering earthworks for embankments (such as Bourne and Stockwell Heath embankments) and cuttings into their wider landscape context and to mitigate views of structures and overhead line equipment from sensitive receptors, where reasonably practicable. Earthworks design also takes account of the relationship to surrounding land uses and management, such as agriculture;
- compensatory woodland planting in areas of loss, using the same species composition and planting types, such as woodland planting to compensate for the partial loss of Tomlinson's Spinney woodland, and to provide habitat connectivity, enhanced landscape/green infrastructure connectivity, as well connectivity of historic landscape features, where reasonably practicable, and to soften embankments and viaduct abutments;
- hedgerow replacement and restoration in areas of loss to restore connectivity and landscape pattern, where reasonably practicable, and to tie the Proposed Scheme mitigation into the wider landscape character; and
- compensation for loss of field ponds with new wetlands, ecological ponds and biodiversity wetland features and wetland enhancement at Pyford Brook and Moreton Brook.

Assessment of impacts and effects

- 11.5.3 The likely effects on landscape and visual receptors during operation of the Proposed Scheme relate to the presence of new structures and elements in the landscape including the Pyford Brook, Kings Bromley, River Trent and Moreton Brook viaducts, the presence of earthworks and the power line between the Newlands Lane auto-transformer feeder station and the grid supply point at Rugeley substation. Other aspects include the presence of overhead line equipment and noise fence barriers.

Landscape assessment

- 11.5.4 The following four LCAs will be significantly affected during operation, see Table 23. Full details of effects are described in Volume 5: Appendix LV-001-001 Part 2.

Table 23: Operational phase significant landscape effects

Fradley Settled Heathlands	Medium susceptibility and medium sensitivity.
<p>Year 1:</p> <p>At year 1 of operation the presence of the Pyford South embankment, Pyford Brook viaduct and Pyford North embankment will form locally substantial alterations to the rural and gently undulating nature of the landscape and will cause severance of field patterns. The Proposed Scheme will also reduce the tranquillity of the landscape and cause localised intrusion on the wooded skyline, though only a minimal area of the LCA will be directly affected.</p> <p>Operation of the Proposed Scheme in year 1 will result in a medium magnitude of change and moderate adverse effect on the LCA, which is significant.</p> <p>Year 15:</p> <p>By summer of year 15, due to the establishment of landscape planting, the above landscape effects will be slightly reduced although there will remain severance created by the Proposed Scheme.</p> <p>Operation of the Proposed Scheme in year 15 will remain a medium magnitude of change and moderate adverse effect on the LCA, which is significant.</p> <p>Year 60:</p> <p>By year 60 the Proposed Scheme will remain prominent locally, though the further maturing of the mitigation planting will help to integrate it into the landscape.</p> <p>Operation of the Proposed Scheme in year 60 will reduce to non-significant, as reported in Volume 5: Appendix LV-001-001</p>	
Kings Bromley Terrace Alluvial Lowlands	Medium susceptibility and medium sensitivity.
<p>Year 1:</p> <p>At year 1 of operation the presence of the Pyford North embankment, Kings Bromley viaduct, Bourne embankment, and the southern section of the River Trent viaduct, with associated overhead line equipment and noise fence barriers, and road realignments, will substantially alter the flat and open nature of the rural landscape.</p> <p>Operation of the Proposed Scheme in year 1 will result in a high magnitude of change and major adverse effect on the LCA, which is significant.</p> <p>Year 15:</p> <p>By year 15 mitigation planting will provide some landscape integration though the Kings Bromley viaduct will remain prominent.</p> <p>Operation of the Proposed Scheme in year 15 will reduce to a medium magnitude of change and moderate adverse effect on the LCA, which is significant.</p> <p>Year 60:</p> <p>By year 60 the Proposed Scheme will remain prominent locally, though the further maturing of the mitigation planting will help to integrate it into its landscape context.</p> <p>Operation of the Proposed Scheme in year 60 will reduce to non-significant, as reported in Volume 5: Appendix LV-001-001</p>	
Trent Riparian Alluvial Lowlands	Medium- high susceptibility and medium sensitivity.
<p>Year 1:</p> <p>In year 1 of operation, the presence of River Trent viaduct and Pipe Ridware embankment will substantially alter the character of the lowland valley landscape. The presence of the River Trent viaduct will introduce an uncharacteristic large scale infrastructure element that will be out of scale with the landscape with few detracting elements and due to the height of the viaduct it will become a principal feature on the skyline.</p> <p>Operation of the Proposed Scheme in year 1 will result in a high magnitude of change and major adverse effect on the LCA, which is significant.</p> <p>Year 15:</p> <p>By summer of year 15, due to the establishment of landscape planting, the above landscape effects will be slightly reduced although the magnitude of change will remain high due to the presence of the River Trent viaduct within the lowland valley.</p>	

Operation of the Proposed Scheme in year 15 will remain a **high magnitude of change and major adverse effect** on the LCA, which is significant.

Year 60:

By Year 60 the Proposed Scheme will remain prominent though the further maturing of the mitigation planting will help to integrate it into the landscape.

Operation of the Proposed Scheme in year 60 will remain a **high magnitude of change and major adverse effect** on the LCA, which is significant.

Colton and Stockwell Heath Settled Farmlands	Medium- high susceptibility and high sensitivity
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Year 1:

The Pipe Ridware embankment, Blithbury cuttings (South, Central and North), Stockwell Heath embankment and the Stockwell Heath cutting will alter the character of the landscape locally, reducing scenic quality and introducing localised intrusion upon a landscape with high levels of tranquillity. Historic field patterns and their hedgerows will be lost, while settlements such as Colton and Stockwell Heath will be severed. The power line between the Newlands Lane auto-transformer feeder station and Rugeley substation will increase the extent of adverse effect upon the landscape beyond the route.

Operation of the Proposed Scheme in year 1 will result in a **high magnitude of change and major adverse effect** on the LCA, which is significant.

Year 15:

The increased screening effect and maturing of the mitigation planting will result in the effects on the landscape reducing, though the presence of the viaducts, embankments and associated severance will remain.

Operation of the Proposed Scheme in year 15 will remain a **high magnitude of change and major adverse effect** on the LCA, which is significant.

Year 60:

The Proposed Scheme will remain prominent though the further maturing of the mitigation planting will help to integrate it into the landscape.

Operation of the Proposed Scheme in year 60 will remain a **high magnitude of change and major adverse effect** on the LCA, which is significant.

Visual assessment

Introduction

- 11.5.5 The following section describes the likely significant effects on visual receptors during operation year 1, year 15 and year 60. The assessment has been undertaken for the winter period, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of the operational Proposed Scheme may be reduced during summer when vegetation, if present in a view, will be in leaf. Likely significant effects on residential receptors from additional lighting at night-time are also identified. Non-significantly affected visual receptors are reported in Volume 5: Appendix LV-001-001.
- 11.5.6 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity will be lower than those reported.
- 11.5.7 The assessment has not identified any locations within this study area where additional lighting in operation of the Proposed Scheme will result in significant visual effects at night.
- 11.5.8 The assessment has identified locations where the operation of the Proposed Scheme will result in significant effects (summarised in Table 24 and described in detail in Volume 5: Appendix LV-001-001 Part 3).

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Table 24: Operation phase significant visual effects

Views north east from the Trent and Mersey Canal at Woodend Lock (VP 001.03.014)

Year 1 - winter and summer:

Users of the canal towpath at Woodend Lock will have mid-range views of the Pyford South embankment, Pyford North embankment and Pyford Brook viaduct, seen through canalside vegetation.

In summer, views will be screened by canalside vegetation in the foreground and field boundary vegetation in the mid ground. However, there will be glimpsed views in the direction of the Proposed Scheme and views from the elevated bridge at Woodend Lock will extend further.

The operation of the Proposed Scheme will result in a noticeable change within the mid-ground of the view that will be filtered by intervening vegetation.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant for year 15 and remain so for year 60 due to the growth of the scrub, woodland and hedgerow mitigation planting along the Pyford North embankment and Pyford South embankment, which will help integrate the Proposed Scheme into its landscape setting, as reported in Volume 5: Appendix LV-001-001.

Views west from Alrewas Hayes Hotel (VP 001.05.011)

Year 1 - winter and summer:

Hotel receptors will have mid to long range views of the Pyford Brook viaduct, Pyford North embankment, and the overhead line equipment and passing trains. Whilst the lower parts of these features will be screened by field boundary vegetation and woodland within the mid-ground and background, the upper parts of the Proposed Scheme such as the overhead line equipment and the Pyford Brook viaduct and noise fence barriers will be apparent on the skyline.

The operation of the Proposed Scheme will result in a noticeable alteration of the view that is uncharacteristic of the view within the mid-ground and background that will be partially filtered by intervening vegetation.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 001.05.011 during operation Year 1 is illustrated on the photomontage shown in Figure LV-01-502 (Volume 5: Appendix LV-001-001).

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the scrub and woodland mitigation planting along the Pyford North embankment, as reported in Volume 5: Appendix LV-001-001.

Views west from Kings Bromley Footpath 13 (VP 002.03.001)

Year 1 - winter and summer:

User of the footpath will have mid to long range views of the Pyford Brook viaduct, Pyford North embankment, the overhead line equipment, noise fence barriers and passing trains. Whilst the lower parts of these features will be screened by field boundary vegetation and woodland within the mid-ground and background of the view, the upper parts of the Proposed Scheme such as the overhead line equipment and the Pyford North viaduct will be apparent on the skyline.

The operation of the Proposed Scheme will result in a noticeable alteration that is uncharacteristic of the view within the mid-ground and background that will be partially filtered by intervening vegetation.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60, due to the growth of the scrub and woodland mitigation planting along Pyford North embankment and, as reported in Volume 5: Appendix LV-001-001.

Residential receptors from The Old Farmhouse and Woodgate Farm Cottage

(VP 002.02.002)

Year 1 - winter and summer:

Residents will have mid to long range views of the Pyford North embankment, Kings Bromley viaduct, overhead line equipment, noise fence barriers and passing trains. Whilst the lower parts of these features will be screened by field boundary vegetation and woodland within the mid-ground and background, the upper parts and particularly the viaduct will be apparent on the skyline.

The operation of the Proposed Scheme will result in a noticeable alteration that is uncharacteristic of the view within the mid-ground and background of the view that will be partially filtered by intervening vegetation.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 002.02.002 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-503 (Volume 5: Appendix LV-001-001).

Year 15:

The Proposed Scheme will become less apparent in the view in year 15, due to mitigation planting along the Pyford North embankment maturing and filtering views of the Proposed Scheme and integrating the embankment within its landscape context. The Proposed Scheme, however, will still be visible and uncharacteristic of the view.

Operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 002.02.002 during operation year 15 is illustrated on the photomontage shown in Figure LV-01-624 (Volume 5: Appendix LV-001-001).

Year 60:

The Proposed Scheme will become more integrated into the view due to the continuing growth of the scrub and woodland mitigation planting along the Pyford North embankment to maturity and the growth of existing vegetation within view.

However, due to the scale of the Kings Bromley viaduct and Pyford North embankment, the operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View east from Kings Bromley Footpath 0.390

(VP 002.03.010)

Year 1 - winter and summer:

Users of the footpath will experience mid-range views of the Kings Bromley viaduct and Pyford North embankment, overhead line equipment, noise fence barriers and the passing of trains. The operation of the Proposed Scheme will result in the addition of a prominent new feature that will be continuously visible across much of the view and will change the wooded skyline character. Lower elements, such as the realigned A515 Lichfield Road will be partially filtered by field boundary vegetation. Operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

As mitigation planting along the Pyford North embankment and north of the A515 Lichfield Road matures it will help to both filter views and to integrate the Pyford North embankment into its landscape context. However, the Proposed Scheme, in particular the Kings Bromley viaduct, will still be prominent within the view. Operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

The Proposed Scheme will become more integrated into the view due to the continuing growth of the woodland planting to maturity and the growth of existing vegetation within view.

However, due to the scale of the Kings Bromley viaduct and Pyford North embankment within the view the operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View from residences on Shaw Lane

(VPs 002.02.005)

Year 1 - winter and summer:

Residents will have close range views of the Pyford North embankment, Kings Bromley viaduct and Bourne embankment. Also visible will be associated features such as the Bourne Brook auto-transformer station, the A515 Lichfield Road realignment, overhead line equipment, noise fence barriers and the passing trains. Whilst the lower parts of these features will be screened by field boundary vegetation and woodland within the mid-ground and background of the view, the upper parts of the Pyford North embankment, Kings Bromley viaduct and Bourne embankment, including views of overhead line equipment, will be apparent across the view on the skyline.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of scrub and woodland mitigation planting along the Pyford North embankment and Bourne embankment, as reported in Volume 5: Appendix LV-001-001.

View north from the Trent and Mersey canal

(VPs, 002.03.011)

Year 1 - winter and summer:

Users of the footpath will have mid to long range views of the Pyford North embankment, Kings Bromley viaduct and Bourne embankment, these views will be partially filtered by vegetation within the foreground.

Operation of the Proposed Scheme in year 1 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of scrub and woodland mitigation planting along the Pyford North embankment, as reported in Volume 5: Appendix LV-001-001.

Views south west from residences on A515 Lichfield Road

(VP 002.02.014)

Year 1 - winter and summer:

Residents will have mid to long range views of the Kings Bromley viaduct, with associated overhead line equipment and noise fence barriers, though this view will be partially screened by garden vegetation in the foreground and hedgerow boundaries and waterside vegetation within the mid-ground.

The operation of the Proposed Scheme will result in a noticeable change that will be visible across much of the view.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 002.02.014 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-505 (Volume 5: Appendix LV-001-001).

Year 15 – summer:

As the scrub and woodland mitigation planting along the A515 Lichfield Road and existing hedgerows and trees mature it will help to both filter views and integrate the Kings Bromley viaduct within its landscape context.

However, the Kings Bromley viaduct will still be prominent within the view. The operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the scale of the Kings Bromley viaduct within the view, the operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from residence and Kings Bromley Footpath 1 to the east of Handsacre

(VPs 003.02.010 and 003.03.002)

Year 1 - winter and summer:

Residents and users of the footpath will have mid-range views of the River Trent viaduct, which will form a large new feature that will span the view. The River Trent viaduct, along with overhead line equipment and passing of trains, will define the horizon, though partially obscured by woodland and field boundary vegetation particularly in the summer months.

The operation of the Proposed Scheme will result in a noticeable alteration that is uncharacteristic of the view.

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Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 – summer:

As existing hedgerows and trees mature it will help to filter views of the River Trent viaduct, however it will still remain prominent.

Operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the scale of the River Trent viaduct within the view, the operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Bromley Lane Farm

(VP 003.02.009)

Year 1 - winter and summer:

Residents will have close-range views of the River Trent viaduct that will form a large and prominent new feature, particularly within views from first floor windows of Bromley House Farm. From ground level, lower elements of the viaduct will be screened by intervening garden and field boundary vegetation.

The operation of the Proposed Scheme will result in the addition of a new feature that will be continuously visible.

Operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15 – summer:

The River Trent viaduct will remain a large and prominent feature in the view.

Operation of the Proposed Scheme in year 15 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Year 60:

Due to the scale of the River Trent viaduct within the view, the operation of the Proposed Scheme in year 60 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Views from Hamstell Ridware Footpath 3

(VP 003.03.012)

Year 1 - winter and summer:

Users of the footpath will have open mid-range views of the River Trent viaduct and the overhead line equipment, noise fence barriers and the passing of trains. The operation of the Proposed Scheme will result in a new feature that will cross horizontally across the mid ground the view, forming a new horizon of the view to the west and will screen long distance views to the Cannock Chase Area of Outstanding Natural Beauty (AONB). The foreground of the view will be formed by the recently restored borrow pit at Blithbury (located to the north of the River Trent viaduct).

The operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 003.03.012 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-510 (Volume 5: Appendix LV-001-001).

Year 15 – summer:

The River Trent viaduct will remain prominent on the skyline, though the maturing of the restored borrow pit landscape in the foreground and mid-ground will help the Proposed Scheme to become more integrated in to the view.

The operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the scale of the River Trent viaduct within the view, the operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from residences in Nethertown

(VPs 003.02.011, 003.02.013)

Year 1 - winter and summer:

Residents will have mid-long range views of the River Trent viaduct that will form a large and prominent new feature in the open lowland valley.

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The operation of the Proposed Scheme will result in the addition of new features such as overhead power lines and noise fence barriers on top of the viaduct that will be visible on the skyline of the view, though some lower elements will be screened by landform and field boundary vegetation.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 – summer:

The River Trent viaduct will become more integrated in to the view as the mitigation planting matures and helps to both filter views and integrate the new features within their landscape context. However, the River Trent viaduct will remain prominent on the skyline within views from residences within the elevated settlement of Nethertown.

The operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the scale of the River Trent viaduct within the view, operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views east from Pipe Ridware

(VPs 003.02.018, 003.03.024)

Year 1 - winter and summer:

Residents and users of the footpath will have close to mid-range views of the northern end of the River Trent viaduct and the adjoining Pipe Ridware embankment with associated overhead line equipment and noise fence barriers.

The operation of the Proposed Scheme will introduce uncharacteristic features that will be visible across much of the landscape.

Operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

As the scrub and woodland mitigation planting along the Pipe Ridware embankment matures it will help to both filter views and integrate the River Trent viaduct and the adjoining Pipe Ridware embankment within the landscape context.

However, due to the scale and proximity of the River Trent viaduct and Pipe Ridware embankment, the features will remain prominent. The operation of the Proposed Scheme in year 15 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Year 60:

Due to the scale of the River Trent viaduct and Pipe Ridware embankment within the view, the operation of the Proposed Scheme in year 60 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Views east from School Lane, Pipe Ridware

(VP 003.02.019)

Year 1 - winter and summer:

Residents will have mid-range views of the northern end of the River Trent viaduct and the adjoining Pipe Ridware embankment with associated overhead line equipment and noise fence barriers.

The operation of the Proposed Scheme will introduce uncharacteristic features that will be visible within the mid-ground, forming a new skyline of the view, partially screened by garden vegetation in the foreground and mature field and roadside trees in the mid-ground.

Operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

In summer effects will reduce due to denser summer vegetation resulting in a **medium magnitude of change and a moderate adverse effect**, which is significant.

Year 15:

The Pipe Ridware embankment will become more integrated in to the view due to the growth of existing intervening vegetation and as the scrub and woodland mitigation planting on the embankment matures it will help to both filter views and integrate the new features within their landscape context.

However, the River Trent viaduct and Pipe Ridware embankment will remain visible due to their scale and proximity. The operation of the Proposed Scheme in year 15 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

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Mature scrub and woodland mitigation planting on the Pipe Ridware embankment will help to mitigate the Proposed Scheme into the view, but the scale of the River Trent viaduct and Pipe Ridware embankment will still dominate the view.

The operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views south west from Hamstall Ridware Footpath 8

(VP 003.03.017)

Year 1 - winter and summer:

Users of the footpath will have mid to long-range elevated views of the Pipe Lane diversion, the River Trent viaduct, the Pipe Ridware embankment and associated overhead line equipment and noise fence barriers.

The operation of the Proposed Scheme will result in the River Trent viaduct and Pipe Ridware embankment being visible on the valley floor, partially obstructed by vegetation within the mid-ground of the view.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of scrub and woodland mitigation planting along the Pipe Ridware embankment, as reported in Volume 5: Appendix LV-001-001.

Views from Mavesyn Ridware Footpath 34

(VP 004.03.005)

Year 1 - winter and summer:

Users of the footpath will have elevated mid-range views of Pipe Ridware embankment and Blithbury South cutting, with associated overhead line equipment and noise fence barriers, and the Mavesyn Ridware Footpath 38 accommodation overbridge and the Pipe Wood Lane diversion.

The operation of the Proposed Scheme will result in a noticeable alteration that is uncharacteristic of the view within the mid-ground of the view.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 004.03.005 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-511 (Volume 5: Appendix LV-001-001).

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the scrub and woodland mitigation planting along the Pipe Ridware embankment, as reported in Volume 5: Appendix LV-001-001.

Residences within Quinton's Orchard

(VP 004.02.006)

Year 1 - winter and summer:

Residents will have close to mid-range views of Pipe Ridware embankment and Blithbury South cutting, with associated overhead line equipment and noise fence barriers, and Mavesyn Ridware Footpath 38 accommodation overbridge.

The operation of the Proposed Scheme will result in a substantial change in proximity to the visual receptors.

The operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15 – summer:

The Proposed Scheme will still appear to be prominent, though as the scrub and woodland mitigation planting along the Pipe Ridware embankment and Blithbury South cutting matures it will help to both filter views and integrate the Pipe Ridware embankment and Blithbury South cutting within their landscape context.

The operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Effects will reduce to non-significant in year 60 due to the growth of the scrub and woodland mitigation planting along the Pipe Ridware embankment, as reported in Volume 5: Appendix LV-001-001.

Views from the Mavesyn Ridware Footpath 8 to south of Blithbury

(VPs 004.03.014 and 004.03.015)

Year 1 - winter and summer:

Users of footpaths will have close to mid-range views of Pipe Ridware embankment and Blithbury South cutting, with associated overhead line equipment and noise fence barriers, and Mavesyn Ridware Footpath 38 accommodation overbridge.

The operation of the Proposed Scheme will result in a substantial change in proximity to the visual receptors.

The operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15 – summer:

Views will become more filtered by the maturing woodland habitat creation and the scrub and woodland that will help integrate Pipe Ridware embankment and Blithbury South cutting within their landscape context.

The operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

The Proposed Scheme will appear more integrated due to the continuing growth of the scrub and woodland mitigation and hedgerow planting along the Blithbury South cutting to maturity and the growth of existing vegetation within the view.

The operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Colton Footpath 34 to the west of Newlands Lane

(VP 006.03.006)

Year 1 - winter and summer:

Users of the footpath will have mid-range views of the Newlands Lane realignment, Newlands Lane overbridge, Blithbury North cutting and overhead line equipment and long-range views of Newlands Lane auto-transformer feeder station. The operation of the Proposed Scheme will result in a series of components that will be partially visible, mostly screened by vegetation and landform.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the scrub and woodland mitigation planting surrounding the Newlands Lane auto-transformer feeder station, and hedgerow, scrub and woodland mitigation planting along the Blithbury north cutting, as reported in Volume 5: Appendix LV-001-001.

View from Old Wood Farm

(VP 005.02.017)

Year 1- winter and summer:

Residents will have mid-range views of the power line between the Newlands Lane auto-transformer feeder station and the Rugeley substation, three lines of wooden poles will be visible crossing through pasture fields within the mid-ground and there will be views of the cable sealing end compound.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the hedgerows, scrub and woodland mitigation planting in proximity to the cable sealing end compound and existing planting integrating the Proposed Scheme into its landscape setting, as reported in Volume 5: Appendix LV-001-001.

View from Old Wood Farm No.2

(VP 005.02.018)

Year 1:

Residents will have mid-range views of the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation, three line of wooden poles would be visible crossing through pasture fields within the mid-ground and there will be views of the cable sealing end compound.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15:

The wooden poles within the power line between the Newlands Lane auto-transformer feeder station and the Rugeley substation and the cable sealing end compound will remain visually prominent within the rural landscape.

The operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

The wooden poles within the power line between the Newlands Lane auto-transformer feeder station and the Rugeley substation and the cable sealing end compound will remain visible within the mid-ground of the view.

The operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from Hill Top Farm

(VP 006.02.034)

Year 1 – winter and summer:

Residents will have close-range views of the cable sealing end compound and views of the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation, including the three lines of wooden poles, within the mid-ground.

These new features will form detracting features within the rural view across the localised valley.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the woodland habitat creation, hedgerows, scrub and woodland mitigation planting to the south of Hollow Lane, as reported in Volume 5: Appendix LV-001-001.

Views east from individual residences south of Colton

(VPs 005.02.006, 005.02.009)

Year 1 - winter and summer:

Residents will have mid-range views of the Blithbury Central cutting, Blithbury Road overbridge, Blithbury Road realignment and Manor Farm overbridge. The upper elements of the overhead line equipment will be partially screened by the cutting and the Proposed Scheme will be intermittently visible due to vegetation within the view.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of scrub and woodland mitigation planting along the Blithbury Central cutting, as reported in Volume 5: Appendix LV-001-001.

Views from Colton Footpaths 31 and Colton 29 to east of Colton

(VPs 006.03.003, 006.03.017)

Year 1 - winter and summer:

Users of footpaths will have mid-range views of the Blithbury North cutting, Stockwell Heath embankment, Newlands Lane overbridge, Newlands Lane realignment, and the power line between the Newlands Lane auto-transformer feeder station and Rugeley substation. Overhead line equipment and noise fence barriers will be visible, particularly on the embankment.

The operation of the Proposed Scheme will be visible as a series of components that cross the view, partially obscured by existing vegetation and landform.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of scrub and woodland mitigation planting along the Blithbury North cutting, as reported in Volume 5: Appendix LV-001-001.

Views from Hamley House Farm and Dringle Cottage

(VPs 006.02.021 and 006.02.013)

Year 1 - winter and summer:

Residents will have mid to close range views of the Stockwell Heath embankment, with associated overhead line equipment and noise fence barriers, and Newlands Lane underbridge. Some elements will be partially obscured by garden and field boundary vegetation within the mid-foreground of the view, particularly within the summer months.

The operation of the Proposed Scheme in year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15 – summer:

Views will be partially screened due to the growth of existing intervening vegetation and the growth of proposed mitigation planting and hedgerows along the Stockwell Heath embankment. However the Proposed Scheme will still appear to be prominent.

The operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Effects will reduce to non-significant in year 60 due to the growth of reinstated hedgerows along Moor Lane and the scrub and woodland mitigation planting on the Stockwell Heath embankment, as reported in Volume 5: Appendix LV-001-001.

Views north-west from Colton Footpath 53

(VP 006.02.014)

Year 1 - winter and summer:

Residents will experience mid-ground views of the Stockwell Heath embankment, Moor Lane diversion, noise fence barriers and overhead line equipment. The operation of the Proposed Scheme will affect a small part of the view, however lower elements of the Stockwell Heath embankment will be screened due to intervening vegetation.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 – summer:

Views will be partially screened due to the growth of existing intervening vegetation and the growth of scrub and woodland mitigation planting on the Stockwell Heath embankment. However, the Proposed Scheme will still appear to be prominent. Operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Effects will reduce to non-significant at year 60 due to the growth of scrub and woodland mitigation planting on the Stockwell Heath embankment, as reported in Volume 5: Appendix LV-001-001.

Views north from the Staffordshire Way and residences on High Street, Colton

(VPs 006.02.015 and 006.03.032)

Year 1 - winter and summer:

Users of the footpath and residents will have mid to close range views of the Stockwell Heath embankment, with associated overhead line equipment and noise fence barriers, and Newlands Lane underbridge. Some elements will be partially obscured by garden and field boundary vegetation within the mid-foreground particularly within the summer months.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of the woodland habitat creation adjacent to Newlands Lane and the scrub and woodland mitigation planting along the Stockwell Heath embankment, as reported in Volume 5: Appendix LV-001-001.

Views south-west from Colton Footpath 41 and residence to the north of Stockwell Heath

(VPs 006.02.011 and 006.03.012)

Year 1 - winter and summer:

Residents and users of the footpath will have mid-range elevated views of the Stockwell Heath embankment and Stockwell Heath cutting, with associated overhead line equipment and noise fence barriers, and Newlands Lane underbridge. Some elements will be partially obscured by hedgerows and field boundary trees in the foreground and mid-ground particularly within the summer months and also by landform due to the elevated nature of the viewpoints.

The Proposed Scheme will appear as a series of components partially obscured by vegetation and landform. The Proposed Scheme will be less visible within the view when the route is in cutting.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of mitigation planting along the Stockwell Heath embankment and Stockwell Heath cutting, integrating the Proposed Scheme into its landscape setting, as reported in Volume 5: Appendix LV-001-001.

Residences and road receptors near Admaston

(VPs 006.02.027 and 006.04.002)

Year 1 - winter and summer:

Residents and road users will have mid-range views of the realigned B5013 Uttoxeter Road and mid to long range views of the B5013 Uttoxeter Road underbridge, Stockwell Heath cutting, Moreton South embankment and the tops of overhead line equipment. Roadside and field boundary wooded hedgerows and trees in the foreground and mid-ground and landform will provide some screening of views.

Operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant at year 15 and remain so for year 60 due to the growth of the scrub and woodland mitigation planting along the Stockwell Heath cutting and Moreton South embankment, as reported in Volume 5: Appendix LV-001-001.

Residences in Hamley Heath

(VP 006.02.025)

Year 1 - winter and summer:

Residents will have close range views of the Stockwell Heath embankment and Stockwell Heath cutting, with associated overhead line equipment and noise fence barriers, B5013 Uttoxeter Road underbridge and Moor Lane diversion.

Views of these features will be partially filtered by field boundary within the mid-ground.

These new features in the view will result in a **high magnitude of visual change and major adverse effect** on these sensitive receptors.

Year 15 – summer:

As the hedgerow mitigation planting along Moreton South embankment matures it will help to both filter views and integrate the Proposed Scheme in its landscape context, however due to the large scale and proximity of the Stockwell Heath embankment it will remain prominent within the view.

The operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the scale of the Stockwell Heath embankment within the view, operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Residence at Oakfields Farm and Rectory Farm

(VPs 007.02.001 and 007.02.004)

Year 1 - winter and summer:

Residents will have mid to long range elevated views of the Moreton Brook viaduct and Moreton South embankment, with associated overhead line equipment and noise fence barriers. Views will be partially filtered by intervening field boundary hedgerows and hedgerow trees and woodland in the mid-ground and by rolling topography.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Effects will reduce to non-significant in year 15 and remain so for year 60 due to the growth of woodland habitat creation and hedgerow mitigation planting along the Moreton South embankment, as reported in Volume 5: Appendix LV-001-001.

Views north-east from Colton Footpath 57

(VP 007.03.008)

Year 1 - winter and summer:

Users of the footpath will have mid-range views of the Moreton Brook viaduct, Moreton South embankment and Moreton North embankment, with associated overhead line equipment and noise fence barriers. Views will be partially filtered by intervening field vegetation and the rolling nature of the topography within the view.

The operation of the Proposed Scheme in year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 007.03.008 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-519 (Volume 5: Appendix LV-001-001).

Year 15:

As woodland habitat creation and hedgerow mitigation planting along the Moreton South embankment matures it will help to both filter views and integrate the new features within their landscape context. However, the Proposed Scheme, in particular the Moreton Brook viaduct, will remain prominent.

The operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 007.03.008 during operation year 15 is illustrated on the photomontage shown in Figure LV-01-634 (Volume 5: Appendix LV-001-001).

Year 60:

Due to the scale and proximity of the Moreton Brook viaduct, operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views north-east from Colton Footpath 19

(VP 007.03.007)

Year 1 - winter and summer:

Users of the footpath will have mid-range views of the Moreton Brook viaduct, Moreton South embankment and Moreton North embankment, with associated overhead line equipment and noise fence barriers. Views will be partially filtered by intervening field vegetation and the rolling nature of the topography within the view.

The operation of the Proposed Scheme will result in a **medium magnitude of visual change and a moderate adverse effect** on these sensitive receptors.

Year 15:

As the woodland habitat creation adjacent to the Moreton North embankment matures it will help to both filter views and integrate the Moreton Brook viaduct, Moreton South embankment and Moreton North embankment within their landscape context. However, the Proposed Scheme, in particular the Moreton Brook viaduct, will remain prominent.

The operation of the Proposed Scheme in year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Effects will reduce to non-significant at year 60 due to the growth of woodland habitat creation, as reported in Volume 5: Appendix LV-001-001.

Other mitigation measures

- 11.5.9 The permanent effects of the Proposed Scheme on landscape and visual receptors have been reduced through incorporation of the measures described in this section. Effects in year 1 of operation may be reduced by establishing planting early in the construction programme. This will provide additional screening and greater integration of the Proposed Scheme into the landscape. However, no other mitigation measures are considered practicable due to the high visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

- 11.5.10 In many cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following likely residual significant effects will remain following year 15 of operation:
- major adverse significant effects in relation to two LCAs;
 - moderate adverse significant effects in relation to two LCAs;
 - major adverse significant visual effects at two residential viewpoint locations;
 - major adverse significant visual effects at one recreational viewpoint location;
 - moderate adverse significant visual effects at 12 residential viewpoint locations; and
 - moderate adverse significant visual effects at seven recreational viewpoint locations.

Cumulative effects

HS2 Phase One and the Proposed Scheme

- 11.5.11 The cumulative effects on landscape and visual receptors during operation of the Proposed Scheme and HS2 Phase One are reported below.

Landscape cumulative effects

- 11.5.12 As reported in SES and AP2 ES (Volume 2 CFA22: Whittington to Handsacre)¹⁶⁸, Phase One in operation will introduce vertical and linear infrastructure features in the Settled Heathlands LCA, including embankments and viaducts that will be incongruous in the local rural landscape. This will result in moderate adverse effects on the landscape at year 1, which will be significant. Effects on the landscape at year 15 will remain moderate adverse, but will reduce to minor adverse at year 60, which is non-significant.
- 11.5.13 The Proposed Scheme will result in moderate adverse effects upon the Settled Heathlands LCA at year 1 of operation, which will be significant. Effects on the

¹⁶⁸ HS2 Ltd., (2015), *High Speed Rail (London-West Midlands) Supplementary Environmental Statement and Additional Provisions 2 Environmental Statement, Volume 2 CFA22*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442226/SES_and_AP2_ES_Volume_2_CFA22.pdf

landscape at year 15 will remain moderate adverse, but will reduce to minor adverse at year 60.

- 11.5.14 The combined effect of the Proposed Scheme and HS2 Phase One will cause further change in the severance of field patterns and localised increases in the levels of intrusion and will reduce the perceived tranquillity of the landscape. The cumulative effect of the Proposed Scheme and HS2 Phase One will, therefore, increase the level of effect from moderate adverse to a major adverse effect, which will be significant, on the character of the Settled Heathlands LCA in both winter and summer of year 1 of operation. Effects will remain major adverse at year 15 (summer) due to the scale and geographical extent of the effect of HS2 Phase One across the LCA, which will be significant. However, effects will decrease at year 60 to moderate adverse, which will be significant, due to mitigation planting maturing and providing some integration of both HS2 Phase One and the Proposed Scheme within their landscape setting.

Visual cumulative effects

Viewpoint 361.2.002

- 11.5.15 As reported in SES and AP2 ES (Volume 2 CFA22: Whittington to Handsacre), Phase One in operation will result in a major adverse visual effect on visual receptors at viewpoint 361.2.002, view south-west from Cranberry residence near Fradley Junction (a viewpoint assessed in the HS2 Phase One assessment). This will reduce to a moderate adverse effect at year 15 and minor adverse at year 60 due to the growth of mitigation planting, which is not significant.
- 11.5.16 Footpath users will have close range views of the operation of the Proposed Scheme at the HS2 Phase One (Manchester Spur), Pyford South embankment, Pyford Brook viaduct and Pyford North embankment that will result in major adverse effects that will remain at year 15 and year 60 due to the proximity and scale of the Proposed Scheme.
- 11.5.17 The cumulative effect of HS2 Phase One and the Proposed Scheme at viewpoint 361.2.002 will be major adverse at year 1 of operation, which is significant, and will remain at year 15 and year 60.

Viewpoint 001.3.007

- 11.5.18 Footpath users will have filtered mid-range views of the operation of the Handsacre Link within Hs2 Phase 1 including the diverted Wood End Lane and overbridge, the Curborough Brook viaduct and adjoining embankments that will result in a moderate adverse effect at Year 1 that would reduce to non-significant effect at year 15 due to the growth of proposed woodland planting to the west of the canal.
- 11.5.19 The Proposed Scheme will result in non-significant visual effects at viewpoint 001.3.007 due to highly filtered views by canal side vegetation, effects will remain non-significant at year 15.
- 11.5.20 In combination with HS2 Phase One the effects of the Proposed Scheme at viewpoint 001.3.007 will be moderate adverse during operation year 1, effects will reduce to non-significant at year 15 and remain non-significant at year 60.

Viewpoint 002.02.13

- 11.5.21 Residents will have views of the operation of Hs2 Phase One, including views of the Shaw Lane embankment and viaduct in the mid-ground, at Harvey's Rough flyover on the approach to the tie-in with the WCML. This will result in major adverse effects that will remain at Year 15 and Year 60.
- 11.5.22 The Proposed Scheme will result in non-significant visual effects at viewpoint 002.02.013 at year 1 that will remain at year 15 and year 60.
- 11.5.23 The cumulative effect of HS2 Phase One and the Proposed Scheme at viewpoint 001.3.007 will be major adverse during year 1 of operation, which is significant, and will remain at year 15 and year 60.

Viewpoint 365.2.003

- 11.5.24 HS2 Phase One in operation will result in a non-significant adverse visual effect on visual receptors at viewpoint 365.2.003 that will remain at year 15.
- 11.5.25 Residents at this location (Rileyhill, Rose Cottage and Pool Cottage), will have close to mid-range views of the operation of the Proposed Scheme including the Pyford North embankment and the Kings Bromley viaduct, that will result in major adverse effects at year 1, that will remain at year 15 and will reduce to moderate adverse at year 60 due to the growth of woodland and hedgerow planting.
- 11.5.26 The cumulative effect of HS2 Phase One and the Proposed Scheme at viewpoint 365.2.003 will result in major adverse effects at operation year 1, which is significant. Effects will remain at year 15 and will reduce to moderate adverse at Year 60 due to the growth of mitigation planting.

Viewpoint 363.2.001

- 11.5.27 HS2 Phase One in operation will result in a non-significant adverse visual effect on visual receptors at viewpoint 363.2.001 that will remain at year 15.
- 11.5.28 Residents at this location will have mid-range views of the operation of the Proposed Scheme including the Pyford Brook viaduct and Pyford North embankment that will result in moderate adverse effects, that will remain at year 15 and will reduce to non-significant at year 60 due to the growth of mitigation planting.
- 11.5.29 The cumulative effect of HS2 Phase One and the Proposed Scheme at viewpoint 363.2.001 will result in moderate adverse effects at operation year 1, which is significant. Effects will remain at year 15 and will reduce to non-significant at year 60 due to the growth of mitigation planting.

Other committed developments

- 11.5.30 No additional significant cumulative temporary or permanent effects during operation are anticipated.

Monitoring

- 11.5.31 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

- 11.5.32 There are no area-specific requirements for monitoring landscape and visual mitigation during the operation of the Proposed Scheme in the Fradley to Colton area.

12 Socio-economics

12.1 Introduction

- 12.1.1 This section reports on the environmental baseline, likely economic and employment impacts as well as significant effects during construction and operation of the Proposed Scheme within the Fradley to Colton area. The assessment considers existing businesses, community organisations, local employment and local economies, including planned growth and development.
- 12.1.2 Engagement with Lichfield District Council (LDC), Cannock Chase District Council (CCDC) and Staffordshire County Council (SCC) has been undertaken as part of the development of the Proposed Scheme. The purpose of the engagement was to increase the understanding of socio-economic characteristics identified through a review of publicly available data.
- 12.1.3 The socio-economic effects on employment at a route-wide level are reported in Volume 3, Route-wide effects (Section 12).
- 12.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 12.1.5 In addition, business and labour market data is presented in Background Information and Data (BID)¹⁶⁹, (BID-SE-001-000: Business and labour market data).

12.2 Scope, assumptions and limitations

- 12.2.1 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)¹⁷⁰.

12.3 Environmental baseline

Existing baseline

Study area description

- 12.3.1 The following provides a brief overview of employment, economic structure, labour market, and business premises availability within the Fradley to Colton area.
- 12.3.2 It lies within the administrative area of Lichfield and Cannock Districts within the County of Staffordshire. It also falls within the Stoke-on-Trent and Staffordshire Local Enterprise Partnership (LEP) area¹⁷¹ and the West Midlands region.

Business and labour market

- 12.3.3 Within the LDC area there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (17%), with construction the second largest

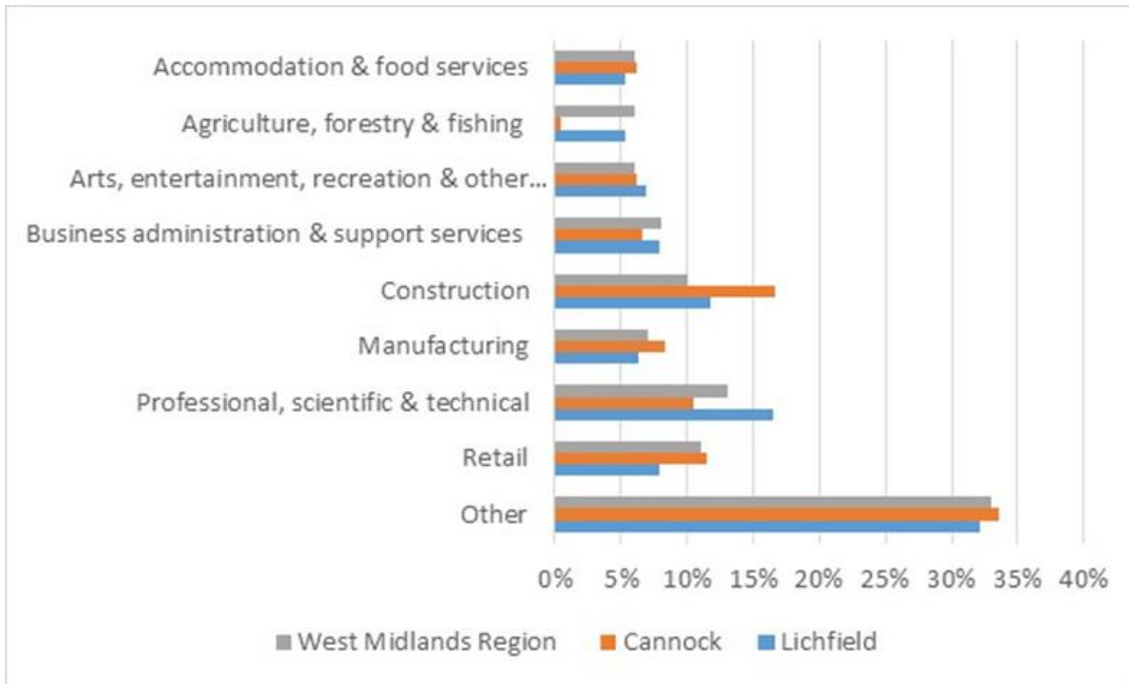
¹⁶⁹ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2

¹⁷⁰ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

¹⁷¹ Stoke-on-Trent and Staffordshire Local Enterprise Partnership, (2014), *Strategic Economic Plan Summary March 2014*.

(12%), followed by retail (8%) and business administration and support services (8%). Within the CCDC area there is a similar wide spread of business types, the construction sector accounts for the largest proportion of businesses (17%), with retail the second largest (11%), followed by professional, scientific and technical sector (10%). This is shown in Figure 7. For comparison within the West Midlands region, the largest sectors were professional, scientific and technical (13%), followed by retail (11%) and construction (10%)¹⁷².

Figure 7: Business sector composition in LDC and CCDC areas and the West Midlands¹⁷³



12.3.4 In 2015¹⁷⁴, approximately 49,000 people and 38,000 people worked in the LDC and CCDC areas respectively. According to the Office for National Statistics Business Register and Employment Survey 2015, the top five sectors in terms of share of employment in LDC were: accommodation and food services (14%); manufacturing (10%); retail (9%); business administration and support services (9%); and health (9%). In CCDC, the top five sectors were manufacturing (13%); retail (13%); construction (10%); wholesale (10%) and transport and storage (9%). These compare with the top five sectors for the West Midlands region, which were: health (12%); manufacturing (12%); retail (9%); education (9%); and business administration and support services (8%). This is shown in Figure 8¹⁷⁵.

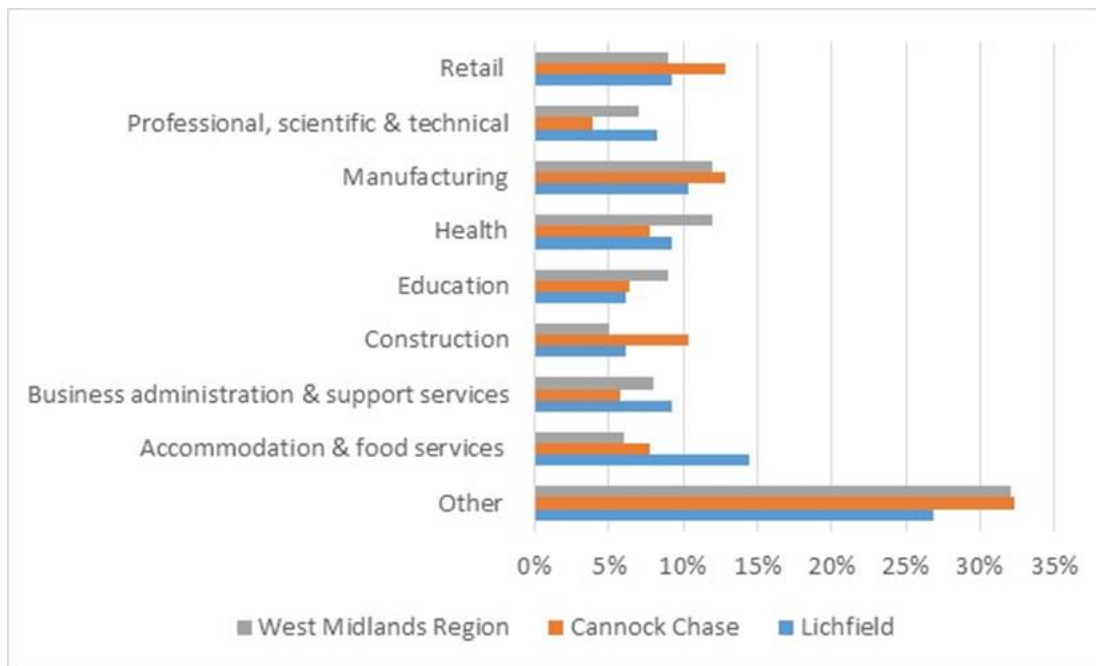
¹⁷² Office for National Statistics; UK Business Count – Local Units 2015; Available online at <https://www.nomisweb.co.uk>

¹⁷³ "Other" includes: information and communication; wholesale; health; property; transport and storage (including postal); motor trades; education; financial and insurance; mining, quarrying and utilities; public administration and defence.

¹⁷⁴ Office of National Statistics, (2015) Business Register and Employment Survey; Available online at: <http://www.nomisweb.co.uk>

¹⁷⁵ Office for National Statistics; 2015; Business Register and Employment Survey; Available online at <http://www.nomisweb.co.uk>

Figure 8: Employment by industrial sector in the LDC and CCDC areas and the West Midlands¹⁷⁶



12.3.5 According to the Annual Population Survey (2016)¹⁷⁷, the employment rate¹⁷⁸ within the LDC area was 77% (47,100 people) and 79% (48,300) for CCDC, which is higher than that recorded for both the West Midlands (71%) and England (74%). In 2016, unemployment¹⁷⁹ in both the LDC and CCDC areas was 3%, which was lower than the West Midlands (6%) and England (5%).

12.3.6 According to the Annual Population Survey (2016)¹⁸⁰, 33% of LDC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 31% in the West Midlands and 38% in England, while 5% of residents had no qualifications, which was lower than that recorded both for West Midlands (12%) and England (8%). In the CCDC area, 25% of residents aged 16-64 were qualified to NVQ4 and above, with 3% of its residents having no qualifications.

Property

12.3.7 A review of employment land in 2014¹⁸¹ identified a need for 4.2ha per year to 2029 for general business land in the LDC area and that there had been an historic shortfall in the provision of employment land up until 2011. In the CCDC area¹⁸², it was concluded that there is currently sufficient supply of 88ha of available employment

¹⁷⁶ 'Other' includes retail, construction, wholesale, information and communication, motor trades, public administration and defence, property, financial and insurance, and agriculture, forestry and fishing sectors.

¹⁷⁷ Annual Population Survey, (2016), NOMIS; Available online at: <http://www.nomisweb.co.uk>

¹⁷⁸ The proportion of working age (16-64 year olds) residents that is in employment.

¹⁷⁹ Refers to people without a job who were available to start work in the two weeks following their interview and who had either looked for work in the four weeks prior to interview or were waiting to start a job they had already obtained. As the unemployed form a small percentage of the population, the APS unemployed estimates within local authorities are based on very small samples so for many areas would be unreliable. To overcome this ONS has developed a statistical model that provides better estimates of total unemployed for unitary authorities and local authority districts (unemployment estimates for counties are direct survey estimates), NOMIS.

¹⁸⁰ Annual Population Survey, (2016), NOMIS. Available online at: <http://www.nomisweb.co.uk>

¹⁸¹ GVA (2014) Lichfield District Council Employment Land Review 2014. Scenario 2 figure used based on 83.69 ha of employment land required from 2009 to 2029. Scenario 2 figure used based on 83.69 ha of employment land required from 2009 to 2029.

¹⁸² Cannock Chase District Council (2015) Employment Land Availability Assessment, Sept 2015.

land against the Local Plan requirements for the period 2006-2028¹⁸³. The importance of developing a range of employment sites to support growth has been highlighted in the LEP Strategic Economic Plan¹⁸⁴.

- 12.3.8 The average vacancy rate for industrial and warehousing property in the LDC and CCDC areas in April 2017 has been assessed as 33% and 13% respectively, based on marketed space against known stock¹⁸⁵.

Future baseline

Construction (2020)

- 12.3.9 Volume 5: Appendix CT-004-000 provides details of the developments in the Fradley to Colton area that are assumed to have been implemented by 2020.
- 12.3.10 Implementation of all outstanding development consents and land allocations that can be built could result in approximately 13,600 additional jobs by 2020. The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast. These developments are considered in the cumulative assessment of the construction phase of the Proposed Scheme.

Operation (2027)

- 12.3.11 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.
- 12.3.12 No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for business receptors.

12.4 Effects arising during construction

Avoidance and mitigation measures

- 12.4.1 The draft Code of Construction Practice¹⁸⁶ (CoCP) includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:
- reducing nuisance through sensitive layout of construction sites (Section 5);
 - consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (Section 12);
 - applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses),

¹⁸³ Cannock Chase District Council (2014) Local Plan Part 1, 2014.

¹⁸⁴ Stoke-on-Trent and Staffordshire LEP (undated), Stoke-on-Trent & Staffordshire Economic Growth Strategy 2012 - 2026, v2.1; <http://www.staffordbc.gov.uk/live/Documents/Forward%20Planning/Examination%20Library%202013/E17--STOKE-ON-TRENT-AND-STAFFORDSHIRE-LOCAL-ENTERPRISE-PARTNERSHIP-ECONOMIC-GROWTH-STRATEGY-2012-2026.pdf>

¹⁸⁵ Vacant space is based on marketed space identified from Estates Gazette data (EGI); stock data is taken from information supplied by the Valuation Office (VOA).

¹⁸⁶ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

monitor and manage flood risk and other extreme weather events that may affect socioeconomic resources during construction (Section 13);

- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (Section 14); and
- maintaining access to businesses for the duration of construction works where reasonably practicable (Section 14).

Assessment of impacts and effects

12.4.2 The proposed construction works are assessed for socio-economic effects in relation to:

- premises demolished with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme;
- in-combination effects (e.g. air quality, noise, vibration, construction traffic and visual impacts) and isolation of an area that could affect a business's operations. Any resulting effects on employment are reported at a route-wide level (see Volume 3: Route-wide effects); and
- potential employment opportunities arising from construction in the local area (including in adjacent community areas).

Temporary effects

In-combination effects

12.4.3 Businesses within the Fradley to Colton area may experience air quality, noise and vibration or construction traffic impacts as a result of construction of the Proposed Scheme. Taken in-combination, the residual effects from these other topic assessments may amount to a significant change in the environment experienced by these businesses leading to a possible loss of trade for the following affected businesses.

12.4.4 Common Farm Bed and Breakfast, located in Bromley Hayes, will experience significant visual effects (throughout the construction period) and effects from HGV construction traffic (for three years and two months) as a result of the proposed construction activities. The sensitivity of this establishment is considered to be high as users are considered to be susceptible to changes in amenity with the construction works likely to discourage guests. Given the duration of effects and the high level of sensitivity, the Proposed Scheme is assessed to have a significant in-combination effect on this business.

12.4.5 The Bromley Hayes Garden Centre cluster, located on Shaw Lane, comprises a number of shops including Bits & Pieces and JK Home Furnishing. The business cluster may experience significant visual effects (throughout the construction period) and effects from HGV construction traffic (for three years and two months) as a result of the proposed construction activities. The sensitivity of this establishment is considered to be high as garden centres may attract customers in part because of their ambient environment or setting. Therefore, users are considered to be

susceptible to changes in amenity and the construction works are likely to discourage customers. Given the duration of effects and the high level of sensitivity, the Proposed Scheme is assessed to have a significant in-combination effect on this business.

- 12.4.6 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Isolation

- 12.4.7 No non-agricultural¹⁸⁷ businesses have been identified within the Fradley to Colton area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

- 12.4.8 Eleven satellite construction compounds will be located in the Fradley to Colton area. These sites could result in the creation of up to 1,350 person years of construction employment¹⁸⁸ opportunities, broadly equivalent to 140 full-time jobs¹⁸⁹, which, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment created by the Proposed Scheme has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).
- 12.4.9 Direct construction employment could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of the indirect construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).
- 12.4.10 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Permanent effects

Businesses

- 12.4.11 Businesses directly affected, comprising those that lie within land required for the Proposed Scheme, are reported, where possible, in groups to form defined resources based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses and resources are clustered together.
- 12.4.12 Two business accommodation units or sites in the study area will be directly impacted upon by the Proposed Scheme. These together form two defined resources: a medical supplies distribution business off Shaw Lane and a provider of canine support services near Colton.

¹⁸⁷ Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

¹⁸⁸ Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.

¹⁸⁹ Based on the convention that 10 employment years is equivalent to one full time equivalent job.

- 12.4.13 Across all the employment areas reviewed, an estimated 10 jobs¹⁹⁰ will either be displaced or possibly lost within the Fradley to Colton area. There is a reasonable probability that businesses will be able to relocate to places that will still be accessible to residents within the areas due to the general availability of vacant premises. However, there may be cases where alternative locations are problematic and the businesses may be unable to relocate on a like-for-like basis within the area. The impact on the local economy from the loss and/or relocation of jobs is considered to be relatively modest compared to the scale of economic activity and employment opportunity in the LDC area (approximately 49,000 jobs) and the CCDC area (approximately 38,000 jobs).
- 12.4.14 From an employment perspective, no significant direct effects on non-agricultural employment have been identified within the area.

Cumulative effects

- 12.4.15 No cumulative socio-economic effects have been identified in the Fradley to Colton area.
- 12.4.16 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed as part of the route-wide assessment (see Volume 3, Route-wide effects).

Other mitigation measures

- 12.4.17 The above assessment has concluded that there will be no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.
- 12.4.18 Businesses displaced by the Proposed Scheme will be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses, displaced from their existing premises, being able to relocate to suitable alternative premises and will, therefore, offer additional support over and above statutory requirements to facilitate this process¹⁹¹.
- 12.4.19 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

Summary of likely residual significant effects

- 12.4.20 Likely significant residual effects are shown on Volume 5: Socio-economic Map Book: Maps SE-01-201 to SE-01-210a.
- 12.4.21 There are no residual significant permanent effects identified in the assessment that will arise during construction. However, there are two temporary residual significant

¹⁹⁰ Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) Employment Densities Guide 3rd Edition (2015). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

¹⁹¹ HS2 Phase 2a Information Paper C8: Compensation code for compulsory purchase.

in-combination effects. During construction, customers may be discouraged from using the Bromley Hayes Garden Centre and the Common Farm Bed and Breakfast.

12.5 Effects arising from operation

Avoidance and mitigation measures

- 12.5.1 No mitigation measures are proposed in relation to business resources during operation of the Proposed Scheme.

Assessment of impacts and effects

Resources with direct effects

- 12.5.2 There are no resources considered likely to experience significant direct socio-economic effects during the operation of the Proposed Scheme.

In-combination effects

- 12.5.3 One business has been identified within the area that is expected to experience significant in-combination effects as a result of the Proposed Scheme.
- 12.5.4 Common Farm Bed and Breakfast, located in Bromley Hayes, may experience significant noise (permanent) and visual (year 1 through to year 15) residual effects during the operational phase of the Proposed Scheme. The sensitivity of this establishment is considered to be high as users are considered to be susceptible to changes in the local environment and this is likely to discourage guests. Given the duration of effects and the high level of sensitivity, the Proposed Scheme is assessed to have a significant in-combination effect on this business.

Operational employment

- 12.5.5 Operational employment will be created at the Stone Infrastructure Maintenance Base – Rail (IMB-R)¹⁹² for maintaining the Proposed Scheme, located within the Stone and Swynnerton area (CA3). It is likely that some of these jobs will be accessed by local residents.
- 12.5.6 Direct operational employment created by the Proposed Scheme could lead to indirect employment opportunities for local businesses in terms of potentially supplying the Proposed Scheme or benefiting from expenditure of directly employed workers on goods and services.
- 12.5.7 The impact of operational employment creation has been assessed and reported at a route-wide level in Volume 3, Route-wide effects.

Other mitigation measures

- 12.5.8 The assessment has concluded there are significant in-combination effects arising at Common Farm Bed and Breakfast during operation, namely associated with residual noise and visual effects. The requirement for other mitigation measures in relation to noise and visual effects are described in the relevant topic chapters.

¹⁹² The Stone IMB-R is located within the Stone and Swynnerton area (CA3) and the travel to work area extends into the Fradley to Colton area.

Summary of likely residual significant effects

- 12.5.9 Likely significant residual effects are shown on Volume 5: Socio-economic Map Book: Maps SE-01-201 to SE-01-210a.
- 12.5.10 The Common Farm Bed and Breakfast, located in Bromley Hayes, will be affected by a combination of noise and visual effects as a result of the operation of the Proposed Scheme. Customers may be discouraged from using the Common Farm Bed and Breakfast during operation up to Year 15.

Cumulative effects

- 12.5.11 No cumulative effects on socio-economic characteristics have been identified in the Fradley to Colton area during operation.

Monitoring

- 12.5.12 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 12.5.13 There are no area-specific requirements for monitoring socio-economic effects during the operation of the Proposed Scheme in the Fradley to Colton area. Where there are likely residual significant effects at Common Farm Bed and Breakfast, the specific operational monitoring requirements in relation to noise and visual effects, which will contribute to the in-combination effect, are described in the relevant topic chapters.

13 Sound, noise and vibration

13.1 Introduction

- 13.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme within the Fradley to Colton area on:
- people, primarily where they live ('residential receptors') in terms of individual dwellings and on a wider community basis, including any shared community open areas¹⁹³; and
 - community facilities such as schools, hospitals, places of worship, and also commercial properties such as offices and hotels, collectively described as 'non-residential receptors' and 'quiet areas'¹⁹⁴.
- 13.1.2 Engagement with Lichfield District Council (LDC) and Stafford Borough Council (SBC) has been undertaken with respect to the sound, noise and vibration assessment. The purpose of this engagement has been to obtain relevant information regarding residential and non-residential resources and existing baseline sound levels, and to discuss the development of the mitigation to be included in the Proposed Scheme. LDC and SBC officers were also invited to attend and witness the baseline sound measurements being undertaken within this area.
- 13.1.3 More detailed information regarding the sound, noise and vibration assessment for Fradley to Colton area is available in the relevant appendices in Volume 5:
- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000); and
 - sound, noise and vibration baseline, construction and operation assessment (Appendix SV-002-001).
- 13.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book. Mapping to support the sound, noise and vibration assessment is presented in Map Series SV-05 (Volume 2: CA1 Map Book) and Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5: Sound, noise and vibration Map Book).
- 13.1.5 The assessment of likely significant effects from noise and vibration on agricultural, community, heritage, ecological and health receptors and the assessment of tranquillity are presented in Section 4, Agriculture, forestry and soils; Section 6, Community; Section 7, Cultural heritage; Section 8, Ecology and biodiversity; Section 9, Health; and Section 11, Landscape and visual of this report respectively.

¹⁹³ 'Shared community open areas' are those that the National Planning Practice Guidance identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space (e.g. park or local green space) that is nearby.

¹⁹⁴ Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity.

13.2 Scope, assumptions and limitations

- 13.2.1 The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 (Section 8), the Scope and Methodology Report (SMR)¹⁹⁵, and the SMR Addendum¹⁹⁶.
- 13.2.2 In this assessment 'sound' is used to describe the acoustic conditions that people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of an area is likely to be modified through the introduction of the Proposed Scheme. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.
- 13.2.3 Effects can either be temporary from construction or permanent from the operation of the Proposed Scheme. These effects may be direct, resulting from the construction or operation of the Proposed Scheme, and/or indirect, resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

13.3 Environmental baseline

Existing baseline

- 13.3.1 The Fradley to Colton area is characterised by small towns, villages, hamlets, isolated residential properties and farms. The sound environment is generally dominated by local and distant road traffic, with overflying aircraft, local neighbourhood sources and natural and agricultural sounds also contributing.
- 13.3.2 There are several main roads within the Fradley to Colton area, notably; the A515 Lichfield Road, which runs through Rileyhill and Kings Bromley, the A513 Rugeley Road, the B5014 Uttoxeter Road and the B5013 Uttoxeter Road. Close to these roads, the existing daytime sound levels are fairly high. Lower sound levels are experienced in areas further from these sources. Sound levels also reduce overnight, particularly in the more rural areas.
- 13.3.3 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for Fradley to Colton area in Volume 5: Appendix SV-002-001.
- 13.3.4 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration¹⁹⁷. The predicted vibration levels at all receptors as a result of the Proposed Scheme has, therefore, been assessed using specific thresholds, below which receptors will not be affected by vibration. Further information is provided in Volume 1 (Section 8).

¹⁹⁵ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

¹⁹⁶ Volume 5 Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

¹⁹⁷ Further information is available in the Volume 5: Appendix SV-001-000, Sound, noise and vibration methodology, assumptions and assessment report, and Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

Future baseline

- 13.3.5 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth, which may be as a result of local or national trends or due to specific committed developments. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads, tyre sound¹⁹⁸ dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.
- 13.3.6 Committed developments involving sound or vibration sensitive uses within the relevant study area have been included within the relevant assessment and are reported for the Fradley to Colton area in Volume 5: Appendix SV-002-003. Where applicable, sound, noise or vibration significant effects on these committed developments are discussed in the following sections. For those receptors that fall within the relevant sound or vibration study areas for HS2 Phase One and the Proposed Scheme, the sound or vibration levels from both schemes have been provided in the assessment. The information is reported for the Fradley to Colton area in Volume 5: Appendix SV-002-001.

Construction (2020)

- 13.3.7 The assessment of noise from construction activities assumes a baseline year of 2020, which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline year of 2016 and the future baseline year of 2020.

Operation (2027)

- 13.3.8 The operational assessment is based upon the predicted change in sound levels that result from operation of the Proposed Scheme. The assessment initially considered a worst case (that would over-estimate the change in levels) by assuming that sound levels would not change from the existing baseline year of 2016. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2027 to coincide with the proposed start of passenger services. The future baseline is the sound environment that would exist in 2027 without the Proposed Scheme. This is presented in Table 14 and Table 15 in Volume 5: Appendix SV-002-001.

¹⁹⁸ Tyre noise typically becomes the dominant sound source for steady road traffic.

13.4 Effects arising during construction

Local assumptions and limitations

Local assumptions

- 13.4.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report and in Volume 1 (Section 8). The following assumptions have also been made in relation to the construction methods.
- 13.4.2 During certain construction processes, there may be the need to operate fixed construction plant such as generators¹⁹⁹ and water pumps for reasons of safety or engineering practicability on a continuous basis. This equipment will be sited, or locally screened to control sound to neighbouring residential premises.
- 13.4.3 It is assumed there will be some night-time working during road and rail possession periods and it is expected that the noise effects from these works will be limited in duration and are therefore not considered to be significant. Any noise effects arising from these short-term construction activities will be controlled and reduced by the management processes set out in the draft Code of Construction Practice²⁰⁰ (CoCP).
- 13.4.4 The assessment takes account of people's perception of noise throughout the day. More stringent criteria are applied during evening and night-time periods, when people are more sensitive to noise, compared to the busier and more active daytime period.
- 13.4.5 Piling and vibratory compaction is likely to result in short-term²⁰¹ appreciable ground-borne vibration at a small number of dwellings, situated very close to these activities. These receptors will also be exposed to appreciable noise from the construction of the Proposed Scheme. The significance of the identified vibration effects has been assessed in combination with the airborne noise effects also identified at these receptors. The assessment is presented in Volume 5: Appendix SV-002-001.

Local limitations

- 13.4.6 There are a number of locations in this area where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient baseline sound level information has been obtained at neighbouring representative locations to undertake the assessment. Further information is provided in Volume 5: Appendix SV-002-001.

Avoidance and mitigation measures

- 13.4.7 The assessment assumes the implementation of the principles and management processes set out in the noise and vibration section of the draft CoCP (Section 13), which are:

¹⁹⁹ As required by the CoCP. The use of diesel or petrol-powered generators will be reduced by using mains electricity or battery-powered equipment where reasonably practicable.

²⁰⁰ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

²⁰¹ Typically less than 1 month.

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), which will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
 - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;
 - screening: for example, local screening of equipment or perimeter hoarding; and
 - where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the HS2 noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of noise insulation/temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by, the nominated undertaker and made available to the local authorities; and
- contractors will be required to comply with the terms of the CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

13.4.8 In addition to this mitigation, to avoid or reduce likely significant effects, screening²⁰², as described in the draft CoCP, has been assumed at worksites in the vicinity of Rugeley School, Blithbury Road, Blithbury.

13.4.9 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP. Noise insulation or, where appropriate, temporary re-housing will avoid residents being significantly affected by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for noise insulation. None are predicted to qualify for temporary rehousing.

13.4.10 Qualification for noise insulation and temporary re-housing will be confirmed as part of seeking prior consent from the local authority under Section 61 of the CoPA.

²⁰² Provided by solid temporary hoarding, temporary stockpiles, screening close to activities or other means to provide equivalent noise reductions.

Qualifying buildings will be identified, as required in the draft CoCP so that noise insulation can be installed, or any temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

- 13.4.11 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, the following five residential properties are forecast to experience noise above the eligibility criteria as defined in the HS2 noise insulation and temporary rehousing policy²⁰³. These residential dwellings are indicated on Map Series SV-03 (Volume 5: Sound, noise and vibration Map Book):
- Proctors, Hadley Gate Farm, Blithbury Road, Rugeley (assessment location ref.: 11145);
 - Rose Cottage, Moor Lane, Stockwell Heath (assessment location ref.: 11168); and
 - Bleak Cottage, Moor Lane, Stockwell Heath (assessment location ref.: 11168).
- 13.4.12 For daytime construction, the trigger level for eligibility for noise insulation is 75dB²⁰⁴ measured outside.
- 13.4.13 The mitigation measures, including noise insulation for the three residential properties, will reduce noise inside all dwellings such that it does not reach a level where it will significantly affect residents.

Residential receptors: direct effects – communities

- 13.4.14 The avoidance and mitigation measures to be implemented during construction in this area will avoid airborne construction noise adverse effects on the majority of receptors and communities. Residual temporary noise or vibration effects are identified later in this section. With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.
- 13.4.15 In locations with lower existing sound levels²⁰⁵, construction noise effects are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life for that community. These effects are considered to be significant when assessed on a community basis taking account of the local context.
- 13.4.16 The adverse effects on the residential areas identified in Table 25, including shared open areas, are considered to be significant on a community basis.

²⁰³ Further information is provided in HS2Phase 2a Information Paper E13: Control of construction noise and vibration.

²⁰⁴ $L_{pAeq, 0800-1800}$ measured at the façade.

²⁰⁵ Further information is presented in Volume 5: Appendix SV-001-000, Sound, noise and vibration methodology, assumptions and assessment report.

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Table 25 Direct adverse effects on residential communities and shared open areas that are considered to be significant on a community basis

Significant effect number ²⁰⁶	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact ²⁰⁷
CSV01-Co1	Construction noise	Daytime	Approximately 10 residential dwellings in the vicinity of Rugeley Road and Shaw Lane, to the west of Kings Bromley.	Site establishment (including demolitions), earthworks, road construction and movement of vehicles on the site haul routes. The typical and highest monthly noise levels are approximately 65dB and 70dB ²⁰⁸ .	Up to 3 years
CSV01-Co2	Construction noise	Daytime	Approximately 10 residential dwellings at Pipe Ridware.	Site establishment (including vegetation clearance), utility diversions and viaduct construction. The typical and highest monthly noise levels are approximately 65dB and 70dB ²⁰⁸ .	Up to 1 year and 2 months
CSV01-Co3	Combined Construction site and traffic noise	Daytime	Approximately 10 residential dwellings at Hadley Gate, Blithbury Road	Site establishment (including demolitions), utility diversions, earthworks, movement of vehicles on the site haul routes and vehicles on Blithbury Road / Hollow Lane. The typical and highest monthly noise levels are approximately 70dB and 80dB ²⁰⁸ .	Up to 2 years and 8 month
CSV01-Co4	Construction noise	Daytime	Approximately 10 in Stockwell Heath in the vicinity of Moor Lane.	Site establishment, earthworks, overbridge construction, and movement of vehicles on the site haul routes. The typical and highest monthly noise levels are approximately 70dB and 80dB ²⁰⁸ .	Up to 3 years and 3 months

13.4.17 Track laying, power system and signalling installation works are unlikely to result in significant construction noise effects, given the short duration close to any communities and, where included in the Proposed Scheme, the presence of the permanent noise fence barriers.

Residential receptors: indirect effects

13.4.18 Construction traffic is likely to cause adverse noise effects on occupants of residential dwellings adjacent to the following construction traffic routes. However, when the change in the typical monthly construction traffic noise level and/or the number of properties adjacent to the route are considered, a likely significant construction traffic noise effect has not been identified:

- Common Lane (South) in Rileyhill, from the junction with the A515 Lichfield Road in Rileyhill to the junction with Crawley Lane near Common Farm south of Kings Bromley;

²⁰⁶ , Volume 5: Appendix SV-002-001, Sound, noise and vibration report.

²⁰⁷ At the closest properties in the community.

²⁰⁸ Equivalent continuous sound level at the facade, $L_{pAeq, 0700-1900}$.

- Ridware Road (B5014) through Hill Ridware - from the junction with the connecting track to School Lane (just north of Mavesyn Nurseries) to the junction with Uttoxeter Road and School Lane in the centre of Hill Ridware;
- Uttoxeter Road (B5014) - from the junction with Stonyford Lane to the junction with Blithbury Road in the centre of Blithbury;
- Pipe Wood Lane - from the junction with the track connecting Pipe Wood Lane to Quintons Orchard Fish Farm and the junction with Blithbury Road in the centre of Blithbury;
- Pipe Lane, Pipe Ridware - from the T-junction immediately to the west of Pipe Ridware to the junction with Pipe Wood Lane; and
- a farm track serving Goldmayfields Farm - from the junction with Pipe Wood Lane to the junction with Blithbury Road.

13.4.19 Construction traffic is likely to cause adverse noise effects on residents of dwellings along Blithbury Road/Hollow Lane between Blithbury and Colton. Approximately 40 dwellings located immediately adjacent to the road are forecast to experience a change in road traffic noise levels of around 6dB LpAeq, 16 hour during the peak months (further information on traffic is provided in Section 14, Traffic and transport). This is considered to be a likely significant effect on a community basis at the residential dwellings on this route, denoted as CSV01-Co5 in Volume 5: Appendix SV-002-001. This temporary adverse effect represents a change in the acoustic character of the area which may be perceived as a change in the quality of life for that community.

Non-residential receptors: direct effects

13.4.20 The assessment has identified the following non-residential receptors where the predicted airborne sound levels exceed both the relevant impact screening criteria and the noise change criterion (a change of greater than 3dB compared with the existing baseline sound level). These locations are identified in the Fradley to Colton area, as shown in Map Series SV-03 (Volume 5: Sound, noise and vibration Map Book):

- Kingfisher Holiday Park (assessment location ref.: 11008(N));
- Alrewas Hayes Hotel (assessment location ref.: 8001(N));
- Bromley Hayes Cattery (assessment location ref.: 8003(N));
- Rookery Lodge Boarding Kennels / Cattery (assessment location ref.: 8014(N));
- Four Season Nature Study Centre (assessment location ref.: 11080(N));
- Ridware Theatre, Pipe Ridware (assessment location ref.: 11089(N)); and,
- Woodhouse Farm holiday cottages (committed development (CD) ref: 15/00940/COU) (assessment location ref.: 11103(N)).

13.4.21 At each of the non-residential receptors identified above an assessment has been undertaken to determine if this impact would result in a significant effect, using the significance criteria set out in Annex A of Volume 5: Appendix SV-001-000.

- 13.4.22 Kingfisher Holiday Park is a caravan park close to Fradley Junction, Staffordshire. The site is located to the north-east of the Proposed Scheme. The highest predicted daytime monthly construction noise levels at the closest accommodation are 1dB(A) above the screening criteria defined in the SMR for this use²⁰⁹ for a period of eight months. The typical predicted monthly construction noise levels are below the screening criteria defined in the SMR. The screening criteria are defined on a precautionary basis to ensure that more detailed consideration is undertaken where appropriate. In this situation, considering the small magnitude above the screening criteria a likely significant construction noise effect has not been identified at Kingfisher Holiday Park.
- 13.4.23 Alrewas Hayes is a countryside venue including a hotel. The site is located to the north-west of the Proposed Scheme. Accommodation buildings at the site are modern brick buildings with double glazed windows. The highest predicted daytime monthly construction noise levels at this building are 1dB(A) above the screening criteria defined in the SMR for this use²⁰⁹ for a period of one year and seven months. The typical predicted monthly construction noise levels are below the screening criteria defined in the SMR. The construction sound levels are predicted at the part of the building which is closest to the Proposed Scheme. At the majority of the accommodation it is likely that the monthly construction sound levels will be below the daytime impact screening criteria throughout the works. The screening criteria are defined on a precautionary basis to ensure that more detailed consideration is undertaken where appropriate. In this situation, considering the orientation of the accommodation to the Proposed Scheme and the small magnitude above the screening criteria, a likely significant construction noise effect has not been identified at Alrewas Hayes Hotel.
- 13.4.24 Bromley Hayes Cattery is located at Rose Cottage, Rileyhill, Lichfield to the south-west of the Proposed Scheme. The cottage is a two storey brick building with openable windows providing ventilation. The cottage may also include an office associated with the cattery, which would be sensitive to noise. The highest predicted daytime monthly construction noise level is 2dB(A) above the screening criteria defined in the SMR for this use²⁰⁹ for a period of three months. The typical monthly daytime construction noise level is below the screening in criteria defined in the SMR. The screening criteria are defined on a precautionary basis to ensure that more detailed consideration is undertaken where appropriate. In this situation, considering the small magnitude above the screening criteria and the duration of the effect, a likely significant construction noise effect has not been identified at Bromley Hayes Cattery. No effect is identified on the animals themselves based upon the assessment approach defined in Annex F²¹⁰, Volume 5: Appendix SV-001-000. Rose Cottage has also been assessed as a residential dwelling (assessment location ref.: 11040).
- 13.4.25 Rookery Lodge Boarding Kennels/Cattery is located at Rookery Lodge, Rugeley Road, Kings Bromley to the north-east of the Proposed Scheme. The lodge is a two storey brick building with openable windows providing ventilation. The lodge may also include an office associated with the kennels / cattery, which would also be sensitive

²⁰⁹ 50 dB L_{pAeq,0700-2300} (free-field) during the day which is equivalent to 53 dB L_{pAeq,0700-2300} (façade).

²¹⁰ Effects of noise on animals.

to noise. The highest predicted daytime monthly construction noise level is 3dB(A) above the screening criteria defined in the SMR for this use²¹¹ for a period of one year and four months. The typical monthly daytime construction noise level is below the screening in criteria defined in the SMR. Considering the duration of the effect, Rookery Lodge Boarding Kennels/Cattery has been identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by CSVo2-No1 in Table 7, Volume 5: Appendix SV-002-001. No effect is identified on the animals themselves based upon the assessment approach defined in Annex F210, Volume 5: Appendix SV-001-000. Rookery Lodge has also been assessed as a residential dwelling (assessment location ref.: 11069).

- 13.4.26 The Four Seasons Nature Study Centre on Kings Bromley Lane, Staffordshire is operated by CHADS²¹². The centre is located to the south of the Proposed Scheme, and consists of a hall, which is used by the group and is also available for hire, and outside activity areas. The main building has been assessed against the hall criteria and the outside activity areas against the external amenity criteria. The typical and highest predicted daytime monthly construction noise levels at the main building are 6dB(A) and 9dB(A) above the screening criteria defined in the SMR for this use²¹¹ for a period of just under five years. The highest predicted daytime monthly construction noise level is below the external amenity space criteria²¹³. Four Seasons Nature Study Centre is identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by CSVo1-No2 in Table 7, Appendix SV-002-001 (Volume 5).
- 13.4.27 Ridware Theatre, Pipe Ridware is located to the south-west of the Proposed Scheme. The theatre is in a converted chapel, constructed of masonry with single glazed stained glass windows, although it is not currently operating as a theatre. The typical and highest predicted daytime monthly construction noise level at this building are 10dB(A) and 13dB(A) above the screening criteria defined in the SMR for this use²¹¹. The construction works in this area are typically proposed to be undertaken during daytime, which is likely to be outside of the time when performances are undertaken at the theatre, which are assumed to be in the evenings. However, the construction noise may affect rehearsals and weekday matinee performances should the theatre be reopened. Ridware Theatre is identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by CSVo1-No3 in Table 7, Appendix SV-002-001 (Volume 5).
- 13.4.28 At Woodhouse Farm, Pipe Ridware, there is a committed development for seven holiday cottages (CD ref: 15/00940/COU). The development is located to the north-west of the Proposed Scheme. The typical and highest predicted daytime monthly construction noise level are 6dB(A) and 10dB(A) above the screening criteria defined in the SMR for this use²¹⁴. Woodhouse Farm holiday cottages are identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by CSVo1-No4 in Table 7, Appendix SV-002-001 (Volume 5).

²¹¹ 50 dB L_{pAeq,0700-2300} (free-field) during the day which is equivalent to 53 dB L_{pAeq,0700-2300} (façade).

²¹² Conservation, Horticulture, Agriculture for the Disabled Society.

²¹³ Based upon a lower cut off value of 65 dB L_{pAeq,0700-2300} during the day (façade).

²¹⁴ 50 dB L_{pAeq,0700-2300} (free-field) during the day which is equivalent to 53 dB L_{pAeq,0700-2300} (façade).

Non-residential receptors: indirect effects

- 13.4.29 The assessment of construction noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in the Fradley to Colton area.

Summary of likely residual significant effects

- 13.4.30 The proposed avoidance and mitigation measures will reduce noise inside all dwellings from the construction activities such that residents will not be significantly affected²¹⁵.

- 13.4.31 The measures will also reduce the construction noise effects on acoustic character in the majority of residential communities. Despite these measures, the effect on the acoustic character in the following local residential community areas are considered to be significant:

- Rugeley Road and Shaw Lane, to the west of Kings Bromley;
- Pipe Ridware;
- Hadley Gate, Blithbury Road; and
- Stockwell Heath in the vicinity of Moor Lane and Hamley Heath.

- 13.4.32 Construction traffic on Blithbury Road/Hollow Lane in this area is likely to cause significant noise effects on adjacent residential dwellings.

- 13.4.33 On a precautionary basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on non-residential buildings at:

- Rookery Lodge Boarding Kennels/Cattery;
- Four Seasons Nature Study Centre;
- Ridware Theatre; and
- Woodhouse Farm.

- 13.4.34 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures.

Cumulative effects

- 13.4.35 The assessment described above takes into account predicted noise effects of the Proposed Scheme and other committed developments including HS2 Phase One adjacent to the Fradley to Colton area. A qualitative assessment has also been undertaken for the construction of HS2 Phase One in conjunction with construction of the Proposed Scheme (without HS2 Phase One in the future baseline). This qualitative assessment showed that no significant cumulative effects are anticipated for noise and vibration as a result of construction of the Proposed Scheme and HS2 Phase One.

²¹⁵ Refer to Volume 5: Appendix SV-001-000.

13.5 Effects arising from operation

Local assumptions and limitations

Local assumptions

- 13.5.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based upon the highest likely train flows, assuming the service pattern for Monday to Saturday including Phase One and Phase Two services. The expected passenger service frequency for Phase 2a, with both Phase One and Phase Two services are described in Volume 1 (Section 4).
- 13.5.2 Passenger services will start at or after 05:00 from the terminal stations and in this area, with Phase One and Phase Two in operation will progressively increase to 12 trains per hour in each direction on the main lines with an operating speed of 330kph for 90% of services and 360kph for 10% of services. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Further information is presented in Volume 1 (Section 4).

Avoidance and mitigation measures

- 13.5.3 The development of the Proposed Scheme has sought to keep the route as low as is reasonably practicable and away from main communities.

Airborne noise

- 13.5.4 HS2 trains will be quieter than the relevant current European Union specifications, in line with the assumptions made for the HS2 Phase One ES. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 186mph (300kph) with current pantograph designs, drawing on proven technology in use in East Asia. Overall these measures will reduce noise emissions by approximately 3dB at 360kph (225mph) compared to a current European high speed train. The track will be specified to reduce noise, as will the maintenance regime. Further information is provided in Volume 5: Appendix SV-001-000.
- 13.5.5 The Proposed Scheme incorporates noise mitigation in the form of landscape earthworks and/or noise fence barriers to avoid or reduce significant adverse airborne noise effects. The assessment has been based on the assumption that noise fence barriers are acoustically absorbent on the railway side and are located 5m from the outer rail.
- 13.5.6 In the Fradley to Colton area noise barriers have been incorporated into the Proposed Scheme to avoid or reduce adverse effects due to airborne noise at the following communities:
- Rileyhill;
 - Kings Bromley;
 - Pipe Ridware;
 - Blithbury;

- Colton; and
- Stockwell Heath.

- 13.5.7 The location and height of these noise barriers is shown on Map Series SV-05 in Volume 2: CA1 Map Book.
- 13.5.8 In practice, noise barriers may differ from this general assumption while maintaining the required acoustic performance. For example, where noise barriers are in the form of landscape earthworks, they need to be higher above rail level to achieve similar noise attenuation to a noise fence barrier because the crest of the earthwork will be further than 5m from the outer rail.
- 13.5.9 Noise effects will be reduced in other locations along the route by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise barriers are not required). The location of the landscape earthworks is shown on Map series SV-05 in Volume 2: CA1 Map Book.
- 13.5.10 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements. Further information is presented in Volume 5: Appendix SV-001-000.
- 13.5.11 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996²¹⁶ (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations based upon the currently available information. Qualification for noise insulation under the Regulations will be formally identified and noise insulation offered at the time the Proposed Scheme becomes operational. Where noise insulation is required, as well as improvements to noise insulation of windows facing the railway, ventilation will be provided so that windows can be kept closed to protect internal sound levels.
- 13.5.12 Noise insulation will avoid any residual significant effects on health and quality of life arising inside dwellings taking into account mitigation incorporated into the design of the Proposed Scheme.
- 13.5.13 Where the noise from the operation of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the World Health Organization (WHO)'s Night Noise Guidelines for Europe²¹⁷, residents are considered to be significantly affected by the resulting noise inside their dwelling. The Interim Target is a lower level of noise exposure than the trigger threshold for night noise in the Regulations, i.e. 55dB equivalent continuous level, L_{pAeq}, 23:00-07:00 measured without reflection from the front of buildings. The effect on people at night due to the maximum sound level as each train passes has also been assessed²¹⁸. In line with these

²¹⁶ Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.

²¹⁷ World Health Organization (2010), *Night time Noise Guidelines for Europe*.

²¹⁸ During the night (2300-0700) a significant effect is also identified where the Proposed Scheme results in a maximum sound level at the façade of a building at or above: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).

criteria, where night-time noise levels for the use of new or additional railways or altered roads authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB²¹⁹, or the maximum noise level as a train passes exceeds the criterion, noise insulation will be offered for these additional buildings.

- 13.5.14 In the case of public rights of way (PRoW), they are by their nature transitory routes, with users not staying in any one location for long periods. Train sound from the Proposed Scheme will be intermittent and its level will vary as the PRoW moves closer to and further from the Proposed Scheme. No significant noise effects have, therefore, been identified on users of PRoW within the Fradley to Colton area.

Ground-borne noise and vibration

- 13.5.15 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

- 13.5.16 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified seven residential dwellings, close to the Proposed Scheme, where noise levels are predicted to exceed the daytime trigger threshold set out in the Regulations. It is, therefore, estimated that these buildings are likely to qualify for noise insulation under the Regulations. These residential dwellings are indicated on Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):

- Barn Farm, Common Lane (South), Rileyhill (assessment location ref.: 11027);
- The Bungalow, Woodhouse Farm, Blithbury, Rugeley (assessment location ref.: 11103);
- Woodhouse Farm, Blithbury, Rugeley (assessment location ref.: 11103);
- Proctors, Hadley Gate Farm, Blithbury Road, Rugeley (assessment location ref.: 11145);
- Jongham's Cottage, Hamley Heath, Rugeley (assessment location ref.: 11202).

- 13.5.17 The assessment has identified three additional residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations, but the predicted night-time noise level exceeds the World Health Organization's Interim Target of 55dB, or the maximum noise level as a train passes exceeds the relevant criteria²¹⁷. It is estimated that these buildings will also be offered noise insulation as described previously in the avoidance and mitigation measures section. These residential dwellings are indicated on Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):

- Shaw Lane Farm, Shaw Lane, Kings Bromley (assessment location ref.: 11064);

²¹⁹ Equivalent continuous level, L_{pAeq,23:00-07:00} measured without reflection from the front of buildings.

- Echills Farm, Rugeley Road, Kings Bromley (assessment location ref.: 11068); and
- Luthbur, Pipe Ridware, Rugeley (assessment location ref.: 11099).

13.5.18 The mitigation measures, set out in the previous section, including noise insulation, will reduce noise inside all dwellings such that it will not reach a level where it will significantly affect residents.

Residential receptors: direct effects – communities

13.5.19 The proposed mitigation measures in the Fradley to Colton area will avoid or reduce airborne noise adverse effects on the majority of receptors, and in the following communities:

- Rileyhill;
- Kings Bromley;
- Pipe Ridware;
- Blithbury;
- Colton; and
- Stockwell Heath.

13.5.20 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2: CA1 Map Book) shows the long term 40dB²²⁰ night-time sound level contour from the operation of trains on the Proposed Scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 50dB daytime contour²²¹. In general, below these levels adverse effects are not expected.

13.5.21 Above 40dB during the night and 50dB during the day the community effect of noise is dependent on the baseline sound levels in that area and the change in sound level (magnitude of effect) brought about by the Proposed Scheme. The airborne noise impacts and effects forecast for the operation of the scheme are presented on Map Series SV-05 (Volume 2: CA1 Map Book). The changes in noise levels shown on those Maps are likely to affect the acoustic character of the area such that taking account of the local context²²², this may be considered to be significant when assessed on a community basis²²³.

13.5.22 Approximately 60 isolated properties within the area have been identified as being subject to a likely adverse noise effect; these effects are likely to be received as an effect on the acoustic character of the area. However, as the affected properties are spatially remote from larger defined residential areas, are subject to smaller

²²⁰ Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$.

²²¹ With the train flows described in the assumptions section of this report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or $L_{pAeq,day}$) from the Proposed Scheme would be approximately 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.

²²² Further information is provided in Volume 5: Appendices SV-001-000 and SV-002-001.

²²³ Further information is contained in Volume 1.

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magnitudes of noise effect, or are small in number, the effects are not considered to be significant on a community basis.

- 13.5.23 In this study area, the direct adverse effects on the acoustic character of the areas of the residential communities identified in Table 26 are considered to be significant on a community basis.

Table 26: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number ²²⁴	Source of significant effect	Time of day	Location and details
OSV01-Co1	Airborne noise increase from new train services	Daytime and night-time	Rileyhill Approximately 25 dwellings in the vicinity of Shaw Lane, Crawley Lane and Rugeley Road. Forecast increases in sound from the Proposed Scheme are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway would be either minor or moderate adverse. There are no shared open spaces identified as being affected in this community.
OSV01-Co2	Airborne noise increase from new train services	Daytime and night-time	Nethertown Approximately 15 dwellings in Nethertown. Forecast increases in sound from the route of the Proposed Scheme are likely to cause a moderate adverse effect on the acoustic character of the area around the properties. There are no shared open spaces identified as being affected in this community.
OSV01-Co3	Airborne noise increase from new train services	Daytime and night-time	Pipe Ridware Approximately 10 dwellings in Pipe Ridware. Forecast increases in sound from the Proposed Scheme are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway will be moderate adverse. There are no shared open spaces identified as being affected in this community.
OSV01-Co4	Airborne noise increase from new train services	Daytime and night-time	Hadley Gate Approximately 10 dwellings in Hadley Gate. Forecast increases in sound from the Proposed Scheme are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway will be moderate adverse. There are no shared open spaces identified as being affected in this community.
OSV01-Co5	Airborne noise increase from new train services	Daytime and night-time	Colton Approximately 15 dwellings (including the committed development at Newlands Farm ref CD/14/01231/PND) in the vicinity of the High Street and Narrow Lane. Forecast increases in sound from the Proposed Scheme are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway would be moderate adverse. There are no shared open spaces identified as being affected in this community area.
OSV01-Co6	Airborne noise increase from new train services	Daytime and night-time	Stockwell Heath and surrounds Approximately 25 dwellings in the vicinity of Moor Lane and Hamley House and their shared external community spaces. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties.

²²⁴ See Map Series SV-05 (Volume 2: CA1 Map Book).

Residential receptors: indirect effects

- 13.5.24 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

- 13.5.25 The assessment has identified airborne noise impacts at the following non-residential receptors in the Fradley to Colton area. These properties are indicated on Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):
- Common Farm Bed and Breakfast (assessment location ref.: 11236(N));
 - Bromley Hayes Cattery (assessment location ref.: 8003(N));
 - Rookery Lodge Boarding Kennels/Cattery, Rugeley Road, Kings Bromley, Burton-On-Trent (assessment location ref.: 8014(N));
 - Four Seasons Nature Study Centre (assessment location ref.: 11080(N));
 - Ridware Theatre, Pipe Ridware, Rugeley (assessment location ref.: 11089(N)); and
 - a committed development for seven holiday cottages at Woodhouse Farm, Pipe Ridware (assessment location ref.: 11231(N)).
- 13.5.26 For each of the non-residential receptors identified above an assessment has been undertaken to determine if this impact would result in a significant effect using the significance criteria defined in Section A, Volume 5: Appendix SV-001-000.
- 13.5.27 Common Farm (assessment location ref.: 11236(N)) provides bed and breakfast accommodation and is located to the south of the Proposed Scheme. A major operational airborne noise effect has been identified based on the change in sound level of greater than 10dB compared to the future baseline sound level. Daytime operational sound levels at the receptor are predicted to exceed the impact screening criteria for hotels of 50dB LpAeq, 16hr by 7dB. Night-time operational noise levels are predicted to exceed the impact screening criteria for hotels of 45dB LpAeq, 18hr by 2dB. Considering the magnitude of the impacts Common Farm Bed and Breakfast is identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by OSV01-No1 on Map Series SV-05 (Volume 2: CA1 Map Book). Common Farm has also been assessed as a residential dwelling (assessment location ref.: 11042).
- 13.5.28 Bromley Hayes Cattery is located at Rose Cottage, Rileyhill, Lichfield (assessment location ref.: 8003(N)) to the south-west of the Proposed Scheme. A major operational airborne noise effect has been identified based on the change in sound level of greater than 10dB compared to the future baseline sound level. The cottage is a two storey brick building with openable windows providing ventilation. The cottage may also include an office associated with the cattery, which would be sensitive to noise. Daytime operational sound levels at the most exposed façade of the cottage exceed the impact screening criteria for offices of 55dB LpAeq, 16hr by 4dB. Considering the magnitude of the impact, Bromley Hayes Cattery has been identified, on a precautionary basis, as being subject to a significant adverse effect denoted by

OSV01-No2 on Map Series SV-05 (Volume 2: CA1 Map Book). No effect is identified on the animals themselves based upon the assessment approach defined in Annex F210, Volume 5: Appendix SV-001-000. Rose Cottage has also been assessed as a residential dwelling (assessment location ref.: 11040).

- 13.5.29 Rookery Lodge Boarding Kennels/Cattery is located at Rookery Lodge, Rugeley Road, Kings Bromley (assessment location ref.: 8014(N)) to the north-east of the Proposed Scheme. A moderate noise effect has been identified based on the change in sound level at the site of between 5dB and 9dB compared to the future baseline sound level. The lodge is a two storey brick building with operable windows providing ventilation. The lodge may also include an office associated with the cattery, which would also be sensitive to noise. Daytime operational sound levels at the most exposed façade of the lodge are predicted to exceed the impact screening criteria for offices of 55dB LpAeq, 16hr by 6dB. Considering the magnitude of the impact Rookery Lodge Boarding Kennels/Cattery has been identified, on a precautionary basis, as being subject to a significant adverse effect denoted by OSV01-No3 on Map Series SV-05 (Volume 2: CA1 Map Book). No effect is identified on the animals themselves based upon the assessment approach defined in Annex F210, Volume 5: Appendix SV-001-000. Rookery Lodge has also been assessed as a residential dwelling (assessment location ref.: 11069).
- 13.5.30 The Four Seasons Nature Study Centre on Kings Bromley Lane, Staffordshire is operated by CHADS²¹². The centre is located to the south of the Proposed Scheme, and consists of a hall, which is used by the group and is also available for hire, and outside activity areas. The main building has been assessed against the hall criteria and the outside activity areas against the external amenity criteria. A moderate noise effect has been identified based on the change in sound level at the site of between 5dB and 9dB compared to the future baseline sound level. The nature centre is a one storey brick building with operable windows providing ventilation. Daytime operational sound levels at the most exposed façade of the lodge are predicted to exceed the impact screening criteria for a hall of 50 dB LpAeq,16hr by 9dB, and the external activity areas are predicted to exceed the impact screening criteria of 55dB LpAeq,16hr by 4dB. Considering the magnitude of the impact Four Season Nature Study Centre has been identified, on a precautionary basis, as being subject to a significant adverse effect denoted by OSV01-No4 on Map Series SV-05 (Volume 2: CA1 Map Book).
- 13.5.31 Ridware Theatre, Pipe Ridware (assessment location ref.: 11089(N)) is located to the south-west of the Proposed Scheme. A major noise effect has been identified based on the change in sound level at the site based on the change in sound level of greater than 10dB compared to the future baseline sound level. The theatre is in a converted chapel constructed of masonry walls with single glazed stained glass windows. Operational noise levels are predicted to exceed the daytime impact screening criteria of 50dB LpAeq, 16hr by 10dB. Considering the magnitude of the impact, Ridware Theatre has been identified, on a precautionary basis, as being subject to a significant adverse effect denoted by OSV01-No5 on Map Series SV-05 (Volume 2: CA1 Map Book).
- 13.5.32 At Woodhouse Farm, Pipe Ridware there is a committed development for seven holiday cottages (CD ref: 15/00940/COU), assessment location ref.: 11231(N)). The

development is located to the north-west of the Proposed Scheme. A major noise effect been identified based on the change in sound level of greater than 10dB compared the future baseline sound level. Daytime operational sound levels at the closest boundary of the site to the railway are predicted to exceed the impact screening criteria for hotels of 50 dB LpAeq, 16hr by 9dB. Night-time operational sound levels exceed the impact screening criteria for hotels of 45 dBLpAeq, 8hr by 4dB. Considering the magnitude of the impact, this development has been identified, on a precautionary basis, as being subject to a significant adverse effect denoted by OSV01-No6 on Map Series SV-05 (Volume 2: CA1 Map Book).

- 13.5.33 The assessment of operational noise and vibration indicates that significant effects are likely on the non-residential receptor identified in Table 27. The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis. Further information can be found in Volume 5: Appendix SV-002-001.

Table 27: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number ²²⁵	Type of significant effect and source	Time of day	Location and details
OSV01-No1	Major adverse effect on activity and sleep disturbance to patrons of bed and breakfast accommodation resulting from operational airborne sound.	Daytime and night-time	Common Farm Bed and Breakfast, Rileyhill, Lichfield
OSV01-No2	Major adverse effect on office activities due to increased sound levels from the operation of the new railway.	Daytime	Bromley Hayes Cattery located at Rose Cottage, Rileyhill, Lichfield
OSV01-No3	Moderate adverse effect on office activities due to increased sound levels from the operation of the new railway.	Daytime	Rookery Lodge Boarding Kennels/Cattery at Rookery Lodge, Rugeley Road, Kings Bromley
OSV01-No4	Moderate adverse effect on individuals within the hall and the external activity areas due to increased sound levels from the operation of the new railway.	Daytime	Four Season Nature Study Centre, Kings Bromley Lane
OSV01-No5	Major deterioration of the acoustic quality in the theatre due to increased sound levels from the operation of the new railway.	Daytime and evening	Ridware Theatre, Pipe Ridware
OSV01-No6	Major activity disturbance and sleep disturbance to patrons of proposed holiday cottages resulting from operational airborne sound.	Daytime and night-time	Committed development for seven holiday cottages at Woodhouse Farm, Pipe Ridware

Non-residential receptors: indirect effects

- 13.5.34 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely residual significant effects

- 13.5.35 At individual residences, the mitigation measures, including noise insulation, will reduce noise inside all dwellings such that it will not reach a level where it will

²²⁵ See Map Series SV-05 (Volume 2: CA1 Map Book).

significantly affect residents and therefore no likely residual significant effects are identified.

13.5.36 At the community level the envisaged mitigation, including landscape earthworks and noise mitigation, described in this section, and presented in Map Series SV-05 (Volume 2: CA1 Map Book), will substantially reduce the potential airborne sound impacts and noise effects that would otherwise arise from the Proposed Scheme. Likely significant adverse airborne noise effects due to increased noise levels around the following communities have been identified:

- Rileyhill: occupants of residential properties in the vicinity of Shaw Lane, Crawley Lane and Rugeley Road identified by OSV01-Co1 on Map SV-05-102;
- Nethertown: occupants of residential properties in Nethertown by OSV01-Co2 on Map SV-05-102;
- Pipe Ridware: occupants of residential properties in the vicinity of Pipe Ridware identified by OSV01-Co3 on Map SV-05-103;
- Hadley Gate: occupants of residential properties in the vicinity of Hadley Gate identified by OSV01-Co4 on Map SV-05-104;
- Colton: occupants of residential properties in the vicinity of the High Street and Narrow Lane identified by OSV01-Co5 on Map SV-05-104; and,
- Stockwell Heath and surrounds: occupants of residential properties and their shared community open spaces in the vicinity of Moor Lane and Hamley House identified by OSV01-Co6 on Map SV-05-104.

13.5.37 The assessment has identified a likely significant airborne noise effect at the following non-residential receptors, identified in Map Series SV-05 (Volume 2: CA1 Map Book):

- Common Farm bed and breakfast, Rileyhill, Lichfield identified by OSV01-No2 on Map SV-05-102;
- Bromley Hayes Cattery, Rileyhill, Lichfield identified by OSV01-No2 on Map SV-05-102;
- Rookery Lodge Boarding Kennels/Cattery, Rugeley Road, Kings Bromley, Burton-On-Trent identified by OSV01-No3 on Map SV-05-102;
- Four Seasons Nature Study Centre, Kings Bromley Lane, identified by OSV01-No4 on Map SV-05-102;
- Ridware Theatre, Pipe Ridware, Rugeley identified by OSV01-No5 on Map SV-05-103; and
- a committed development for seven holiday cottages at Woodhouse Farm, Pipe Ridware, identified by OSV01-No6 on Map SV-05-103.

13.5.38 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures.

Cumulative effects

- 13.5.39 The operational assessment, presented in the preceding sections and reported in detail in Volume 5: Appendix SV-002-001 includes train movements associated with both HS2 Phase One and the Proposed Scheme. Furthermore, the baseline sound levels used in the assessment explicitly ignores any increase in sound levels as a result of HS2 Phase One. Therefore, the cumulative noise effects of both Phase One and the Proposed Scheme are already considered in the assessment. It is not anticipated that there will be any additional significant noise effects to those identified in the assessment above during the operation of the Proposed Scheme.

Monitoring

- 13.5.40 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 13.5.41 Operational noise and vibration monitoring will be carried out at different times during the lifetime of the Proposed Scheme at a combination of carefully selected monitoring locations including: adjacent or attached to moving vehicles, at fixed positions or in the vicinity of individual assets; and locations within the surrounding areas and communities alongside the railway corridor.
- 13.5.42 The expected noise and vibration performance of the Proposed Scheme, operational noise and vibration measurement data, associated asset information, description of corrective actions, results of measured performance compared to expected conditions, and monitoring reports will be shared with the relevant local authorities at appropriate intervals.

14 Traffic and transport

14.1 Introduction

- 14.1.1 This section describes the likely impacts on all forms of transport and the consequential significant effects on transport users arising from the construction and operation of the Proposed Scheme through the Fradley to Colton area. The effects on traffic and transport are assessed quantitatively, based on existing baseline traffic conditions and future scenarios.
- 14.1.2 Engagement with Highways England and Staffordshire County Council (SCC) has been undertaken. An important focus of this engagement has been to obtain relevant baseline information.
- 14.1.3 A detailed report on traffic and transport impacts and surveys undertaken within the Fradley to Colton area is contained in Volume 5: Appendix TR-001-000: Transport Assessment.
- 14.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 14.1.5 Maps showing traffic and transport significant effects during construction (Map Series TR-03) and operation (Map Series TR-04) and construction traffic routes to compounds (Map Series TR-08) can be found in Volume 5: Traffic and transport Map Book.
- 14.1.6 In addition, further traffic survey data is set out in Background Information and Data (BID)²²⁶, (see BID-TR-001-000: Traffic assessment baseline data).

14.2 Scope, assumptions and limitations

- 14.2.1 The scope, key assumptions and limitations for the traffic and transport assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)²²⁷ and the SMR Addendum²²⁸.
- 14.2.2 The study area for traffic and transport includes all roads affected by the Proposed Scheme including: the A38 Rykneld Street; the A5192 Eastern Avenue; the A515 Lichfield Road; the A513 Rugeley Road; the A51 Stafford Road; the B5014 Uttoxeter Road; the B5013 Uttoxeter Road; and local roads serving the settlements of Kings Bromley, Handsacre, Armitage, Colton and Stockwell Heath.
- 14.2.3 The baseline forecast traffic flows for the future years of assessment have been derived using the Department for Transport's (DfT) traffic forecasting tool, Trip End Model Presentation Program (TEMPro). The assessment covers the average weekday morning (08:00-09:00) and evening (17:00-18:00) peak periods.

²²⁶ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2

²²⁷ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

²²⁸ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

- 14.2.4 Since it is not possible to forecast how services may change in the future, it has been assumed that bus services for the future years of assessment will be the same as those currently operating.
- 14.2.5 Forecast future year traffic flows with and without the Proposed Scheme have been based on an approach that does not take account of wider effects such as redistribution and reassignment of traffic. It is unlikely that these wider changes would affect the conclusions drawn in this section.

14.3 Environmental baseline

Existing baseline

- 14.3.1 Existing conditions in the study area have been determined through site visits, traffic and transport surveys, liaison with Highways England and SCC (including provision of information on public transport, public right of way (PRoW) and accident data) and desktop analysis.

Surveys

- 14.3.2 Traffic surveys, comprising automatic traffic counts, junction turning counts and queue surveys, of roads crossing the route of the Proposed Scheme or potentially affected by the Proposed Scheme were undertaken in: November and December 2015; February, March, July and November 2016; and March and April 2017. This data has been supplemented by existing traffic data from other sources where available, including from Highways England and SCC. Assessment of the data indicates that the peak hours in the area are 08:00-09:00 and 17:00-18:00.
- 14.3.3 PRoW surveys were undertaken in May, June, July and November 2016 and April 2017 to establish their nature and usage by non-motorised users (pedestrians, cyclists and equestrians). The surveys included all PRoW and roads that will cross the route of the Proposed Scheme, and any additional PRoW and roads that may be affected by the Proposed Scheme. The majority of the surveys were undertaken during the weekend, when usage is expected to be highest, but some were undertaken on a weekday where routes may be influenced by commuting or other localised uses.

Highway network

- 14.3.4 There are no strategic routes in the Fradley to Colton area. However, the A38 Rykneld Street, which is part of the strategic road network, passes approximately 2.5km to the east of the route of the Proposed Scheme and will cross HS2 Phase One to the south-east. The A38 Rykneld Street runs in a north-south direction and is the main route into Birmingham in the south and Burton upon Trent and Derby in the north and has connections to Lichfield, Alrewas and Fradley.
- 14.3.5 There are two primary 'A' roads in the Fradley to Colton area, these are: the A515 Lichfield Road, which connects Kings Bromley with Lichfield; and the A51 Stafford Road, which connects Lichfield with Stone via Rugeley. The strategic and primary road network, particularly around Lichfield, can get busy at peak times and delays can be experienced.
- 14.3.6 The main local roads that will be affected by the Proposed Scheme are: the A513 Rugeley Road, which is an east-west link connecting Rugeley with Alrewas; the B5014

Uttoxeter Road, which is a north-south link connecting the settlements of Blithbury, Abbots Bromley, Handsacre and Hill Ridware to Uttoxeter in the north and Lichfield in the south; the B5013 Uttoxeter Road, which is a north-south link connecting Uttoxeter with Rugeley via Admaston; the A5192 Eastern Avenue, which connects the A38 Rykneld Street with the A51 Stafford Road; and Wood End Lane, which connects the A38 Rykneld Street with the A515 Lichfield Road. The local road network in this area generally operates well although some localised delays can be experienced, particularly at peak times.

- 14.3.7 Relevant accident data for the road network subject to assessment has been obtained from SCC. Data for the three year period (2012 to 2015²²⁹) has been assessed and any identified clusters have been examined. No substantial accident clusters were identified within the Fradley to Colton area.
- 14.3.8 The Proposed Scheme will cross 12 roads and roadside footways within the Fradley to Colton area, these are: Common Lane; the A515 Lichfield Road; Shaw Lane; the A513 Rugeley Road; Pipe Lane, also known locally as Pipe Wood Lane (twice); Dawson Lane; the B5014 Uttoxeter Road; Blithbury Road; Hadley Gate Lane; Newlands Lane (twice); Moor Lane; and the B5013 Uttoxeter Road.

Parking and loading

- 14.3.9 There is no designated parking or loading identified in the Fradley to Colton area that is expected to be impacted by the Proposed Scheme. Consequently, this topic is not considered further in this assessment.

Public transport network

- 14.3.10 Bus services in the Fradley to Colton area operate out of Lichfield city centre, which acts as a hub for local bus services. The only road on which services operate that crosses the route of the Proposed Scheme is the B5013 Uttoxeter Road, which is served by one service (number 825) that provides connections to Stafford, Rugeley, Lichfield, Handsacre and Stockwell Heath.
- 14.3.11 There are bus stops located to serve the main built-up areas. Where bus stops are expected to be affected by either the construction or operation of the Proposed Scheme these are referred to in the relevant assessment sections.
- 14.3.12 National and local rail services are accessible via Lichfield Trent Valley Station and local rail services are accessible via Rugeley Trent Valley Station. Lichfield Trent Valley Station provides access to national services between London, Manchester and Glasgow. Both Lichfield Trent Valley and Rugeley Trent Valley provide access to local services into Birmingham New Street.

Non-motorised users

- 14.3.13 There are pedestrian footways adjacent to many of the roads in the built up areas of Kings Bromley, Handsacre, Armitage, Colton and Stockwell Heath. Footways vary in

²²⁹ Represents the last full year of data available at the time of undertaking the assessment.

width and condition within these areas. Where there is no formal footway provision adjacent to a road, non-motorised user numbers are generally low.

- 14.3.14 The route of the Proposed Scheme will cross the existing route of 12 PRow. A further 14 PRow in the Fradley to Colton area will be affected either temporarily or permanently due to, for example, temporary diversion of PRow during construction and permanent upgrades for maintenance access to the Proposed Scheme. The surveys undertaken to inform the assessment showed that there were fewer than 10 people a day recorded on most of the PRow in the area. The route with the greatest usage was Mavesyn Ridware Footpath 40 with 29 users observed during the survey day.
- 14.3.15 In the Fradley to Colton area, National Route 54 (part of the National Cycle Network) passes through the area including along part of Wood End Lane as well as crossing A5192 Eastern Avenue. The towpath of the Trent and Mersey Canal, to the north of Handsacre and Armitage, also provides an off-road cycle route and there are a number of advisory cycle routes²³⁰, including the B5014 Uttoxeter Road between Handsacre and Blithbury. In the areas of Colton and Stockwell Heath there are networks of advisory cycle routes, including the High Street between Colton and Stockwell Heath.

Waterways and canals

- 14.3.16 There are two navigable waterways in the Fradley to Colton area, the Trent and Mersey Canal and the Coventry Canal, which meet at Fradley Junction. Kings Bromley Marina, is located at Bromley Hayes approximately 1.2km south-west of the route of the Proposed Scheme and has capacity for up to 275 boats.

Air transport

- 14.3.17 There is no relevant air transport in the Fradley to Colton area. Consequently, this topic is not considered further in this assessment.

Future baseline

- 14.3.18 The future baseline traffic volumes have been calculated by applying growth factors derived from TEMPro for the future years of 2023, 2027 and 2041. These represent the construction assessment year (2023), the year of opening (2027) and future assessment year (2041). Growth factors from TEMPro have been checked to ensure that committed developments are appropriately reflected in the growth forecasts.
- 14.3.19 The committed development at the land near Royal Oak, B5014 Uttoxeter Road, Hill Ridware (reference: 14/00147/OUTM) is not included in TEMPro and has consequently been added into the growth forecasts for this assessment.
- 14.3.20 HS2 Phase One has commenced construction and will be operational in 2026. There is the potential for a six year period during which construction of the Proposed Scheme and HS2 Phase One are both under way, with the Proposed Scheme becoming operational in 2027, one year after HS2 Phase One. The main assessment has included the predicted traffic associated with the construction stage of HS2 Phase One as part

²³⁰ Advisory cycle routes are locally promoted routes for use by cyclists that do not generally have any formal cycle infrastructure provision, such as cycle lanes.

of the future baseline. The cumulative assessment reports the effects of the Proposed Scheme and HS2 Phase One compared to a future baseline without either.

- 14.3.21 There are no known planned substantial changes to the transport network in the Fradley to Colton area.

Construction (2023)

- 14.3.22 Construction of the Proposed Scheme is expected to commence in 2020 with construction activity continuing to 2027 (although activity in 2027 will be limited to testing and commissioning). Construction activities have been assessed against 2023 baseline traffic flows, irrespective of when they occur during the construction period. The year 2023 has been adopted as a common base year and the impact of individual or overlapping activities are considered against this single year. The year 2023 broadly represents the likely peak period during construction of the Proposed Scheme and is therefore considered to be reasonably representative.
- 14.3.23 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 10% by 2023 compared to the baseline year of 2016.

Operation (2027 and 2041)

- 14.3.24 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 14% by 2027 compared to the baseline year of 2016.
- 14.3.25 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 29% by 2041 compared to the baseline year of 2016.
- 14.3.26 There is no traffic associated with the operation of HS2 Phase One that needs to be included in the future baseline in this area as there are no HS2 stations or depots proposed that would impact on the future baseline in this area and the maintenance of HS2 Phase One will generate a limited number of vehicular trips.

14.4 Effects arising during construction

Avoidance and mitigation measures

- 14.4.1 The following measures are proposed to avoid or reduce effects on transport users:
- new highways (roads and PRow) will be constructed and operational prior to the permanent closure of any existing highways, insofar as reasonably practicable;
 - the majority of roads crossing the route of the Proposed Scheme will be maintained or locally diverted during construction to limit the need for diversions of traffic onto alternative routes;
 - traffic management measures will be implemented to limit any disruption;
 - road closures will be restricted to overnight and weekends, insofar as reasonably practicable;
 - temporary alternative routes for PRow will be provided during construction, insofar as reasonably practicable, where either the existing or final proposed route is not available;

- insofar as reasonably practicable, site haul routes will be created adjacent to the route of the Proposed Scheme to transport construction materials and equipment to reduce heavy goods vehicle (HGV) movements on public roads with access taken via the main road network;
- HGV will be routed, insofar as reasonably practicable, along the strategic and/or primary road network;
- insofar as reasonably practicable, the use of the local road network will be limited to use for site set-up, access for surveys and on-going servicing (including refuse collection and general deliveries to compounds) during construction;
- a temporary railhead will be provided near to Stone in the Stone and Swynnerton area (CA3) to allow construction materials, including excavated materials, and equipment to be transported by the existing rail network. The temporary railhead will include direct access to and from the M6, which will reduce HGV movements on the local road network;
- the reuse of excavated material, insofar as reasonably practicable, along the route of the Proposed Scheme;
- borrow pits in the Fradley to Colton area, Whitmore Heath to Madeley area (CA4) and South Cheshire area (CA5) will limit the volume of construction traffic on the road network;
- highway measures including junction improvements, passing places and carriageway widening will be provided, as required, to manage the safe passing of construction vehicles on construction HGV routes. These are considered in this assessment and Volume 4: Off-route effects;
- the draft Code of Construction Practice²³¹ (CoCP) includes the requirement to develop local traffic management plans which will consider the local traffic management strategy including consideration of sensitive receptors, such that the effect on safety and accidents is not significant; and
- on-site welfare facilities will be provided which will reduce daily travel by site workers.

14.4.2 Section 14 of the draft CoCP includes measures whose purpose is to reduce the impacts and effects of deliveries of construction materials and equipment, including where appropriate timing of site operations and timing of traffic movements.

14.4.3 The number of private car trips to and from the construction compounds (both workforce and visitors) will be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This will be supported by an overarching framework travel plan that will require construction workforce travel plans²³² to be produced that

²³¹ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

²³² Construction and operational travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

will include a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme.

- 14.4.4 The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic. In order to achieve this, general and site specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads and PRow affected by the Proposed Scheme.
- 14.4.5 Site staff and workers will generally arrive before the morning peak hour and depart after the evening peak hour.

Assessment of impacts and effects

Temporary effects

- 14.4.6 The following section considers the impacts on traffic and transport and the likely consequential significant effects resulting from construction of the Proposed Scheme.

Key construction transport issues

- 14.4.7 The traffic and transport impacts during the construction period within the Fradley to Colton area will include:
- road closures and associated realignments and diversions;
 - alternative routes for PRow; and
 - construction vehicle movements to and from the various worksites.
- 14.4.8 The construction assessment has also considered any impacts in the Fradley to Colton area that arise from construction of the Proposed Scheme in the adjoining community areas.
- 14.4.9 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips. Works will include utilities diversions, earthworks, underpass, viaduct, bridge and highway construction.
- 14.4.10 Details of construction compounds are provided in Section 2.3. The locations of the compounds and the associated access routes are shown in the TR-08 Map Series (Volume 5: Traffic and transport Map Book). Table 28 provides a summary of this along with the transport activity at each compound. For each compound the peak month of activity is the month within which HGV traffic is at its highest for that compound. The busy period is the period during which HGV traffic serving that compound will be greater than 50% of the HGV traffic in the peak month. The average daily combined two-way vehicle trips for the busy period is the lower end of the range shown in the table below. The average daily combined two-way vehicle trips for the peak month is the upper end of the range shown in Table 28.

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Table 28: Typical vehicle trip generation for construction sites in the Fradley to Colton area

Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Pyford Brook viaduct satellite compound	Common Lane (South) for site set up and servicing, followed by site haul route thereafter to A515 Lichfield Road	January 2021	3 years and 6 months	4	16-22	87-109
Satellite	Pyford North embankment satellite compound	Common Lane (South) for site set up and servicing, followed by site haul route thereafter to A515 Lichfield Road	January 2021	Civil Engineering - 3 years and 9 months	3	40-55	99-111
			October 2024	Railway System Works - 1 year and 3 months	10	57-84	up to 10
Transfer node	Transfer node associated with Pyford North embankment satellite compound	A515 Lichfield Road	January 2021	4 years and 3 months	4	N/A	1,135-1,367
Satellite	Bourne embankment satellite compound	A513 Rugeley Road and on to the A515 Lichfield Road	January 2021	4 years and 3 months	4	64-88	86-107
Transfer node	Transfer node associated with Bourne embankment satellite compound	A513 Rugeley Road and on to the A515 Lichfield Road	January 2021	4 years and 3 months	11	N/A	339-474
Satellite	River Trent viaduct satellite compound	A513 Rugeley Road and on to the A515 Lichfield Road	January 2021	4 years 3 months	16	88-121	73-106

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Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Pipe Ridware embankment satellite compound	Access via diverted Pipe Lane for site set up and servicing, followed by site haul route thereafter to B5014 Uttoxeter Road, A513 Rugeley Road and on to A515 Lichfield Road	January 2021	Civil Engineering - 3 years and 9 months	3	48-66	96-122
			October 2024	Railway System - 1 year and 3 months	10	57-84	up to 10
Satellite	Blithbury crossovers satellite compound	Pipe Lane and site haul route to B5014 Uttoxeter Road, A513 Rugeley Road and on to A515 Lichfield Road	April 2025	9 months	3	18-30	up to 10
Satellite	Blithbury Central cutting satellite compound	Blithbury Road and site haul route to B5014 Uttoxeter Road, A513 Rugeley Road and on to A515 Lichfield Road	January 2021	3 years and 6 months	6	48-66	85-109
Satellite	Blithbury North cutting satellite compound	Newlands Lane and site haul route to B5014 Uttoxeter Road, A513 Rugeley Road and on to A515 Lichfield Road	January 2021	4 years	15	112-154	68-88
Satellite	Newlands Lane auto-transformer feeder station satellite compound	Newlands Lane to Hollow Lane, Blithbury Road, B5014 Uttoxeter Road, A513 Rugeley Road and on to A515 Lichfield Road	January 2024	2 years	18	85-158	up to 10

Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Stockwell Heath cutting satellite compound	B5013 Uttoxeter Road and on to the A51 Stafford Road	January 2021	4 years and 3 months	4	40-55	66-87
Satellite	Moreton Brook viaduct satellite compound	B5013 Uttoxeter Road and then via the site haul route constructed to the north of the route	January 2021	4 years and 3 months	2	08-11	67-82

- 14.4.11 Information on the indicative construction programme is provided in Section 2.3 and the construction methodology is summarised in Volume 1 (Section 6). This illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 28.
- 14.4.12 Where construction routes serve more than one construction compound, the combined vehicle movements during the busiest period for each section of each route have been assessed.

Highway network

Strategic and local road network traffic

- 14.4.13 Temporary road or lane closures and associated diversions will be required in a number of locations including: the A515 Lichfield Road; Shaw Lane; the A513 Rugeley Road; Pipe Lane; the B5014 Uttoxeter Road; Blithbury Road; Hadley Gate Lane; Newlands Lane; the B5013 Uttoxeter Road; and Jonghams Lane. In most cases, these works will be restricted to short-term overnight and/or weekend closures, and are not, therefore, considered significant. Where works are of a longer duration and/or have a significant effect, these are addressed below.
- 14.4.14 In order to facilitate the construction of the Kings Bromley viaduct and the realignment of Shaw Lane, a temporary closure of Shaw Lane for one year and six months will be implemented, with an alternative diversion route available via the existing A515 Lichfield Road and the A513 Rugeley Road. The temporary diversion (adding up to 600m to journeys) will not have a significant effect on traffic flows and delays for vehicle occupants, but will impact on non-motorised users and the effect on these is considered in the relevant section.
- 14.4.15 Construction works associated with the River Trent viaduct will require a short section of the A513 Rugeley Road to be temporarily diverted over a length of 250m for a period of up to six months before returning to its existing alignment. The temporary

diversion will not have a significant effect on traffic flows and delays for vehicle occupants.

- 14.4.16 Where site haul routes, created adjacent to the route of the Proposed Scheme, cross the existing road network, traffic control measures will be implemented and could include the provision of temporary signals or roundabouts, which will be removed upon completion of the works. Short-term lane restrictions will be required in some locations to implement access points for construction vehicles. These traffic control measures are not likely to have a significant effect on traffic flows and delays for vehicle occupants.
- 14.4.17 Construction of the Proposed Scheme is forecast to result in changes in daily traffic flows due to the movement of excavated or fill material and construction vehicles accessing construction compounds and also temporary road closures and diversions.
- 14.4.18 These changes in traffic flow, which includes HS2 Phase One construction traffic in the future baseline, will lead to increases in delays to vehicle users and congestion²³³, which are significant, at the following junctions:
- A5192 Eastern Avenue/A5127 Trent Valley Road roundabout – major adverse effect;
 - B5014 Lichfield Road/A515 Tewnals Lane – major adverse effect;
 - A515 Lichfield Road/Wood End Lane – minor adverse effect;
 - A51 Stafford Road/A513 Rugeley Road/Armitage Road roundabout – minor adverse effect;
 - A51 Stafford Road/Borough Lane – major adverse effect;
 - A51 Stafford Road/Breretonhill Lane – major adverse effect; and
 - A5192 Eastern Avenue/A51 Stafford Road signals – moderate adverse effect.
- 14.4.19 Junction assessments have been undertaken against the peak month flows and include robust assumptions on the level of construction traffic in the peak hours. The temporary effects identified are considered to be the reasonable worst case and HS2 Ltd will continue to work with the relevant highway authorities to manage the impacts at these locations.
- 14.4.20 Construction of the Proposed Scheme will result in substantial increases in traffic flows (i.e. more than 30% for HGV or all vehicles) in some locations, which can lead to traffic-related severance²³⁴ for non-motorised users from increases in either all traffic (including Proposed Scheme worker trips, LGV and HGV traffic) or HGV traffic. The

²³³ In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows on a road link will be beyond or very close to capacity with the Proposed Scheme and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis at peak times. A moderate adverse effect will occur when traffic flows on a road link will be approaching or at capacity with the Proposed Scheme and modest increases in traffic will increase the frequency of queues and more substantial delays. A minor adverse effect occurs when traffic flows on a road link are not generally exceeding capacity with the Proposed Scheme but the increase in flows will result in occasional queues and delays or small increases in existing delays.

²³⁴ In the context of this Traffic and transport section, severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

effect reported below for each road is the most significant traffic-related severance effect for non-motorised users:

- A51 Stafford Road between the A5192 Eastern Avenue and the boundary with the Colwich to Yarlet area (CA2), close to the A460 Wolseley Road – major adverse effect as a result of an increase in HGV traffic;
- A515 Lichfield Road between the A51 Stafford Road and the Proposed Scheme – major adverse effect as a result of an increase in HGV traffic;
- A513 Rugeley Road/Kings Bromley Lane between Shaw Lane and the B5014 Uttoxeter Road – major adverse effect as a result of an increase in HGV traffic;
- B5014 Uttoxeter Road between Stonyford Lane and the Proposed Scheme – moderate adverse effect as a result of an increase in HGV traffic;
- B5014 Uttoxeter Road between Stonyford Lane and Common Lane – major adverse effect as a result of an increase in HGV traffic;
- B5014 Uttoxeter Road between the A513 Rugeley Road and Common Lane – moderate adverse effect as a result of an increase in HGV traffic;
- B5013 Uttoxeter Road between the Proposed Scheme and Bellamour Lane – minor adverse effect as a result of an increase in HGV traffic;
- Blithbury Road between the B5014 Uttoxeter Road and Hollow Lane – moderate adverse effect as a result of an increase in all traffic;
- Newlands Lane between the B5014 Uttoxeter Road and the Proposed Scheme – moderate adverse effect as a result of an increase in all traffic;
- Dawson Lane between Pipe Lane and the Proposed Scheme – moderate adverse effect as a result of an increase in all traffic;
- Pipe Lane between School Lane and Pipe Wood Lane – moderate adverse effect as a result of an increase in all traffic;
- Common Lane between the A515 Lichfield Road and the Proposed Scheme – moderate adverse effect as a result of an increase in HGV traffic; and
- Hollow Lane between Blithbury Road and Colton Bridleway 33 – major adverse effect as a result of an increase in all traffic.

14.4.21

Utilities works have been assessed in detail where they are major and where the traffic and transport impacts from the works separately, or in combination with other works, will be greater than other construction activities arising within the area. Minor utilities works are expected to result in only localised traffic and pedestrian diversions, which will be of short-term duration. No additional significant effects from these minor utilities works are expected. Similarly, other minor works will involve a low level of use of local roads. Such use is not expected to give rise to significant construction traffic impacts.

Accidents and safety

- 14.4.22 The effect of the Proposed Scheme on accident and safety risks will not be significant as there are no locations where there are both accident clusters and substantial increases in traffic during construction.

Public transport network

- 14.4.23 Construction of the Proposed Scheme is not expected to have a significant effect on bus service operations in the Fradley to Colton area as there are no significant temporary road closures or diversions required in this area that would affect bus services or stops.

Non-motorised users

- 14.4.24 The construction works associated with the Proposed Scheme will require the temporary closure or diversion/realignment of PRow and roads. In most cases, these will be of a short duration and/or distance and therefore will not have a significant severance effect on users.

- 14.4.25 However, there will be temporary adverse effects, which are significant, on non-motorised users during construction as a result of severance from increased travel distance and/or hindrances such as substantial changes in levels for non-motorised users due to temporary PRow and road realignments or diversions at:

- Kings Bromley Footpath 0.392(a) – moderate adverse effect from increase in distance of up to 1.2km;
- Kings Bromley Footpath 1 – moderate adverse effect from increase in distance of up to 750m;
- Mavesyn Ridware Footpath 7 – minor adverse effect from increase in distance of up to 150m;
- Mavesyn Ridware Footpath 8 – moderate adverse effect from increase in distance of up to 800m;
- Hamstall Ridware Footpath 3 – minor adverse effect from increase in distance of up to 150m;
- Mavesyn Ridware Footpath 32 – minor adverse effect from increase in distance of up to 110m;
- Mavesyn Ridware Footpath 33 – minor adverse effect from increase in distance of up to 450m;
- Colton Footpath 34 – moderate adverse effect from increase in distance of up to 700m;
- Colton Footpath 36 – minor adverse effect from increase in distance of up to 400m;
- Colton Footpath 52 – minor adverse effect from increase in distance of up to 300m; and

- Shaw Lane – moderate adverse effect from increase in distance of up to 2.5km;

14.4.26 With the exception of Kings Bromley Footpath 0.392(a), Kings Bromley Footpath 1, Mavesyn Ridware Footpath 8, Colton Footpath 34 and Shaw Lane, the changes in travel distance on the PRoW and road realignments or diversion are less than 500m.

Waterways and canals

14.4.27 The construction of the Proposed Scheme will not have a significant effect upon navigable waterways or canals in the Fradley to Colton area.

Permanent effects

14.4.28 Any permanent effects of construction have been considered in the assessment of operation for traffic and transport. This is because the impacts and effects of ongoing increases in travel demand and the wider impacts and effects of the operations phase need to be considered together.

Other mitigation measures

14.4.29 The implementation of the draft CoCP, in combination with the construction workforce travel plan will mitigate the transport-related effects during construction of the Proposed Scheme.

Summary of likely residual significant effects

14.4.30 The most intensive peak periods of construction for the Proposed Scheme will cause increases in traffic that will from time to time cause significant adverse effects through additional congestion and/or increased delays for road users at: A5192 Eastern Avenue/A5127 Trent Valley Road roundabout (major adverse); B5014 Lichfield Road/A515 Tewnals Lane (major adverse); A515 Lichfield Road/Wood End Lane (minor adverse); A51 Stafford Road/A513 Rugeley Road/Armitage Road roundabout (minor adverse); A51 Stafford Road/Borough Lane (major adverse); A51 Stafford Road/Breretonhill Lane (major adverse); and A5192 Eastern Avenue/A51 Stafford Road signals (moderate adverse).

14.4.31 During the construction period there will be increases in traffic which will increase traffic related severance for non-motorised users at: the A51 Stafford Road between the A5192 Eastern Avenue and the boundary with the Colwich to Yarlet area (CA2), close to the A460 Wolseley Road (major adverse); the A515 Lichfield Road between the A51 Stafford Road and the Proposed Scheme (major adverse); the A513 Rugeley Road/Kings Bromley Lane between Shaw Lane and the B5014 Uttoxeter Road (major adverse); the B5014 Uttoxeter Road between Stonyford Lane and the Proposed Scheme (moderate adverse); the B5014 Uttoxeter Road between Stonyford Lane and Common Lane (major adverse); the B5014 Uttoxeter Road between the A513 Rugeley Road and Common Lane (moderate adverse); the B5013 Uttoxeter Road between the Proposed Scheme and Bellamour Lane (minor adverse); Blithbury Road between the B5014 Uttoxeter Road and Hollow Lane (moderate adverse); Newlands Lane between the B5014 Uttoxeter Road and the Proposed Scheme (moderate adverse); Dawson Lane between Pipe Lane and the Proposed Scheme (moderate adverse); Pipe Lane between School Lane and Pipe Wood Lane (moderate adverse); Common Lane between the A515 Lichfield Road and the Proposed Scheme (moderate adverse); and Hollow Lane between Blithbury Road and Colton Bridleway 33 (major adverse).

- 14.4.32 There will be temporary adverse significant effects due to increased travel distance during construction on non-motorised users of: Kings Bromley Footpath 0.392(a) (moderate adverse); Kings Bromley Footpath 1 (moderate adverse); Mavesyn Ridware Footpath 7 (minor adverse); Mavesyn Ridware Footpath 8 (moderate adverse); Hamstall Ridware Footpath 3 (minor adverse); Mavesyn Ridware Footpath 32 (minor adverse); Mavesyn Ridware Footpath 33 (minor adverse); Colton Footpath 34 (moderate adverse); Colton Footpath 36 (minor adverse); Colton Footpath 52 (minor adverse); and Shaw Lane (moderate adverse).

Cumulative effects

- 14.4.33 The assessment includes the cumulative effects of planned and committed development during construction by taking this into account within the background traffic growth. The assessment reported above also includes construction traffic related to HS2 Phase One within the future baseline.
- 14.4.34 The assessment also takes into account Proposed Scheme construction traffic and transport impacts of works to construct the Proposed Scheme being undertaken in neighbouring community areas.

The Proposed Scheme and HS2 Phase One

- 14.4.35 In addition to the assessment above, an assessment has been undertaken of the effects of the Proposed Scheme and HS2 Phase One compared to a future baseline without either. Insofar as reasonably practicable, construction traffic routes have been chosen for the Proposed Scheme to use roads which would not be used by HS2 Phase One and thereby avoid or limit the cumulative impacts of the two schemes. As a result, there are no junctions where construction traffic associated with the Proposed Scheme and HS2 Phase One in combination will result in new or different significant effects, in relation to delays to vehicle users and congestion when compared to those reported in the HS2 Phase One ES.
- 14.4.36 Construction of the Proposed Scheme and HS2 Phase One in combination will result in new or different significant increases in traffic-related severance for non-motorised users compared to the effects reported in the main assessment. This is due to an overlap in worker trips from HS2 Phase One and the Proposed Scheme at the following locations:
- Blithbury Road between the B5014 Uttoxeter Road and Hollow Lane – major adverse effect as a result of increase in all construction traffic; and
 - Pipe Lane between Blithbury Road and the Proposed Scheme – moderate adverse effect as a result of an increase in all construction traffic.

14.5 Effects arising from operation

Avoidance and mitigation measures

- 14.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:
- reinstatement of roads on or close to their existing alignments; and
 - replacement, diversion or realignment of PRoW.

Assessment of impacts and effects

- 14.5.2 The following section considers the impacts on traffic and transport and the likely consequential effects resulting from the operational phase of the Proposed Scheme.

Key operation transport issues

- 14.5.3 The operation and maintenance of the Proposed Scheme will generate a limited number of vehicular trips and the effect will not be significant.
- 14.5.4 The operational effects are therefore limited to road closures and the permanent diversion and realignment of roads and PRoW.

Highway network

Strategic and local road network traffic

Operation (2027)

- 14.5.5 The Proposed Scheme will require the permanent widening, diversion or realignment of: Crawley Lane; the A515 Lichfield Road; Shaw Lane; Dawson Lane; Pipe Lane; the B5014 Uttoxeter Road; Blithbury Road; Stonyford Lane; Hadley Gate Lane; Hollow Lane; Newlands Lane (twice); Moor Lane; the B5013 Uttoxeter Road; and Jonghams Lane. The diversions or realignments are less than 1km in length and will not result in any significant effects with regard to increased journey times for vehicle occupants.
- 14.5.6 Common Lane will be intersected by the route of the Proposed Scheme and a section will be permanently stopped-up on both sides of the route. Common Lane is an unclassified road that provides access to a number of farm buildings in the vicinity of Bromley Hayes. Accommodation access for farm vehicles will be maintained under the Kings Bromley viaduct reducing the need for farm-related traffic to divert via Crawley Lane and the A515 Lichfield Road. The stopping-up will lead to an increase in travel distance for vehicle occupants of up to 4km for general traffic and result in a minor adverse traffic delay effect, which is significant, due to increased journey times for vehicle occupants. The impact on non-motorised users of Common Lane is considered below.
- 14.5.7 The stopping-up of Common Lane will result in a small increase in traffic at the A515 Lichfield Road/Crawley Lane junction, but this will not result in any significant effect.

Operation (2041)

- 14.5.8 The 2041 future operational traffic impacts will not change the effects assessed in 2027 in the Fradley to Colton area.

Accidents and safety

- 14.5.9 The effect on accident and safety risk is not significant as there are no locations in the Fradley to Colton area where there are substantial forecast increases in traffic due to the operation of the Proposed Scheme.

Public transport network

- 14.5.10 The permanent realignment of the B5013 Uttoxeter Road will increase travel distances for bus passengers. However, as the realignment is less than 1km in length, there will be no significant effects on public transport within the Fradley to Colton area.

Non-motorised users

- 14.5.11 There will be permanent widening, realignment, diversion or extension of 19 PRow (including one Byway Open to All Traffic (BOAT)) and 14 roads in the Fradley to Colton area that will have an impact on travel distances or introduce hindrances such as substantial changes in levels for non-motorised users.
- 14.5.12 There will be adverse effects, which are significant, on non-motorised users of 10 of these PRow and roads as a result of severance from increased travel distance and/or hindrances. These are:
- Kings Bromley Footpath 1 – minor adverse effect from increase in distance of up to 500m;
 - Mavesyn Ridware Footpath 38 – minor adverse effect from increase in distance of up to 250m and diversion via an overbridge;
 - Mavesyn Ridware Footpath 8 – moderate adverse effect from increase in distance of up to 600m and diversion via an overbridge;
 - Mavesyn Ridware Footpath 33 – minor adverse effect from increase in distance of up to 100m;
 - Colton Footpath 34 – minor adverse effect from increase in distance of up to 350m;
 - Colton Footpath 36 – moderate adverse effect from increase in distance of up to 500m and diversion via an underbridge;
 - Common Lane – moderate adverse effect from increase in distance of up to 2.5km;
 - Pipe Lane – minor adverse effect from increase in distance of up to 500m;
 - Hadley Gate Lane – moderate adverse effect from increase in distance of up to 700m; and
 - Moor Lane – minor adverse effect from increase in distance of up to 200m and diversion via an underbridge.
- 14.5.13 With the exception of Mavesyn Ridware Footpath 8, Colton Footpath 36, Common Lane, Pipe Lane, and Hadley Gate Lane, the changes in travel distance on the PRow and road realignments or diversion are less than 500m.
- 14.5.14 The realignment of Stonyford Lane and Blithbury Road results in shorter journey distance. For users of Stonyford Lane the reduction will be up to 160m and there will be a minor beneficial severance effect, which is significant, on the non-motorised users of the route.

Waterways and canals

- 14.5.15 The Proposed Scheme will not have a traffic and transport significant effect on the operation of the waterways and canals in the Fradley to Colton area.

Other mitigation measures

- 14.5.16 No further mitigation measures are considered necessary during operation of the Proposed Scheme based on the outcome of this assessment.

Summary of likely residual significant effects

- 14.5.17 There will be a minor adverse traffic delay effect due to increased journey times for vehicle occupants as a result of the stopping-up of Common Lane.
- 14.5.18 There will be moderate adverse severance effects due to increased travel distance and/or additional hindrances to travel on the non-motorised users of: Mavesyn Ridware Footpath 8; Colton Footpath 36; Common Lane; and Hadley Gate Lane.
- 14.5.19 There will be minor adverse severance effects on the non-motorised users of: Kings Bromley Footpath 1; Mavesyn Ridware Footpath 38; Mavesyn Ridware Footpath 33; Colton Footpath 34; Pipe Lane; and Moor Lane.
- 14.5.20 There will be a minor beneficial severance effect on the non-motorised users of Stonyford Lane.

Cumulative effects

- 14.5.21 The assessment includes cumulative effects of planned and committed development during operation, by taking into account background traffic growth in the future baseline.
- 14.5.22 Operation of the Proposed Scheme will not have any cumulative effects as a result of the combined impact of the operation of the Proposed Scheme with HS2 Phase One.

Monitoring

- 14.5.23 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.
- 14.5.24 Operational and maintenance traffic will be very limited and there are no stations on the route of the Proposed Scheme. Consequently, no specific monitoring requirements are considered necessary for this topic during operation of the Proposed Scheme.

15 Water resources and flood risk

15.1 Introduction

- 15.1.1 This section provides a description of the current baseline for water resources and flood risk in the Fradley to Colton area. The likely impacts and significant effects of the Proposed Scheme's construction and operation on surface water and groundwater bodies and their associated water resources are assessed. The likely impacts and significant effects of the Proposed Scheme on flood risk and land drainage are also considered.
- 15.1.2 Engagement has been undertaken with the Environment Agency, Staffordshire County Council (SCC), which is the Lead Local Flood Authority (LLFA) and Severn Trent Water Limited (the local water and sewerage undertaker). The purpose of this engagement has been to obtain relevant baseline information and to discuss issues and potential effects.
- 15.1.3 Maps showing the location of the key environmental features (Map Series CT-10), and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA1 Map Book.
- 15.1.4 Map Series WR-01, WR-02, WR-03, WR-05 and WR-06, showing details of the water features referred to in this section, are contained in the Volume 5: Water resources and flood risk assessment Map Book.
- 15.1.5 Detailed information on the water resources and flood risk issues specific to the Fradley to Colton area are contained in the Volume 5 appendices. These comprise:
- Appendix WR-002-001 – Water resources assessment; and
 - Appendix WR-003-001 – Flood risk assessment.
- 15.1.6 Volume 5 also includes a detailed route-wide, stand-alone Water Framework Directive (WFD) compliance assessment (Appendix WR-001-000) and a draft route-wide water resources operation and maintenance manual (Appendix WR-002-000).
- 15.1.7 In addition, detailed hydraulic modelling reports are included in Background Information and Data (BID)²³⁵:
- BID-WR-004-001 - Hydraulic modelling report - Pyford Brook;
 - BID-WR-004-002 – Hydraulic modelling report – River Trent and Bourne Brook;
 - BID-WR-004-003 – Hydraulic modelling report – Moreton Brook; and
 - BID-WR-004-004 – Hydraulic modelling report – Stockwell Heath.
- 15.1.8 Volume 3, Route-wide effects, Water resources and flood risk (Section 16) covers the following at a route-wide level:

²³⁵ HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at www.gov.uk/hs2

- the risk to water resources associated with accidents or spillages from trains during operation of the Proposed Scheme;
- a summary of how the Proposed Scheme complies with the statutory requirements of the WFD; and
- route-wide flood risk issues related to application of the Sequential Test and Exception Test in the National Planning Policy Framework (NPPF)²³⁶.

15.2 Scope, assumptions and limitations

- 15.2.1 The scope, assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)²³⁷ and the SMR Addendum²³⁸.
- 15.2.2 Unless indicated otherwise, the spatial scope of the assessment (the study area) is based upon the identification of surface water and groundwater features within 1km of the centre line of the route of the Proposed Scheme, as described in Section 2.2 of this report. In the Fradley to Colton area, the study area has been extended to include the interfaces with Phase One, utility works along the B5103 Uttoxeter Road, works to Gorse Lane, diversion of the National Grid 400kV overhead power line and the 132kV power line from the substation at the former Rugeley Power Station to the Newland's Lane auto-transformer feeder station.
- 15.2.3 This assessment is based on desk study information, including information provided by consultees and stakeholders, as well as surveys of accessible water features.
- 15.2.4 Where surveys have not been undertaken due to land access constraints, a precautionary approach has been adopted in the assessments of receptor value and impact magnitude.
- 15.2.5 Hydraulic modelling has been undertaken of watercourses and key structures within flood risk areas. This includes modelling of the River Trent, Bourne Brook, Crawley Brook, Luth Burn, Pyford Brook and Moreton Brook.
- 15.2.6 Groundwater levels have been inferred from the available Environment Agency groundwater level monitoring boreholes, historic borehole logs and topographic data, as well as from spring and watercourse locations.
- 15.2.7 The assessment is based on existing available water quality information provided by the Environment Agency.
- 15.2.8 Impacts on biological receptors such as aquatic fauna and flora, which are referred to in the Volume 5: Appendix WR-001-000, WFD compliance assessment, are assessed in Section 8, Ecology and biodiversity.

²³⁶ Department for Communities and Local Government, National Planning Policy Framework, 2015.

²³⁷ Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

²³⁸ Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

15.3 Environmental baseline

Existing baseline – Water resources and WFD

Surface water

- 15.3.1 All surface water bodies in the study area fall within the Staffordshire Trent Valley Catchment of the Humber river basin district (RBD).
- 15.3.2 The river basin management plan²³⁹ identifies the chemical²⁴⁰ and ecological²⁴¹ condition of surface water bodies, and the quantitative²⁴² and chemical²⁴³ status of groundwater bodies within this RBD.
- 15.3.3 The statutory objective of the WFD is to prevent deterioration of all water bodies at good or high status and to prevent water bodies at less than good status from deteriorating further.
- 15.3.4 Specialist field surveys have been undertaken, where access has been available. This has included the majority of surface water bodies within the study area. Receptor values have been adjusted to reflect the outputs from these surveys, in close consultation with the Environment Agency. In the absence of field surveys, surface water bodies, other than minor ponds and ditches, have been identified within this assessment as being of either high or very high value on a precautionary basis.
- 15.3.5 Summary information relating to the surface water bodies crossed by the Proposed Scheme within this study area, including their location, current overall WFD status and future overall status objectives, is provided in Table 29. Table 29 also identifies the receptor values attributed to each individual watercourse based on the methodologies set out in the SMR, as applied in the WFD compliance assessment (Volume 5: Appendix WR-001-000).

²³⁹ Environment Agency (2015), Water for life and livelihoods Part 1: Humber river basin district: River basin management plan.

²⁴⁰ The chemical status of surface waters reflects concentrations of priority and hazardous substances present.

²⁴¹ The ecological status of surface waters is determined based on the following elements:

- Biological elements – communities of plants and animals (for example, fish and rooted plants), assessed in the ecology and biodiversity section;
- Physico-chemical elements – reflects concentrations of pollutants such as metal or organic compounds, such as copper or zinc;
- Hydromorphological elements – reflects water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitats.

²⁴² The quantitative status of groundwaters reflects the presence or absence of saline or other intrusions, interactions with surface water, issues related to groundwater dependent terrestrial ecosystems (GWDTE) and overall water balance.

²⁴³ The chemical status of a groundwater body reflects effects on drinking water protected areas, its general quality, the importance of water quality within the water body for GWDTEs and surface water interactions and whether there are intrusions of poor quality groundwater present.

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Table 29: Key surface water bodies and their WFD status

Water body name and identification number ²⁴⁴	Current WFD Status ²⁴⁵	WFD status objective	Watercourse classification	Crossing location description (National Grid Reference ²⁴⁶)	Receptor value
Pyford Brook Catchment (tributary of the Trent) GB104028047250	Bad	Good by 2027	Main river	Pyford Brook (NGR 413072, 314005)	High
Bourne-Bilson Brook Catchment (tributary of the River Trent) GB104028047270	Moderate	Good by 2027	Ordinary watercourse	Ashby Sitch (NGR 412460, 31,895)	Low
	Moderate	Good by 2027	Ordinary watercourse	Bourne Brook at Kings Bromley (from NGR 411918, 315522 to NGR 411286, 316197)	High
	Moderate	Good by 2027	Ordinary watercourse	Crawley Brook NGR 411365, 316099)	Moderate
River Trent (Trent from Moreton Brook to the River Tame) GB104028047290	Poor	Good by 2027	Main river	River Trent (from NGR 410902, 316591 to NGR 409635, 317954)	Very high
Main river tributaries:					
	Poor	Good by 2027	Ordinary watercourse	Unnamed tributary (NGR 410880, 316623)	Moderate
	Poor	Good by 2027	Ordinary watercourse	Unnamed tributary (NGR 410719, 316796)	Moderate
	Poor	Good by 2027	Minor ditch	Unnamed tributary (NGR 410309, 317237)	Low
	Poor	Good by 2027	Ordinary watercourse	Unnamed tributary at Blithbury (NGR 408096, 319519)	Low
	Poor	Good by 2027	Ordinary watercourse	Unnamed tributary at Blithbury West (NGR 407570, 320009)	Low
	Poor	Good by 2027	Ordinary watercourse	Tributary of the Bentley Brook at B5014 Uttoxeter Road (NGR 407943, 319365)	Moderate

²⁴⁴ The Environment Agency has attributed each surface water and groundwater body a unique water body identification (ID) number.

²⁴⁵ See WFD compliance assessment (Volume 5: WR-001-000) for definitions of WFD status.

²⁴⁶ This location is where the Proposed Scheme intersects the watercourse, unless the watercourse is crossed by a proposed new highway, but not HS2.

Water body name and identification number ²⁴⁴	Current WFD Status ²⁴⁵	WFD status objective	Watercourse classification	Crossing location description (National Grid Reference ²⁴⁶)	Receptor value
Blithe – Tad Brook to River Trent GB1040280046491	Moderate	Moderate by 2015	Ordinary watercourse	Luth Burn (NGR 409635, 317954)	Low
Moreton Brook from source to River Trent GB104028047380	Moderate	Good by 2021	Main river	Moreton Brook (NGR 403418, 322539)	High
	Main river tributaries:				
	Moderate	Good by 2021	Ordinary watercourse	Unnamed tributary at Stockwell Heath (NGR 405555, 321449)	Moderate
	Moderate	Good by 2021	Ordinary watercourse	Unnamed tributary at Hamley (South) (NGR 404406, 322094)	Low
	Moderate	Good by 2021	Minor ditch	Unnamed tributary at Hamley (North) (NGR 404027, 322266)	Low

Abstractions and permitted discharges (surface water)

- 15.3.6 There are nine licensed surface water abstractions in the study area. Two of these are located within the land required for the construction and operation of the Proposed Scheme. These are considered high value receptors.
- 15.3.7 Records of private unlicensed surface water abstractions, which comprise those for quantities less than 20m³ per day, have been obtained from the local authorities. This data indicates that there are no registered private unlicensed surface water abstractions within the study area. As there is no obligation to register private water supplies, unregistered private groundwater supplies may be present. Private water supplies would be assessed as high value receptors unless details obtained from the owner indicate otherwise.
- 15.3.8 There are 20 consented discharges to surface waters within the study area, none of which are within the land required for the Proposed Scheme. These have been assessed as being receptors of low value.

Groundwater

- 15.3.9 The location of abstractions, geological formations and indicative groundwater levels, where available, are shown in Map Series WR-02, in Volume 5: Water resources and flood risk Map Book.
- 15.3.10 The geology of the study area is described in Section 10, Land quality, and the superficial and bedrock hydrogeology is summarised in Table 30. Unless stated otherwise, the geological groups listed will all be crossed by the Proposed Scheme.

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Table 30 also identifies the receptor values attributed to each groundwater receptor based on the methodologies set out in the SMR, the SMR Addendum and as applied in the WFD compliance assessment (Volume 5: Appendix WR-001-000).

Table 30: Summary of geology and hydrogeology in the study area

Geology ²⁴⁷	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status	WFD status objective	Receptor value
Superficial deposits						
Alluvium	Along the River Trent and tributaries	Clay, silt, sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
River Terrace Deposits 1	Along the River Trent valley	Sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Glaciofluvial Sheet Deposits	At the southern end of the Proposed Scheme along the River Trent	Sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Glacial Till	Patchy, to the north of Proposed Scheme	Sandy silty clay	Secondary (Undifferentiated)	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Bedrock						
Mercia Mudstone Group – Mudstone (Branscombe Mudstone Formation)	The majority of the route of the Proposed Scheme.	Mudstone and siltstone with some halite-bearing units, and presence of sandstone.	Secondary B	Staffordshire Trent Valley - Mercia Mudstone East and Coal Measures – (GB40402G300300) Good	Good by 2015	Moderate
				Tame Anker Mease – Secondary Combined – (GB40402G990800) Good	Good by 2015	Moderate

²⁴⁷ In recent years the British Geological Survey has revised the nomenclature used to describe the geological materials present in Great Britain, with the publication of a series of lithostratigraphic framework reports. Some of these reports cover an entire geological period e.g. The Carboniferous and others cover a single group e.g. the Triassic Mercia Mudstone. The nomenclature used in these reports supersedes the nomenclature introduced in the 1980s, when the Group/ Formation / Member classification was adopted by the British Geological Survey, replacing the earlier classification adopted by the pioneer geological surveyors in the 19th century. While some traditional names have been retained by this process, many new names have also been generated, and many geological maps have not yet been updated. Some stratigraphic units have been renamed twice in the last 35 years. To reflect this, the previous name used for geological units (if different) is shown in brackets.

Geology ²⁴⁷	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status	WFD status objective	Receptor value
Sherwood Sandstone Group - Helsby Sandstone Formation (Bromsgrove Sandstone Formation)	Outcrops to the south of Blithbury, extending south-west towards Rugeley	Sandstone, interbedded with siltstones and mudstones	Principal	Staffordshire Trent Valley - PT Sandstone Staffordshire – (GB40401G300500) Poor	Poor by 2015	High
Sherwood Sandstone Group – Chester Formation (Kidderminster Formation)	Outcrops to the south of the former Rugeley Power Station	Pebbles and sand	Principal	Staffordshire Trent Valley - PT Sandstone Staffordshire (GB40401, G300500) – Poor	Poor by 2015	High

Superficial deposit aquifers

- 15.3.11 The basis of the receptor values attributed to the superficial deposit aquifers present within the study area, as shown in Table 30, is outlined briefly as follows:
- 15.3.12 Alluvium, River Terrace Deposits and Glaciofluvial Sheet Deposits, may be capable of supporting water supplies at a local rather than regional scale and may also form an important source of baseflow to rivers. They have therefore been classified moderate value receptors; and
- 15.3.13 Glacial Till deposits may supply baseflow to watercourses or store and yield limited amounts of groundwater and so have been classified as low value receptors.

Bedrock aquifers

- 15.3.14 The basis of the receptor values attributed to the bedrock aquifers present within the study area, as shown in in Table 30 is briefly as follows:
- the Sherwood Sandstone Group (locally comprising sandstone of the Helsby Sandstone Formation and the Chester Formation) has been classified as a Principal aquifer by the Environmental Agency. This aquifer can also provide an important component of baseflow to rivers. It has therefore been assessed as a high value receptor; and
 - the Mercia Mudstone Group has traditionally been regarded as predominantly impermeable, or at best a poor aquifer. Limited quantities of groundwater suitable for domestic or agricultural use are however occasionally obtainable within this rock formation and it has therefore been classified as a moderate value receptor.

WFD status of groundwater bodies

- 15.3.15 A summary of locations, current overall WFD status, and future overall status objectives associated with the designated bedrock groundwater bodies within the study area is provided in Table 30. The value attributed to each of these receptors is also indicated.

- 15.3.16 The superficial deposits in the study area are not formally designated as WFD groundwater bodies but may be hydraulically connected to the WFD bedrock aquifers.

Abstraction and permitted discharges (groundwater)

- 15.3.17 There are two groundwater abstractions licenced for public water supply near Hanch Hall Farm. The source protection zone (SPZ) 2 area associated with these supplies extends into the land required for the construction of the Proposed Scheme; the SPZ1 area is located 20m to the south.
- 15.3.18 There are a total of eight private groundwater abstraction licences registered in the study area, as shown on Map WR-02-201. Five of these are high value private potable water supplies, each of which is protected by a SPZ1 and SPZ2 of 50m and 250m radius respectively.
- 15.3.19 Information obtained from the local authorities indicates that there is one unlicensed private groundwater abstraction registered within the study area at Cawarden Springs Farm, the power line diversion at the former Rugeley Power Station. Access to confirm the nature and source of this abstraction has not yet been obtained, but this is assumed to be groundwater from the Mercia Mudstone Group aquifer and therefore assumed to be a high value receptor. Unregistered private groundwater supplies may also be present. Private water supplies have been assessed as high value receptors unless details obtained from the owner indicate otherwise.
- 15.3.20 There are eight consented discharges to groundwater within the study area. These discharges have been assessed as low value receptors.

Surface water/groundwater interactions

- 15.3.21 Desk-based assessment using Ordnance Survey maps identified 12 features within the study area that had potential to be springs. Access was possible to inspect two of these features and they were verified as being minor land drainage features of low value. The remaining ten potential spring features are assumed to be high value receptors, pending site inspection. Two of these eight features are within the land required for the Proposed Scheme, one to the west of Blithbury and one at Blithbury Bank, north of Blithbury.
- 15.3.22 There are 58 ponds within the land required for the Proposed Scheme. The nature and relative value of these features, the magnitude of the impacts that the Proposed Scheme will have on them, and the mitigation proposed, are outlined in Section 8, Ecology and biodiversity.

Groundwater dependent habitats

- 15.3.23 The following features within the study area are potentially groundwater dependent:
- Lount Farm Local Wildlife Site (LWS) will be crossed by the Proposed Scheme at the northern end of the Fradley to Colton area. However, the area of marshland habitat within the LWS is located within the Colwich to Yarlet area and the impacts and effects related to this moderate value receptor have therefore been assessed in Volume 2: Community area 2, Colwich to Yarlet; and

- there is an area of marshland identified from site surveys located to the north of Little Spinney that has the potential to be groundwater fed. This marshland has been identified as a moderate value receptor.

15.3.24 Further details of the ecology of these sites are provided in Section 8, Ecology and biodiversity.

Existing baseline - flood risk and land drainage

15.3.25 The Environment Agency's Flood map for planning (rivers and sea)²⁴⁸ has been used to scope the baseline flood risk for flooding from main rivers and ordinary watercourses. These plans define Flood Zone 2 (land assessed as having between a 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding) and Flood Zone 3 (land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding).

15.3.26 The updated Flood map for surface water²⁴⁹ has been used to scope surface water flood risks. Infrastructure failure flood risks have been scoped using the Environment Agency risks of flooding from reservoirs national dataset²⁵⁰. The British Geological Survey national dataset, Areas susceptible to groundwater flooding²⁵¹, has been used to assess the future risk of groundwater flooding.

15.3.27 The following reports were used to help determine the baseline flood risk within the study area:

- Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011)²⁵²;
- South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014)²⁵³; and
- Shropshire and Staffordshire Local Flood Risk Management Strategy (2015)²⁵⁴.

15.3.28 River and surface water flood zones are shown in Map Series WR-01 in the Volume 5: Water resources and flood risk assessment Map Book.

River flooding

15.3.29 The study area includes substantial areas of floodplain (Flood Zone 2 and 3) associated with the River Trent and Bourne Brook at Kings Bromley. Other floodplains that will be crossed by the route of the Proposed Scheme include those associated with Pyford Brook, south-west of Kings Bromley and Moreton Brook at Upper Moreton. Table 31 shows the watercourses within the study area and the receptors that would potentially be affected by any changes in flood magnitude. The value of these receptors, based on the definitions in Table 52 of the SMR, is also indicated.

²⁴⁸ Environment Agency, Flood map for planning (rivers and sea). Available online at: <https://flood-map-for-planning.service.gov.uk>

²⁴⁹ Environment Agency, Flood map for surface water. Available online at: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?eastng=402498&northing=282043&address=100070518535>

²⁵⁰ Environment Agency, Risks of flooding from reservoirs national dataset. Available online at: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?eastng=402498&northing=282043&address=100070518535>

²⁵¹ British Geological Survey, Areas susceptible to groundwater flooding. Available online at: <http://www.bgs.ac.uk/products/hydrogeology/groundwaterFlooding.html>

²⁵² Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011) Staffordshire County Council.

²⁵³ South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014) Capita.

²⁵⁴ Shropshire and Staffordshire Local Flood Risk Management Strategy (LFRMS) (2015) Staffordshire County Council.

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Table 31: River flood risk sources and receptors

Source	Location (NGR)	Receptor potentially affected	Receptor value / sensitivity to flooding
Pyford Brook	Pyford Brook viaduct (NGR 413072, 314005)	Trent and Mersey Canal	Low
		Wood Lane	Moderate
		Curborough sewage treatment works	High
River Trent and associated tributaries (Bourne Brook, Crawley Brook and Luth Burn)	Kings Bromley viaduct (from NGR 411918, 315522 to NGR 411286, 316197) and River Trent viaduct (from NGR 410902, 316591 to NGR 409635, 317954)	Shaw Lane	Moderate
		A515 Lichfield Road	Moderate
		A513 Rugeley Road	Moderate
		Far End Cottage	High
		Crawley Lane	Moderate
		Woodgate Farm Cottage	High
		The Smithy	High
		The Old Farmhouse	High
		Three properties on the south western side of Kings Bromley accessed from A515 Lichfield Road	High
		Properties located within Manor Park, a residential area on the western edge of Kings Bromley	High
		Gravel pit excavations located to the west and north of Kings Bromley	Low
		Existing residential property also used as a cattery and boarding kennel located adjacent to gravel pitch excavation, accessed from A513 Rugeley Road	High
		Glebe Farm	High
		Buildings associated with a small nature reserve at Spencer's plantation	Moderate
		Properties along Osier Bed Lane	High
Mavesyn nurseries and associated residential Property Toll House	High		
Oak Farm	High		
B5014 Uttoxeter Road	Moderate		

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Source	Location (NGR)	Receptor potentially affected	Receptor value / sensitivity to flooding
		Hall Farm at Pipe Ridware	High
		Littleton House Farm	High
		Pipe Lane	Moderate
		Property located off Pipe Wood Lane adjacent to the Luth Burn	High
		Brookhouse Farm	High
Moreton Brook	Moreton Brook viaduct (NGR 403418, 322539)	B5013 Uttoxeter Road	Moderate
		A building associated with properties located along the B5013 Uttoxeter Road near the Hamlet of Bellamour	High
Ashby Sitch	Ashby Sitch culvert (NGR 412460, 31,895)	Trent and Mersey Canal	Low
		Agricultural land	Moderate
Tributary watercourse of the Bentley Brook	Blithbury drop inlet culvert (NGR 408096, 319519)	Agricultural land	Moderate
Tributary watercourse of the Bentley Brook	Blithbury West drop inlet culvert (NGR 407570, 320009)	Agricultural Lane	Moderate
		Blithbury Road	Moderate
Bentley Brook	Bentley Brook crossings at B5014 Uttoxeter Road (NGR 407858, 319485) and Stonyford Lane (NGR 407086, 320096)	B5014 Uttoxeter Road	Moderate
		Stonyford Lane	Moderate
		Hadley Gate Farm	High
Tributary watercourse of the Moreton Brook	Stockwell Heath culvert (NGR 405555, 321449)	Newlands Lane	Moderate
		Residential property at Pool Farm in Stockwell Heath	Moderate
		Agricultural land and woodland	Moderate
Tributary watercourse of the Moreton Brook	Hamley (South) culvert (NGR 404406, 322094)	Sherracop Lane	Moderate
		B5013 Uttoxeter Road	Moderate
		Access road to Lount Farm from the B5013 Uttoxeter Road	Moderate
		Agricultural land and woodland	Moderate
Tributary watercourse of the Moreton Brook	Hamley (North) drop inlet culvert (NGR 404027, 322266)	Jonghams Cottages	High
		Agricultural land and woodland	Moderate

Surface water flooding

- 15.3.30 There are numerous areas that are susceptible to surface water flooding within the study area. These are identified on Maps WR-01-101 to 102a in the Volume 5: Water resources and flood risk Map Book. The key sources and receptors with potential to be affected are shown in Table 32. The value of these receptors, based on Table 52 of the SMR, is also indicated.

Table 32: Surface water flood risk sources and receptors

Source	Location (NGR)	Receptor potentially affected	Receptor value
Surface water flow path at Woodhouse Farm	Woodhouse culvert (NGR 409025, 318605)	Agricultural land	Moderate
Surface water flow path draining area Hurstwood Pit	Hurstwood drop inlet culvert (NGR 406566, 320780)	Agricultural land	Moderate
Surface water flow path that drains the area around Finners Hill	Finners culvert (NGR 405712, 321351)	Newlands Lane	Moderate
		Agricultural Lane	Moderate

Artificial water bodies

- 15.3.31 Flooding from artificial water bodies may occur due to failure of an impounding structure, such as a dam or canal embankment. The Flood risk assessment (Volume 5: Appendix WR-003-001) considers the risks associated with artificial water bodies within the study area including Blithfield reservoir, Hanch reservoir and the Trent and Mersey Canal. The Proposed Scheme is within the area that could be affected by a failure of the embankment impounding Blithfield reservoir, which is 1.3km to the north of the route of the Proposed Scheme. However, as this is a large raised reservoir, subject to the requirements of reservoir safety legislation²⁵⁵, the inundation risk posed by this reservoir is considered negligible.

Groundwater flooding

- 15.3.32 The formal source of public information regarding historical incidents of groundwater flooding in the Fradley to Colton area is the South Staffordshire Council SFRA²⁵². The SFRA states that there is no history of groundwater flooding within the Stafford Borough.
- 15.3.33 The Environment Agency's Areas susceptible to groundwater flooding map indicates that there is some potential for groundwater flooding to occur at the southern end of the study area in the River Trent floodplain and also where the Proposed Scheme is underlain by Glaciofluvial Sheet Deposits. Between Pipe Ridware and Stockwell Heath the route of the Proposed Scheme will pass through smaller localised areas underlain by Glacial Till or Alluvium where there is some potential for groundwater flooding to occur.

²⁵⁵ Department for Environment, Food & Rural Affairs, Reservoirs: owner and operator requirements, 2016. Available online at: <https://www.gov.uk/guidance/reservoirs-owner-and-operator-requirements>

Land drainage

- 15.3.34 Existing topography, soils and land drainage systems within the study area are described in Section 4, Agriculture, forestry and soils. The rivers and watercourses within the area are connected to an extensive network of existing open drains. Subsurface drainage systems are also likely to be present in fields used for agriculture. The land drainage function of these systems, which is important for crop productivity, is potentially sensitive to increases in water levels within the receiving watercourses.

Future baseline

Construction (2020)

- 15.3.35 The construction of HS2 Phase One includes activities with potential implications for receptors that could also be affected by the Proposed Scheme. This includes Pyford Brook, the Trent and Mersey Canal, the Mercia Mudstone Group Secondary B aquifer and the Glaciofluvial Sheet Deposits. The potential for combined effects between the Proposed Scheme and HS2 Phase One are reported in the assessment of cumulative effects.
- 15.3.36 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2020.
- 15.3.37 No other committed developments have been identified in this area that will materially alter the baseline conditions in 2020.

Operation (2027)

- 15.3.38 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.
- 15.3.39 No committed developments have been identified in this area that will materially alter the baseline conditions in 2027.

Climate change

- 15.3.40 Detailed analysis of the potential impacts of climate change on the Proposed Scheme has been undertaken and is reported in Volume 3, Route-wide effects (Section 4). In general, the design of the Proposed Scheme has adopted a precautionary approach to potential future increase in peak river flows and rainfall intensities, using the latest guidance issued by the Environment Agency in February 2016²⁵⁶.
- 15.3.41 Although no definitive guidance is available, climate change may also affect future surface water and groundwater resources. However any such changes are unlikely to change the significance of the effects identified in this assessment.

15.4 Effects arising during construction

Avoidance and mitigation measures

- 15.4.1 The principal strategy adopted to limit the temporary and permanent effects of the Proposed Scheme is through avoidance of sensitive receptors wherever reasonably

²⁵⁶ Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities.

practicable. Where receptors could not be avoided, mitigation measures have been incorporated where appropriate and reasonably practicable, to limit the potential effects. Section 16 of the draft Code of Construction Practice (CoCP)²⁵⁷ includes a range of mitigation measures that aim to reduce construction impacts as far as is reasonably practicable. The avoidance and mitigation measures that are of particular relevance to water resources and flood risk during construction are described in the following sections of this report.

Water resources and WFD

- 15.4.2 The avoidance of sensitive receptors has reduced the risks associated with the Proposed Scheme not complying with the requirements of the WFD. Examples of this strategy include:
- avoidance of channels and floodplain areas – the route of the Proposed Scheme will avoid passing along river or stream valleys, such as that of Pyford Brook, Bourne Brook, the River Trent and Moreton Brook and their associated floodplains. Instead it will pass over these larger watercourses on viaducts spanning the floodplain, with piers set back from the channel;
 - avoidance, where reasonably practicable, of groundwater dependent terrestrial ecosystems, including natural springs that can play a key role in the hydrology and hydrogeology of such ecosystems; and
 - avoidance, where reasonably practicable, of major public water supplies and smaller licensed and unlicensed abstractions of surface water and groundwater.
- 15.4.3 The presence of any unregistered private water supplies, their function and the means of protecting or if necessary replacing them will be discussed with any landowners potentially affected by the Proposed Scheme.
- 15.4.4 The temporary works shown on Map Series CT-05 in Volume 2: CA1 Map Book have been informed by a detailed consideration of the water resources constraints and have sought to avoid sensitive features wherever reasonably practicable.
- 15.4.5 Where watercourse diversions and/or realignments are proposed, the aim will be to design these with equivalent hydraulic capacity to the existing channels. The Proposed Scheme will also aim to ensure that field subsurface drainage systems can be adapted to discharge into the new channel. Where such watercourses are natural channels, the design aim will be to incorporate appropriate features to retain and, where reasonably practicable, enhance their hydromorphological condition²⁵⁸.
- 15.4.6 For watercourses that are not in their natural condition, the design aim will be to incorporate measures, where reasonably practicable, to improve their hydromorphological condition, provided this is compatible with the watercourses' flood risk and land drainage functions.

²⁵⁷ Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

²⁵⁸ "Hydromorphological condition" reflects the extent to which water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitats departs from that expected of a natural river or stream system.

- 15.4.7 The draft CoCP includes requirements to protect water bodies and their associated water resources from the potential impacts of pollution from construction site runoff, including where appropriate:
- provision of maps showing sensitive areas and buffer zones where no pollutants are to be stored or used; and
 - preparation of method statements for silt management, site drainage at compounds and satellite compounds, for the storage and control of oils and chemicals and the prevention of accidental spillages, in consultation with the Environment Agency, and if appropriate, the LLFA and other relevant authorities as part of the approvals process. These method statements will cover, where applicable:
 - the avoidance of discharges of site runoff to ditches, watercourses, drains, sewers or soakaways without the prior approval of the appropriate authority;
 - measures to prevent silt-laden runoff and other pollutants entering the water environment; and
 - restrictions or controls on excavation within watercourses to limit effects on water quality, sedimentation, fisheries and aquatic ecology.
- 15.4.8 Method statements will be required for all watercourse crossings and channel realignments required for site haul routes. The method statements will describe how potential changes to flood risk, water quality and channel hydromorphology will be safeguarded during the establishment, use and decommissioning of all site haul routes.
- 15.4.9 Permanent culverts proposed on the smaller watercourse crossings within this study area include those on Ashby Sitch, a tributary of the River Trent, the drop inlet culverts at Blithbury and Blithbury (West) and a culvert under the B5014 Uttoxeter Road realignment, all on minor tributaries of Bentley Brook. Culverts are also proposed on minor tributaries of Moreton Brook at Stockwell Heath, Hamley (South) and a drop inlet culvert is proposed at Hamley (North). The detailed design of these culverts will be developed in general accordance with Construction Industry Research and Information Association (CIRIA) and Environment Agency guidance and in consultation with Environment Agency specialists. The design has sought to mitigate the impact on the hydromorphology of the affected watercourses, as follows:
- drop inlet culverts have been avoided wherever reasonably practicable and are proposed on minor headwater channels or ditches only;
 - culvert lengths have been reduced as far as is reasonably practicable; and
 - invert levels will be set below the firm bed of the watercourse to allow a natural substrate to develop along the bed of the culvert.
- 15.4.10 The wider issues associated with these culverts, and how their detailed design will aim to ensure no deterioration in the status of any of the relevant water bodies WFD quality elements, are considered within the WFD compliance assessment (Volume 5: Appendix WR-001-000). The mitigation specifically proposed for the ecological effects of these culverts is considered in Section 8, Ecology and biodiversity.

- 15.4.11 Existing groundwater abstraction boreholes or monitoring points will be protected from physical damage, insofar as reasonably practicable, including appropriate decommissioning of abandoned boreholes in order to prevent pollution pathways. If boreholes are to be decommissioned and replaced with alternatives, the contractors will follow the latest good practices. This will also be applicable to springs potentially affected by construction works, although additional measures may be required to mitigate temporary construction impacts on springs that are to be relocated.
- 15.4.12 Measures will be introduced, as required, to mitigate the temporary and permanent effects on groundwater flows and water quality during excavation and construction of foundations and cuttings as far as is reasonably practicable. The types of measure likely to be adopted could include:
- installation of cut-off²⁵⁹ structures around excavations;
 - ensuring cut-off structures are driven to sufficient depths to meet an underlying strata or zone of lower permeability;
 - promoting groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions; and
 - incorporating passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed around temporary structures allowing groundwater to bypass the below-ground works, without a rise in groundwater levels on the upstream side.
- 15.4.13 The exact requirements will be refined and method of mitigation will be designed following ground investigation at cutting locations.
- 15.4.14 Four borrow pits are proposed within this study area. This assessment is based on excavation to an assumed average and maximum depths of the borrow pits, as described in Section 2.3. The borrow pits will be excavated in the River Terrace Deposits or Glaciofluvial Sheet Deposits in proximity to Ashby Sitch, Bourne Brook, Crawley Brook, the River Trent and Luth Burn. To reduce the potential for impacts on these surface watercourses, buffer strips have been incorporated into the design within which no excavation will be undertaken.
- 15.4.15 All construction operations related to the borrow pits will be managed in accordance with the CoCP to reduce the potential for adverse impacts on the water environment.
- 15.4.16 The borrow pit areas will be reinstated to their existing levels and land use by the end of the construction period as described in Volume 5: Appendix CT-009-000, Borrow pit restoration strategy. The reinstatement works will be designed to ensure that the land within the borrow pit areas drains in a manner suitable for its continued use as agricultural land. These drainage measures will be designed to control groundwater levels and to sustain groundwater baseflow to nearby watercourses.

²⁵⁹ Impermeable barrier preventing water flow.

Flood risk and land drainage

15.4.17 The design of the Proposed Scheme will aim to mitigate permanent impacts on flood risk and land drainage as follows:

- the floodplain avoidance strategy will ensure that the impacts on flood flows within rivers and streams, and their floodplains, will be limited to those associated with the intermediate pier structures on the viaducts and the realignment of the A515 Lichfield Road, which will be located in the Bourne Brook/River Trent floodplain. The Proposed Scheme includes replacement floodplain storage areas to replace losses associated with the piers and highway realignment;
- the temporary works shown on Map Series CT-05 in the Volume 2: CA1 Map Book have been informed by a detailed consideration of the flood risk constraints and have sought to avoid flood zones wherever reasonably practicable;
- provision has been made to pass surface water runoff and land drainage flows beneath sections of raised embankment that will cross surface water flow paths where reasonably practicable. This will be achieved using perimeter drainage and culverts, with their inverts set below the likely level of any upstream field subsurface drainage systems;
- in locations where the route of the Proposed Scheme will cross watercourses, the design aim is for structures to accommodate flood flows up to and including the 1 in 100 year (1%) annual probability storm with an allowance for climate change based on latest guidance issued by the Environment Agency²⁶⁰;
- run-off from the footprint of the infrastructure could occur more rapidly post-construction due to steeper slope angles and the permeability of the newly-created surfaces. The design of drainage systems aims to ensure that there will be no significant increases in flood risk downstream, during storms up to and including the 1 in 100 year (1%) annual probability design event, with an allowance for climate change based on the latest guidance issued by the Environment Agency;
- balancing ponds for new sections of highway and railway drainage have been sized on a precautionary basis, pending more detailed information about the permeability and runoff characteristics of existing and proposed ground surfaces;
- where the Proposed Scheme will pass in cutting, drainage measures will be provided with the aim of preventing flow into the cutting and diverting this water into its natural catchment. Where reasonably practicable, runoff from the cuttings will also be drained to the catchments to which this water would

²⁶⁰ Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities.

naturally drain, avoiding transfer of water from one water body to another, which could increase flood risk or impact on land drainage systems; and

- measures will be introduced to reduce any potentially significant effects on groundwater flood risk as far as is reasonably practicable, including the incorporation of passive hydraulic bypasses at cuttings and other below ground structures. These could for example comprise a 'blanket' of permeable material such as gravel.

15.4.18 The nominated undertaker will, insofar as reasonably practicable, ensure that flood risk is managed throughout the construction period and will consider flooding issues when planning sites and storing materials. If necessary, temporary provision will be made to reduce to the potential for impacts on existing land drainage systems during construction. Some of the specific measures referred to in the draft CoCP, include:

- preparation of flood risk assessments and method statements for temporary works, including main construction and satellite compound drainage, watercourse crossings and realignments and temporary realignments in consultation with the Environment Agency, and where applicable, the LLFA and other relevant regulators;
- location of storage, machinery, equipment and temporary buildings outside flood risk areas where reasonably practicable;
- construction of outfalls during periods of low flow to reduce the risk of scour and erosion;
- design of temporary watercourse realignments with equivalent hydraulic capacity to the existing channels, ensuring that field subsurface drainage systems can be adapted to discharge into the new channel; and
- having regard to the requirement for construction activities to avoid any increases in flood risk to vulnerable receptors.

15.4.19 In accordance with the Section 16 of the draft CoCP, monitoring will also be undertaken in consultation with the Environment Agency and, where applicable, the LLFA, to ensure that temporary structures are installed, maintained and removed in accordance with the relevant environmental approvals and that impact on existing land drainage systems are managed appropriately.

Assessment of impacts and effects

15.4.20 This section describes the significant effects following the implementation of the avoidance and mitigation measures. The majority of the potential temporary impacts on the water environment during construction will be avoided or mitigated by the working methods outlined in the draft CoCP. The mitigation embedded into the design has focused on reducing permanent impacts resulting from the presence of the Proposed Scheme to as low a level as is reasonably practicable.

Temporary effects – Water resources and WFD

Surface water

- 15.4.21 Potential temporary impacts on surface water quality, due to site runoff and increased pollution risk, are a key concern during construction and have the potential to affect abstractions and the water environment more generally. However, the practices outlined in the draft CoCP are considered adequate to mitigate any impacts, such that there are unlikely to be any significant effects.

Groundwater

Aquifers

- 15.4.22 The proposed cuttings in the study area will intersect the Sherwood Sandstone Group Principal aquifer, the Mercia Mudstone Group Secondary B aquifer and the Glacial Till Secondary Undifferentiated aquifer. Whilst there are likely to be minor localised impacts, the implementation of the measures outlined in the draft CoCP will mean that any impacts on the overall status of these aquifers will not be significant.
- 15.4.23 Excavation and dewatering of the borrow pits will result in localised and controlled impacts on groundwater flows and levels within the Glaciofluvial Sheet Deposits and River Terrace Deposits Secondary A aquifers. However implementation of the CoCP measures will ensure that groundwater levels are controlled with minimal losses of water from the aquifer system. Impacts are likely to be minor, resulting in no significant effects.
- 15.4.24 Where the cuttings or borrow pits could affect local receptors, such as groundwater abstractions or springs, this is reported in the sections below.

Springs

- 15.4.25 The Proposed Scheme will result in the permanent loss of the potential spring features west of Blithbury and at Blithbury Bank. Until the nature of these features has been confirmed by a site survey, they have been assumed to be high value receptors. The assessment therefore identifies their loss as potentially resulting in temporary moderate adverse effects, which is significant.

Abstractions

- 15.4.26 There is one licensed private groundwater abstraction near Cowley Hall Farm, Nethertown, 80m north of a borrow pit north-east of the River Trent viaduct, between the River Trent and Pipe Lane. This abstraction is used to feed a man-made pond currently used for recreational fishing, but the licence includes use of this water for wider agricultural purposes and it has been assessed as a high value receptor. It has been assumed on a precautionary basis that the source of this abstraction is the superficial deposits aquifer, with the potential for the borrow pit to have a minor impact on this water supply. This would result in a temporary moderate adverse effect, which is significant.
- 15.4.27 There are two licensed groundwater abstractions in the vicinity of the borrow pit at Kings Bromley North, located adjacent to the realigned A515 Lichfield Road. The abstractions are located at Woodshoot Farm, licensed for spray irrigation, and at

Common Lane Farm, licensed for general farming and domestic use. The depths of the abstractions are not known. It has been assumed on a precautionary basis that the source of these abstractions is the superficial deposits aquifer, with the potential for the borrow pit to have a minor impact on these water supplies. This would result in temporary moderate adverse effects, which are significant.

Groundwater - surface water interactions

- 15.4.28 There remains the potential for baseflows in nearby watercourses to be impacted whilst groundwater levels are lowered in the borrow pits during excavation. This minor impact would result in moderate adverse effects related to flow reductions in Bourne Brook and the River Trent, which would be significant.

Temporary Effects - Flood risk and land drainage

- 15.4.29 Construction of the Pyford Brook viaduct, Kings Bromley viaduct, River Trent viaduct and the Moreton Brook viaduct will require temporary working within flood zones. This will include the site haul route that involves spanning the main channels of Bourne Brook, the River Trent and tributary watercourses. Construction sequencing and temporary works design will be carefully considered and assessed in terms of potential impacts on flood risk. Method statements detailing how these works will be undertaken will be produced by the nominated undertaker in consultation with the Environment Agency and the LLFA. It is not anticipated that these temporary activities will result in significant effects related to flood risk and land drainage.

Permanent effects – Water resources and WFD

- 15.4.30 Permanent effects are those initially caused by activity to construct the Proposed Scheme but which will also remain after the Proposed Scheme has been constructed and is present in the area.

Surface water

- 15.4.31 The construction and use of a maintenance access road will require an existing culvert on Pyford Brook to be upgraded. This has potential to cause a minor localised impact on Pyford Brook, which is a high value receptor. This would potentially result in a permanent moderate adverse effect, which is significant.
- 15.4.32 The A515 Lichfield Road realignment will require the installation of a new culvert on Bourne Brook. This has potential to cause a minor localised impact on Bourne Brook, which is a high value receptor meaning that this would potentially result in a moderate adverse significant effect.
- 15.4.33 The existing A515 Lichfield Road will be permanently closed where it would cross the route of the Proposed Scheme, and a new section of open channel will be created. This is considered a minor beneficial impact, resulting in a moderate beneficial significant effect.
- 15.4.34 The realignment of Moreton Brook under the Moreton Brook viaduct has the potential to cause a minor impact on this watercourse, which is a high value receptor. This would potentially result in a moderate adverse effect, which is significant.

Groundwater

Aquifers

- 15.4.35 Implementation of the avoidance and mitigation measures will ensure that there are no permanent significant effects related to the impact of the proposed cuttings on water levels and quality in the aquifers intercepted by the Proposed Scheme. Where the impacts of the cuttings on the aquifers could affect additional local receptors that rely on the groundwater resource, for example springs and abstractions, the impacts on these have been assessed below.

Springs

- 15.4.36 The potential spring features at Blithbury West and Blithbury Bank will be permanently lost. These features are assumed to be high value receptors on a precautionary basis and their loss would therefore potentially result in a permanent moderate adverse effect, which is significant.

Abstractions

- 15.4.37 The assessment has not identified any permanent significant effects on groundwater abstractions

Groundwater - surface water interactions

- 15.4.38 The implementation of the borrow pit restoration strategy will seek to ensure that there are no permanent significant effects on groundwater-surface water interactions caused by the proposed borrow pits.

Permanent effects - Flood risk and land drainage

- 15.4.39 Hydraulic modelling analysis indicates a potential for increases in peak flood level in excess of 50mm in localised areas within the River Trent and Bourne Brook floodplains associated with the viaduct (see BID-WR-004-002). These changes in peak flood level would not affect any residential properties, but would affect agricultural land and buildings, which are moderate value receptors, resulting in a moderate adverse effect, which would be significant.
- 15.4.40 Hydraulic modelling also indicates potential for an increase in peak flood level of up to 50mm in the vicinity of High Bridge and Mavesyn Ridware. This change would potentially affect two residential properties: Toll House and Pipe Place Farm which are high value receptors. This would result in a moderate adverse effect, which would be significant.

Other mitigation measures

- 15.4.41 Additional mitigation measures have been developed to further reduce the temporary and permanent impacts of construction stage activities, where there is potential for the Proposed Scheme to result in significant effects.

Surface water

- 15.4.42 The embedded mitigation proposed in the design of the culverts on Pyford Brook and Bourne Brook, and the localised realignment of Moreton Brook, will be developed

further in consultation with the Environment Agency. Monitoring will be undertaken to ensure successful establishment of the mitigation proposals developed.

Groundwater

- 15.4.43 The potential impacts of the borrow pit north-east of the River Trent viaduct, on the abstraction required for the recreational fishing pond at Cowley Hall Farm near Nethertown, will be investigated further. If this investigation identifies a risk of this supply being temporarily disrupted, suitable mitigation measures will be discussed with the landowner, which may include provision of a temporary alternative supply.
- 15.4.44 A survey of the potential spring features at Blithbury West and Blithbury Bank will be undertaken to determine their value and to identify whether further mitigation is required. If they are confirmed to be springs, measures would be implemented to re-establish these springs nearby in a manner that ensures any adverse impacts are mitigated.

Groundwater-surface water interactions

- 15.4.45 Additional mitigation measures for the management of groundwater baseflows to the River Trent and Bourne Brook during excavation and dewatering of the borrow pits located north-east of the River Trent viaduct and the borrow pit at Kings Bromley North, adjacent to the realigned A515 Lichfield Road respectively may be required. Mitigation measures will be designed in detail following ground investigation and monitoring of surface water and groundwater levels. Mitigation could take the form of:
- a wider buffer strip, or shallower batter on the excavations;
 - installation of a groundwater cut-off;
 - creation of a temporary section of lined channel on the River Bourne;
 - adoption of wet working techniques that avoid the need for dewatering; and
 - recirculation of treated water to the River Trent and Bourne Brook at an appropriate rate and location.
- 15.4.46 Any such additional measures will be designed in consultation with the Environment Agency.

Flood risk and land drainage

- 15.4.47 As the hydraulic models are further developed and the detailed design refined, particular attention will be paid to the flood risk issues on the River Trent and Bourne Brook floodplains and to the properties in the vicinity of High bridge and Mavesyn Ridware. This work will be undertaken in close consultation with the Environment Agency and the LLFA and, if any residual effects are identified, with the affected landowners. The aim will be to ensure that no parties are affected by unacceptable increases in flood risk.

Summary of likely residual significant effects

- 15.4.48 In the absence of the other mitigation measures set out above, the Proposed Scheme would potentially result in residual significant effects as follows:

- a moderate adverse effect related to the installation of new culverts on Pyford Brook and Bourne Brook and the realignment proposed on Moreton Brook, which is significant;
- a moderate beneficial effect related to removal of an existing highway culvert on Bourne Brook, which is significant;
- a moderate adverse effect related to the potential for the existing groundwater abstraction at Cowley Hall Farm to be affected by a borrow pit located north-east of the River Trent viaduct, which is significant;
- the groundwater abstractions at Woodshoot Farm and Common Lane Farm from the borrow pit at Kings Bromley North, located adjacent to the realigned A515 Lichfield Road, all of which are significant;
- a moderate adverse effect related to the loss of potential spring features west of Blithbury and at Blithbury Bank, which is significant; and
- a moderate adverse effect on flood risk on the River Trent/Bourne Brook floodplain and at Toll House and Pipe Place Farm in the vicinity of High Bridge and Maveysn Ridware, which is significant.

15.4.49 It is currently anticipated that it should be possible to develop the means of mitigating these impacts, to ensure that there are no residual significant effects arising from construction of the Proposed Scheme.

Cumulative effects

15.4.50 No significant cumulative temporary or permanent effects during construction with regard to water resources or flood risk are anticipated.

15.5 Effects arising from operation

Avoidance and mitigation measures

- 15.5.1 The principal issue of concern during operation of the Proposed Scheme is the potential for accidental spillages to occur that could result in the release of contaminants into the water environment. This issue has been assessed on a route-wide basis in Volume 3: Route-wide effects (Section 16), where the mitigation measures associated with this risk are described. A draft operation and maintenance plan for water resources and flood risk is provided in Volume 5: Appendix WR-002-000.
- 15.5.2 The design takes into account the policies in the NPPF and will aim to ensure that the Proposed Scheme is safe from flooding without increasing flood risk elsewhere, as outlined in the Flood risk assessment, Appendix WR-003-001. Evidence of application of the Sequential Test and Exception Tests in the NPPF is provided on a route-wide basis in Volume 3: Route-wide effects.
- 15.5.3 Sustainable drainage systems will be used where reasonably practicable. These will help to remove any suspended material within runoff from the Proposed Scheme through filtration, vegetative adsorption or settlement. The drainage systems proposed will aim to ensure that the quantity and quality of water draining from the

Proposed Scheme during its operational phase will have a negligible impact on the water environment.

- 15.5.4 A route-wide WFD compliance assessment is provided in Volume 3: Route-wide effects. This describes the measures embedded into the design that are specifically designed to ensure that the Proposed Scheme complies with the requirements of the WFD.

Assessment of impacts and effects

- 15.5.5 There are considered to be no significant adverse effects related to water resources and flood risk arising from operation of the Proposed Scheme.

Other mitigation measures

- 15.5.6 There are considered to be no further measures required to mitigate adverse effects on surface water resources, groundwater resources or flood risk.

Summary of likely residual significant effects

- 15.5.7 The assessment shows that there will be no residual significant effects on surface water, groundwater or flood risk during operation of the Proposed Scheme.

Cumulative effects

- 15.5.8 No significant cumulative temporary or permanent effects during operation with regard to water resources or flood risk are anticipated.

Monitoring

- 15.5.9 Volume 1, Section 9 sets out the general approach to monitoring of water resources and flood risk during operation of the Proposed Scheme.
- 15.5.10 There are no area-specific requirements for monitoring water resources and flood risk during operation of the Proposed Scheme.

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