High Speed Two Phase 2a: West Midlands to Crewe

Working Draft Environmental Impact Assessment Report

Volume 2: Community Area report

CA1: Fradley to Colton

September 2016

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Department for Transport

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Structure of the working draft Environmental Impact Assessment Report

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

The working draft EIA Report comprises the following documents:

Non-technical summary

This provides a summary in non-technical language of:

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

Volume 1: Introduction and methodology

This provides:

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

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

Volume 2: Community area reports and map books

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

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

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

The maps relevant to the Fradley to Colton area are provided in a separate corresponding document entitled Volume 2, CA1 Map Book, which should be read in conjunction with this report. These maps include the location of the key environmental features (Map Series CT-10), key construction features (Map Series CT-05) and operation features (Map Series CT-06) of the Proposed Scheme. There are also specific maps showing proposed viewpoint and photomontage locations (Map Series LV-11, to be read in conjunction with Section 11, Landscape and visual), noise contour maps (Map Series SV-01, to be read in conjunction with Section 13, Sound, noise and vibration) and maps showing key water features (Map Series WR-01, to be read in conjunction with Section 15, Water resources and flood risk).

Volume 3: Route-wide effects

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

Glossary of terms and list of abbreviations

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

Appendix: Alternatives report

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

Appendix: Draft Code of Construction Practice (CoCP)

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

1 Introduction

1.1 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, East Midlands and South Yorkshire will be served by high speed trains running at speeds of up to 360kph (225mph).

1.1.2 HS2 will be built in phases. Phase One comprises the first section of the HS2 network of approximately 230km (143 miles) between London, Birmingham and the West Midlands that will become operational in 2026. It was the subject of an Environmental Statement (ES) deposited with the High Speed Two (London - West Midlands) Bill in 2013 and ES deposited with Additional Provisions to that Bill in 2014 and 2015. The Bill is proceeding through Parliament with the aim of achieving Royal Assent by the end of 2016 and commencing construction in 2017.

1.1.3 Phase Two of HS2 would extend the line to the north-west and north-east, to Manchester with connections to the West Coast Main Line (WCML) at Crewe and Golborne, and to Leeds with a connection to the East Coast Main Line approaching York, completing what is known as the 'Y network'.

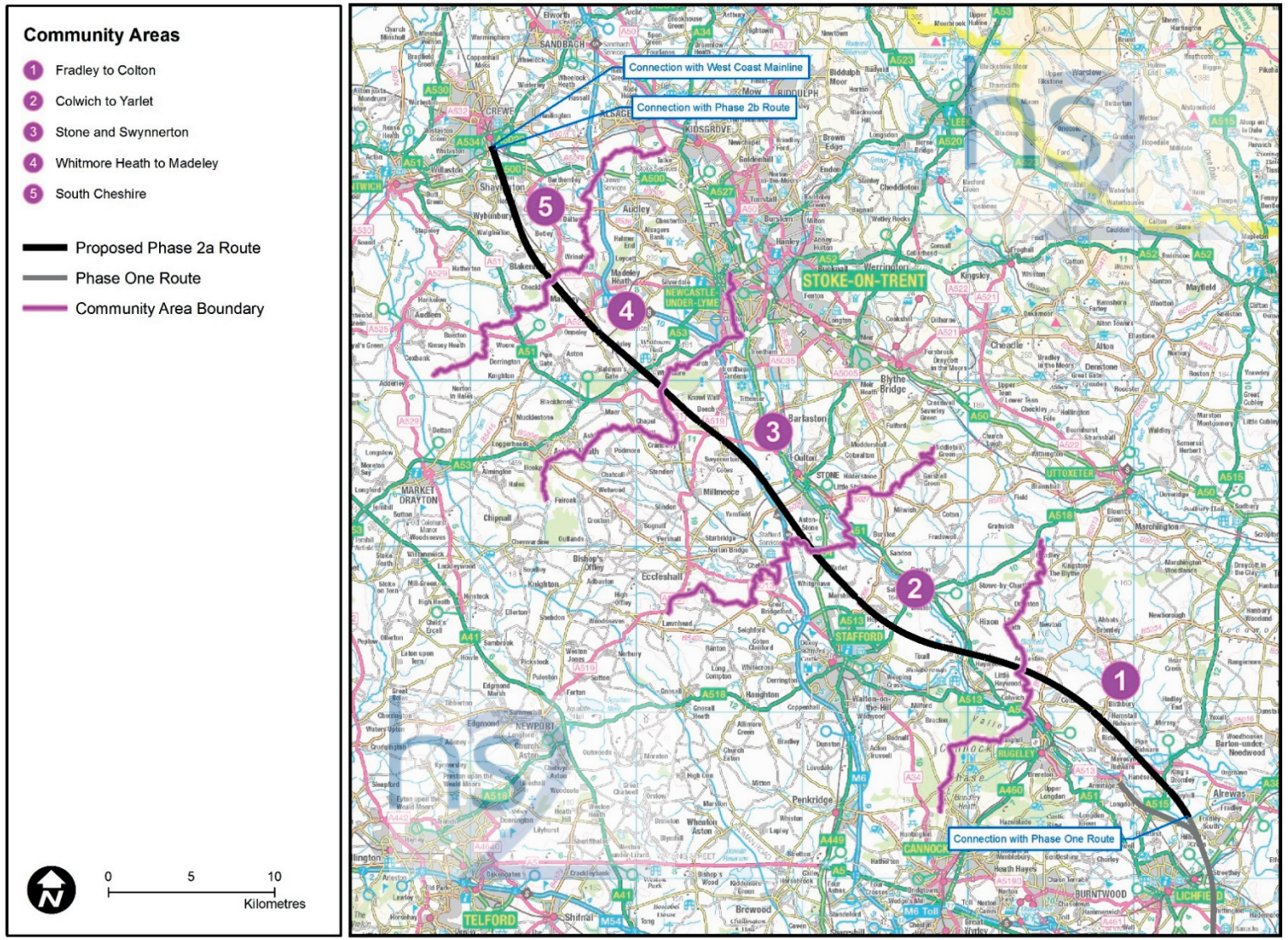
1.1.4 Phase 2a (the Proposed Scheme), the subject of this working draft Environmental Impact Assessment (EIA) Report[1], comprises the first section of the western leg of Phase Two from the West Midlands to Crewe (approximately 60km (37 miles) in length). It would connect with Phase One near Fradley, to the north-east of Lichfield, and connect to the WCML south of Crewe, to provide onward services beyond the HS2 network, to the north-west of England and to Scotland. Construction of the Proposed Scheme would commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027, one year after the opening of Phase One. This is six years earlier than originally planned, bringing some of the benefits of HS2 to the North sooner.

1.1.5 An announcement on the Phase Two route from Crewe to Manchester and from the West Midlands to Leeds, referred to as Phase 2b, is expected in Autumn 2016. Construction of Phase 2b would commence in approximately 2023, with operation planned to start around 2033.

1.1.6 The proposed Phase 2a route has been divided into five community areas (CA), for environmental assessment and community engagement purposes. These are shown in Figure 1.

[1] Note that Parliament's Standing Order 27A makes reference to production of an environmental statement (ES). Under the EIA Directive 2014/52/EU, the output of the environmental assessment is an Environmental Impact Assessment (EIA) Report. This report uses the term EIA Report where referring to the output of the EIA. This 'working draft' EIA report provides an initial environmental assessment of the current stage of design.

Figure 1: The HS2 Phase 2a route and community areas



1.2 Purpose of this report

1.2.1 This working draft EIA Report sets out the current design of the Proposed Scheme, the current environmental baseline information, and describes the likely impacts (and where practicable, the 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 proposed mitigation measures that have been identified, at this stage, to avoid, reduce or manage the likely significant adverse effects of the Proposed Scheme on the environment within the area.

1.2.2 Consultation on the working draft EIA Report is being carried early in the development of the Phase 2a proposals. This is to assist the early engagement with those potentially affected by the Proposed Scheme and to help inform the design and assessment of the Proposed Scheme. Parliamentary Standing Orders do not require a working draft EIA Report. Developing a working draft EIA Report and consulting on it in advance of the statutory formal EIA Report means that consultees have the opportunity to comment on the Proposed Scheme earlier in the process.

1.2.3 As this is a working draft EIA Report, where information is not available at this time, professional judgement and reasonable worst-case assumptions have been used to provide an indication of the likely impact to inform the consultation.

1.2.4 The likely significant environmental effects of the Proposed Scheme will be described in the formal EIA Report to be deposited in accordance with the requirements of Parliamentary Standing Order 27A (SO27A)[2,3]. It is possible that the effects and mitigation described in the formal EIA Report may differ from those presented in this working draft EIA Report, due to the provisional nature of the environmental and design information that is currently available and as a result of consultation on the Proposed Scheme, as appropriate.

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 considered;
- 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);

[2] *Standing Order 27A of the Standing Orders of the House of Commons relating to private business (environmental assessment)*, House of Commons.
[3] House of Lords, 2005, Standing Orders of the House of Lords - Private Business, The Stationery Office

- 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 environmental baseline within the community area;
- a description of the impacts or likely significant environmental effects arising during construction and operation of the Proposed Scheme that have been identified to date; and
- a description of proposed mitigation measures that have been identified to address any significant adverse effects.

1.3.3 Following consultation on this working draft EIA Report, the proposed mitigation measures may be amended to take account of design changes and comments received. Mitigation measures will be set out in full in the formal EIA Report.

1.3.4 Environmental effects have been assessed in accordance with the methodology set out in Volume 1 and the draft Scope and Methodology Report (SMR)[4]. The draft SMR was consulted on between March and May 2016 and subsequently updated to take into consideration comments received. The revised SMR is published alongside this working draft EIA Report and will be used to develop the formal EIA Report.

1.3.5 The maps relevant to the Fradley to Colton area are provided in a separate corresponding document entitled Volume 2, CA1 Map Book, which should be read in conjunction with this report.

1.3.6 In addition to the environmental topics covered in Sections 4-15 of this report, electromagnetic interference is addressed in Volume 1, whilst climate change, major accidents and natural disasters, and waste and material resources are addressed in Volume 3 on a route-wide basis.

[4] https://www.gov.uk/government/consultations/hs2-phase-two-west-midlands-to-crewe-draft-environmental-impact-assessment-scope-and-methodology-report-consultation

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 14km section of the Proposed Scheme passing through the parishes of Fradley and Streethay, Kings Bromley, Armitage with Handsacre, Mavesyn Ridware and Colton. It lies within the local authority areas of Lichfield District Council (LDC) and Staffordshire County Council (SCC) areas. The boundary between Fradley and Streethay and Kings Bromley parish forms the southern boundary of this section. The boundary between Colton parish and Colwich parish forms the northern boundary of this section.

2.1.2 As shown in Figure 2 the Fradley to Colton area (CA1) begins approximately 3km north-east of Lichfield, where the Proposed Scheme would join the HS2 Phase One route, and the Colwich to Yarlet community (CA2) lies to the north.

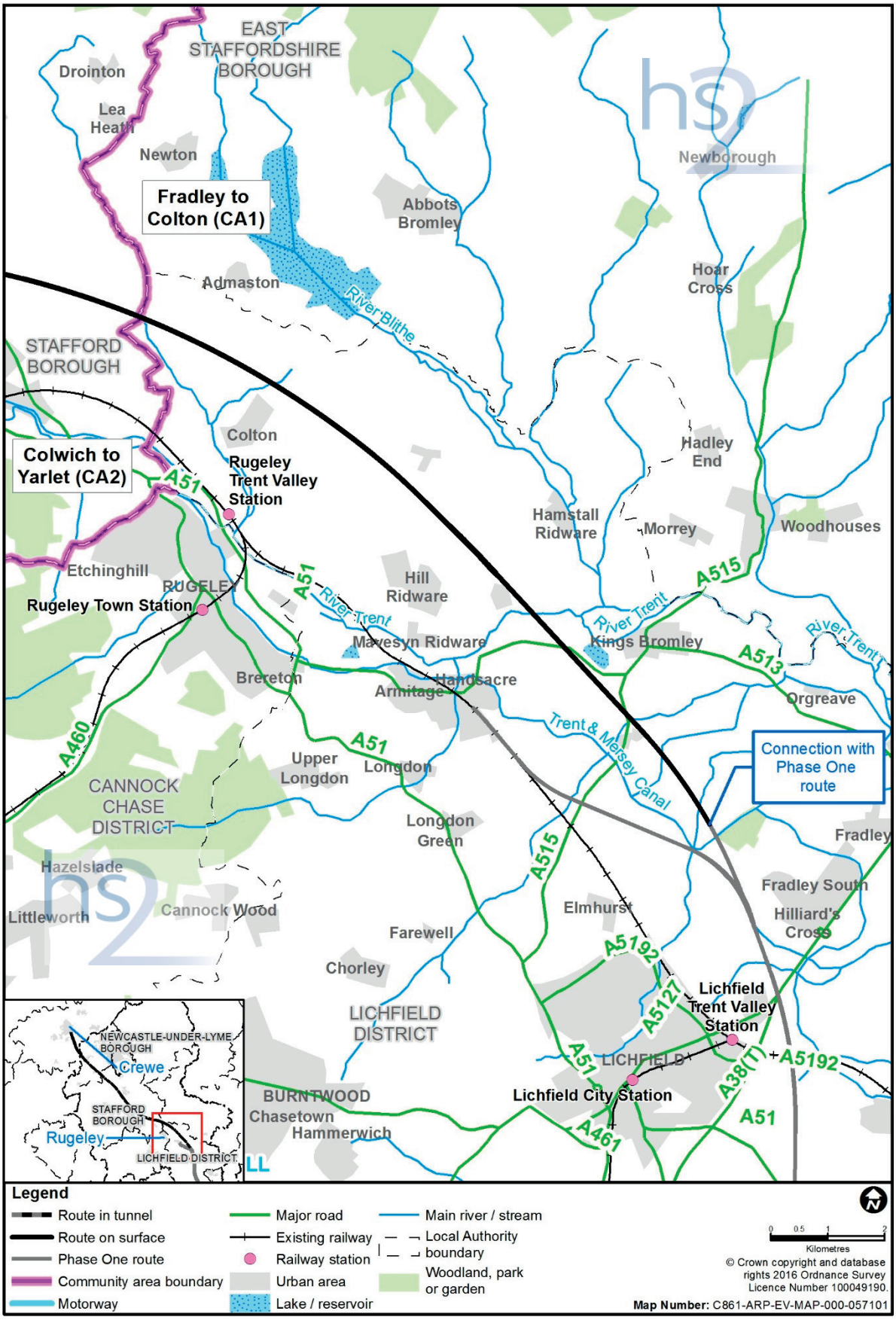
Settlement, land use and topography

2.1.3 The Fradley to Colton area is predominantly rural in character, encompassing lowland and settled river landscapes, often defined by a network of small-scale fields, with agriculture being the main land use.

2.1.4 The area is interspersed with large settlements, notably Fradley, Kings Bromley, Handsacre, Hill Ridware and Colton, and smaller villages and hamlets, such as Hamstall Ridware, Pipe Ridware, Blithbury and Stockwell Heath.

2.1.5 There are a number of water bodies in the area, all falling within the catchment of the Staffordshire Trent Valley, including the River Trent and the Blithfield Reservoir, located approximately 1.7km north of the route.

Figure 2: Area context map



Key transport infrastructure

2.1.6 The route would join the HS2 Phase One route approximately 3km north-east of Lichfield. Principal highways within this area include the A38 Lichfield Road, the A5192 Eastern Avenue, the A51 Stafford Road and the A515 Lichfield Road, which provide links to Rugeley and the wider transport network.

2.1.7 Local roads include the B5014 Uttoxeter Road, which would be realigned to the north-west to cross the line via an overbridge; and the B5013 Uttoxeter Road, which would be realigned to the south to cross the route, also via an overbridge.

2.1.8 Within the area there are a number of footpath and cycle networks associated with the Trent and Mersey Canal, Blithe Valley, Handsacre, the Ridwares and a more extensive path network at Colton and Stockwell Heath.

Socio-economic profile

2.1.9 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 (16%), with construction the second largest (12%) followed by retail (8%). This is shown in Figure 6[5].

2.1.10 According to the Office for National Statistics (ONS) Business Register and Employment Survey 2014, the top five sectors in terms of share of employment in LDC are: production (12%); health (11%); retail (11%); accommodation and food services (9%); and business administration and support services (9%).

2.1.11 According to the Annual Population Survey (2015)[6], 34% of the LDC area's residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, while 10% of the residents had no qualifications.

Notable community facilities

2.1.12 There are a number of community facilities in the larger settlements of Kings Bromley, Handsacre and Rugeley. There are a few local services within Blithbury and Colton, which are smaller villages.

2.1.13 Kings Bromley is located approximately 5km east of Rugeley and 5km north of Lichfield. There is no defined village centre, with most community facilities 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 and a Buddhist monastery.

2.1.14 Blithbury is located approximately 3.5km north-east of Rugeley. The village includes the Bull and Spectacles public house and Rugeley School, which is a specialist residential school associated with The Mayfield Centre located within Moreton House and provides care for young people with autism and moderate to severe learning difficulties.

[5] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.
[6] Annual Population Survey, (2015), NOMIS, Accessed: 26 April 2016.

2.1.15 Colton is a small village linked to the hamlet of Stockwell Heath. Colton provides 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

2.1.16 This is a predominantly rural area, with 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. Cannock Chase Area of Outstanding Natural Beauty (AONB), which is located to the west of the route, includes a wide range of outdoor recreation facilities.

2.1.17 Other open spaces and recreational facilities in the area include: the Kings Bromley Gravel pits, which include fishing and sailing facilities; Four Seasons Nature Study Centre and Trentside Meadows; the Trent and Mersey Canal; the Reindeer Lodge (a visitor attraction); and a number of village public houses.

Policy and planning context

Planning framework

2.1.18 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. Relevant local plan documents and policies have nevertheless been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context.

2.1.19 The following local policies have been considered and referred to where appropriate to the assessment:

- Adopted Lichfield District Local Plan Strategy 2008-2029 (2015)[7];
- Adopted Lichfield District Local Plan (saved policies) (1998)[8];
- Adopted East Staffordshire Local Plan 2012-2031 (2015)[9];
- Adopted Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006 (saved policies) (1999)[10]; and
- Adopted Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026, (2013)[11].

2.1.20 Emerging policies are not generally considered within this report unless a document has been submitted to the Secretary of State for approval. This is the case with the new Minerals Local Plan for Staffordshire (2015 to 2030) - Submission Draft - June 2015 submitted to the Secretary of State on 8 January 2016.

[7] 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.pdf
[8] https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Local-plan/Downloads/1998-lichfield-district-local-plan-saved-policies.pdf
[9] http://www.eaststaffsbc.gov.uk/sites/default/files/docs/planning/planningpolicy/localplan2012-2031/Local-Plan-2012-2031-FINAL.pdf
[10] https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/MineralsLocalPlanadoptedsavedpolicieswebversion1.pdf
[11] 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

2.1.21 There are a number of key planning designations in the area. These include conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens and ancient woodland.

Committed development

2.1.22 Committed developments are defined as developments with planning permission or sites allocated in adopted development plans. Committed developments have not been considered in the assessment for the working draft EIA Report. Those within, or close to, the land required for the Proposed Scheme will be reported in the assessment described in the formal EIA Report.

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, based on the current level of design. Further generic information on typical permanent features is provided in Volume 1, Section 5. Similarly, a general description of the approach to mitigation is set out in Volume 1, Section 9.

2.2.2 Land required permanently for the Proposed Scheme is described in this section and is shown on Map Series CT-06. Land would also be required on a temporary basis for construction. This is set out in Section 2.3 and is shown on Map Series CT-05.

2.2.3 In general, features are described from south to north along the route (and east to west for features that cross the Proposed Scheme).

2.2.4 Design development continues on this section of route as further engineering and environmental baseline is collated, including from field surveys, and as part of ongoing consultation and stakeholder engagement. Any further changes resulting from this will be reported in the formal EIA Report. The main areas of design development being considered include:

- review of the proposed lengths and heights of viaducts and other river crossing structures and associated replacement floodplain storage areas, following hydraulic modelling[12];
- temporary and permanent utility diversions;
- refinement of the realignment of roads and PRoW crossing the Proposed Scheme;
- refinement of drainage features required for rail and highways;
- refinement of maintenance access routes, access to balancing ponds;

[12] The design of viaducts is currently based on flood risk data received from third parties. The effects of any viaducts, bridges, embankments or other structures that intrude into floodplains would be assessed in detail and included in the formal EIA Report.

- additional environmental features required to mitigate likely significant environmental effects;
- accommodation works and crossings of the route for private means of access;
- refinement of construction compound locations and haul roads;
- refinement of auto-transformer station and auto-transformer feeder station locations; and
- grid connection from the sub-station at Rugeley.

2.2.5 The power supply required to operate the Proposed Scheme would come from the national distribution network and connect to the Proposed Scheme via an auto-transformer feeder station. Connections from the distribution network to the auto-transformer feeder station would require new transmission lines; these would be buried or overhead lines, or a combination of both. In the Fradley to Colton area, an auto-transformer feeder station is proposed at Newlands Lane. It is currently anticipated that the transmission lines to connect to the distribution network could extend for up to 6km between the network and the auto-transformer feeder station. Further studies to consider the route and design of these transmission lines are ongoing, informed by continued engagement with the statutory provider, and will be reported in the formal EIA Report.

Overview

2.2.6 The Proposed Scheme through the Fradley to Colton area would be approximately 14km in length within the LDC and SCC areas. The route would extend from near Fradley in the south and travel north towards Blithbury and on to Colton.

2.2.7 This section of route is illustrated on maps CT-06-201 to CT-06-209a in the Volume 2, CA1 Map Book.

Fradley Wood to Woodend culvert

2.2.8 This section of the route would run between Fradley Wood and Woodend culvert, and would be approximately 700m in length.

2.2.9 The route of the Proposed Scheme in this section would continue from the connection with HS2 Phase One through farmland and across the Pyford Brook floodplain. At the connection with the Phase One route, an area of approximately 1ha of replacement broadleaved woodland habitat and scrub planting proposed as part of Phase One would not be planted, but would be provided at an alternative location within the Proposed Scheme.

2.2.10 The initial 300m of this section of the Proposed Scheme from Fradley Wood would be on the Pyford South embankment. Approximately 250m north-west of Fradley Wood, the route would pass over the Pyford Brook viaduct, before returning to the Pyford North embankment approximately 450m north of Fradley Wood, gradually returning to a height above ground level of approximately 2m.

2.2.11 This section of route is illustrated on map CT-06-201 in the Volume 2, CA1 Map Book.

2.2.12 Key features of this section would include:

- connection with the Phase One Manchester spur at Fradley, to the north-east of Lichfield;
- Pyford South embankment, approximately 300m in length and up to 10m in height, and associated landscape mitigation;
- two railway drainage balancing ponds approximately 250m and 350m north-west of Fradley Wood respectively and an ecological mitigation pond to the east of the Proposed Scheme;
- Pyford Brook viaduct, approximately 100m in length and up to 10m in height, running from approximately 250m north-west of Fradley Wood;
- unnamed watercourse diversion passing underneath the Pyford Brook viaduct;
- wetland habitat creation under the Pyford Brook viaduct;
- a replacement floodplain storage area approximately 50m west of Pyford Brook viaduct;
- Pyford North embankment, approximately 300m in length and up to 10m in height; and
- Woodend culvert, crossing beneath the Pyford North embankment in a general east-west direction, approximately 700m north-west of Fradley Wood.

2.2.13 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.14 Construction of this section would be managed from the Pyford Brook viaduct satellite compound and Common Lane satellite compound, which are described in Section 2.3 and shown on maps CT-05-201 and CT-05-202 in the Volume 2, CA1 Map Book.

Woodend culvert to Shaw Lane

2.2.15 This section of the route would run from Woodend culvert to Shaw Lane and would continue from the Pyford North embankment north-west of Woodend culvert, starting to increase in height from approximately 300m south-east of Ashby Stitch culvert. The route would then continue onto Bourne Brook viaduct before reaching Shaw Lane.

2.2.16 This section of route is illustrated on maps CT-06-201 to CT-06-202 in the Volume 2 CA1 Map Book.

2.2.17 Key features of this approximately 2km long section would include:

- continuation of Pyford North embankment for approximately 1.5km varying in height from approximately 5m up to 10m;
- two mitigation ponds, one located approximately 600m to the west and one located approximately 650m to the east of the route, north-west of Woodend culvert;

- permanent diversion of Ashby Stitch watercourse via Ashby Stitch culvert;
- Ashby Stitch culvert, beneath Pyford North embankment, approximately 400m south-east of Common Lane;
- permanent closure of part of Common Lane where it crosses the route;
- Bourne Brook viaduct, approximately 730m in length and up to 13m in height;
- a noise fence barrier up to approximately 3m in height on the eastern side of the route, beginning at Bourne Brook viaduct and continuing for approximately 700m;
- an area of wetland habitat creation under the southern end of Bourne Brook viaduct;
- raising of an overhead power line to provide sufficient headroom above the Bourne Brook viaduct. This would remain on the current alignment;
- permanent diversion of Kings Bromley Footpath 12 in a north–south direction approximately 600m north-west of Common Lane to join the realigned A515 Lichfield Road;
- permanent realignment of approximately 1km of the A515 Lichfield Road, approximately 350m to the north-west of its current alignment and crossing the Proposed Scheme approximately 430m north-west of Bourne Brook;
- permanent realignment of Kings Bromley Footpath 0.390 approximately 470m north-west of Bourne Brook to meet realigned A515 Lichfield Road;
- replacement floodplain storage area approximately 300m to the west of Shaw Lane;
- diversion of Crawley Brook by approximately 200m around Bourne embankment at the northern end of Bourne Brook viaduct; and
- permanent closure of part of Shaw Lane adjacent to the diverted Crawley Brook.

2.2.18 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.19 Construction of this section would be managed from the Common Lane and Bourne Brook viaduct satellite compounds, 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.

Shaw Lane to Pipe Lane

2.2.20 This section of the route would run between Shaw Lane and Pipe Lane (also known as Pipe Wood Lane), and would be approximately 3km long. The route would continue from Bourne Brook viaduct onto Bourne embankment approximately 100m south of the A515 Lichfield Road and Shaw Lane junction. The route would continue from Bourne embankment onto the River Trent viaduct, which would end 50m north of Pipe Ridware.

2.2.21 This section of route is illustrated on maps CT-06-203 to CT-06-204 in the Volume 2 CA1 Map Book.

2.2.22 Key features of this section would include:

- continuation of a noise fence barrier, of up to approximately 3m in height on the eastern side of the Proposed Scheme, to approximately 500m along the River Trent viaduct;
- Bourne embankment approximately 800m in length and up to 14m in height, and associated landscape mitigation;
- permanent diversion of approximately 350m of the Kings Bromley Footpath 1 to pass beneath the River Trent viaduct approximately 20m from the end of the Bourne embankment;
- a balancing pond for railway drainage to the east of the Proposed Scheme, accessed from the A513 Rugeley Road;
- River Trent viaduct approximately 1.9km in length and up to 17m in height;
- three areas of grassland habitat creation under the River Trent viaduct; and
- River Trent viaduct east auto-transformer station located west of the route approximately 600m along River Trent viaduct, accessed via a lane connecting to the A513 Rugeley Road.

2.2.23 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.24 Construction of this section would be managed from the Bourne Brook viaduct satellite compound and the River Trent viaduct 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 Farm

2.2.25 This section of the route would run between Pipe Lane and 100m north-west of Blithbury Farm. The Proposed Scheme would continue from the connection of River Trent viaduct to the Pipe Ridware embankment. The route would pass onto Pipe Ridware embankment and continue into Blithbury South cutting.

2.2.26 This section of route is illustrated on maps CT-06-204 to CT-06-206 in the Volume 2 CA1 Map Book.

2.2.27 Key features of this approximately 2.6km section would include:

- permanent diversion of approximately 1.5km of Pipe Lane north-east of the Proposed Scheme between Pipe Lane and Woodhouse culvert;
- diversion of a high pressure gas main by 50m south-west of its current alignment beneath the western abutment of the River Trent viaduct, approximately 100m north-west of Pipe Lane;
- diversion of an unnamed watercourse passing beneath the River Trent viaduct, approximately 100m north-west of Pipe Lane;

- Pipe Ridware embankment approximately 1.2km in length and up to 16m in height;
- permanent realignment of Mavesyn Ridware Footpath 32 by approximately 200m to follow the Pipe Ridware embankment and crossing under the River Trent viaduct approximately 200m west of the diverted Pipe Lane;
- two balancing ponds for railway drainage: one located east of the Proposed Scheme approximately 200m north-west of Pipe Ridware and accessed via the diverted Pipe Lane; and one located west of the Proposed Scheme approximately 200m north-west of Quintons Orchard Fish Farm and accessed from the southern section of Pipe Lane, surrounded by grassland habitat creation;
- Mavesyn Ridware Footpath 33 permanently diverted to the east of earthworks and balancing pond on the east side of the route to join Mavesyn Ridware Footpath 32;
- two ecological mitigation ponds located along the diverted Pipe Lane approximately 250m east of the route near the junction with Dawson Lane;
- maintenance loops approximately 1.25km in length, up to 16m in height and starting from approximately 200m north-west of the River Trent viaduct, extending to approximately 200m past Woodhouse culvert;
- Woodhouse culvert passing beneath the Proposed Scheme approximately 700m along the Pipe Ridware embankment;
- permanent diversion of Mavesyn Ridware Footpath 38 and Mavesyn Footpath 8 via Mavesyn Ridware Footpath 38 accommodation overbridge;
- Mavesyn Ridware Footpath 38 accommodation overbridge located approximately 300m north-west of Woodhouse culvert to allow pedestrians to cross the route;
- Blithbury South cutting, up to approximately 40m in width, located at the end of Pipe Ridware embankment and continuing for approximately 1km at a depth of up to 4m;
- four ecological mitigation ponds, two located either side of the route approximately 500m north-west of Woodhouse culvert and two located to the west of Blithbury inverted siphon[13];
- grassland habitat creation located between the east of the route and Pipe Lane approximately 600m from the start of Blithbury South cutting;
- Blithbury inverted siphon passing beneath the route approximately 100m east of the existing B5014 Uttoxeter Road;

[13] A form of culvert used on level ground where the water level has to be lowered to pass under the route, other railway or a road access; constructed using enclosed chambers on both sides of the route.

- Blithbury Central cutting approximately 400m in length running from the 50m north-west of the Blithbury inverted Siphon;
- permanent realignment of approximately 1km of the B5014 Uttoxeter Road;
- B5014 Uttoxeter Road overbridge, which would cross the route approximately 150m north of the existing road alignment; and
- two new unnamed culverts north-west and south-east of the route beneath B5014 Uttoxeter Road.

2.2.28 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.29 Construction of this section would be managed from the River Trent viaduct satellite compound, Pipe Lane satellite compound, Maintenance Loop satellite compound and Blithbury Road satellite compound, which are described in Section 2.3, and as shown on maps CT-05-203 to CT-05-206 in the Volume 2 CA1 Map Book.

Blithbury Farm to High Street / Newlands Lane Junction

2.2.30 This section of the route would run from approximately 100m north-west of Blithbury Farm to the junction of the High Street and Newlands Lane. The route of the Proposed Scheme would continue within the central and north sections of the Blithbury cutting, which would range in depth up to approximately 12m below ground level from Blithbury West until the junction of High Street and Newlands Lane.

2.2.31 This section of route is illustrated on maps CT-06-206 to CT-06-208 in the Volume 2 CA1 Map Book.

2.2.32 Key features of this 2.3km section would include:

- Blithbury accommodation overbridge located approximately 200m north-west of the proposed B5014 Uttoxeter Road overbridge to allow agricultural access across the route;
- Blithbury Central cutting continues for approximately 1.5km in length, 12m in depth and 77m in width;
- Blithbury West inverted siphon beneath the Proposed Scheme approximately 200m north-west of Blithbury overbridge;
- permanent diversion of approximately 750m of Blithbury Road and installation of Blithbury Road overbridge to enable Blithbury Road to cross the route approximately 150m south-west of original road alignment;
- permanent diversion of Stonyford Lane to relocate the junction with Blithbury Road approximately 300m south-east of the existing location;
- permanent diversion of Hadley Gate Lane to relocate the junction with Blithbury Road on the eastern side of the route, approximately 200m south-east of its existing location;
- permanent diversion of Colton Footpath 73 to cross the Proposed Scheme via the Colton Footpath 73 overbridge;

- Colton Footpath 73 overbridge across the Proposed Scheme, approximately 600m north of Blithbury Road overbridge;
- Hurstwood drop inlet culvert located approximately 400m north-west of the proposed Colton Footpath 73 overbridge;
- Blithbury North cutting, approximately 900m in length, 80m in width and up to 12m in depth;
- permanent realignment of Newlands Lane approximately 200m west of current alignment and installation of Newlands Lane (South) overbridge;
- Newlands Lane auto-transformer feeder station located immediately west of the route accessed from the realigned Newlands Lane, with approximately 200m of noise fence barrier, of up to 3m height, running along its north-eastern side;
- a grid connection from the sub-station at Rugeley to provide power to the Newlands Lane auto-transformer feeder station (the route of this connection is currently being developed); and
- permanent diversion of Colton Footpath 34 approximately 300m along the eastern side of the Proposed Scheme crossing the route at Newlands Lane (South) overbridge; and
- 10 ecological mitigation ponds either side of the Proposed Scheme.

2.2.33 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.34 Construction of this section would be managed from the Blithbury Road satellite compound and the Newlands Lane satellite compound, which are described in Section 2.3 and as shown on maps CT-05-206 to CT-05-208 in the Volume 2 CA1 Map Book.

High Street / Newlands Lane Junction to Moreton Brook

2.2.35 This section of the route would run from the junction of High Street and Newlands Lane and continue on Stockwell Heath embankment to 400m south-east of the B5013 Uttoxeter Road overbridge, where it would move into Stockwell Heath cutting and then pass onto Moreton South embankment. The route would then pass over Moreton Brook viaduct and onto Moreton North embankment where it would continue into the Colwich to Yarlet area (CA2).

2.2.36 This section of route is illustrated on maps CT-06-208 to CT-06-209a in the Volume 2 CA1 Map Book.

2.2.37 Key features of this approximately 2.8km section would include:

- noise fence barriers of up to approximately 3m in height running along both sides of the route, starting at the junction between High Street and Newlands Lane and running for approximately 650m on the eastern side of the route and approximately 850m along the western side of the route;
- Stockwell Heath embankment, approximately 800m in length and up to 11.5m in height, and associated landscape mitigation planting;

- permanent diversion of Colton Footpath 36 approximately 300m along the eastern side of the Proposed Scheme to Newlands Lane (North) underbridge;
- Finners culvert located within Stockwell Heath embankment;
- permanent realignment of Newlands Lane approximately 50m north-west of the existing road alignment via Newlands Lane (North) underbridge;
- Stockwell Heath culvert for diversion of tributaries of Moreton Brook, located approximately 100m to the north of the Newlands Lane (North) underbridge;
- permanent diversion of Moor Lane approximately 400m to the south-east of the existing road alignment to meet the permanently realigned Newlands Lane and pass underneath the route via Newlands Lane (North) underbridge;
- Sherracop culvert located approximately 200m north-west of the Newlands Lane (North) underbridge;
- Stockwell Heath cutting approximately 550m in length located approximately 450m north-west of the Sherracop culvert;
- three balancing ponds for railway drainage: one located west of the route, approximately 300m north of Colton, accessed from the realigned Moor Lane; one located approximately 150m north-west of B5013 Uttoxeter Road existing alignment, accessed from the B5013 Uttoxeter Road new alignment; and one approximately 150m south-east of Moreton Brook, accessed by an access road running parallel to the route from the B5013 Uttoxeter Road;
- permanent realignment of approximately 1.4km of the B5013 Uttoxeter Road and installation of the B5013 Uttoxeter Road overbridge over the Proposed Scheme, approximately 200m south-east of the existing road alignment;
- Hamley (South) culvert passing beneath the route approximately 200m north-west of the existing B5013 Uttoxeter Road;
- Hamley (North) drop inlet culvert crossing beneath the alignment 400m north-west of the Hamley (South) culvert;
- Moreton South embankment, approximately 1.2km in length and up to 9m in height;
- Moreton Brook viaduct crossing Moreton Brook, approximately 100m in length and up to 10m in height;
- replacement floodplain storage area and wetland habitat creation below Moreton Brook viaduct; and
- approximately 100m of Moreton North embankment.

2.2.38 There would also be maintenance access routes and hedgerow planting throughout this section.

2.2.39 Construction of this section would be managed from the Newlands Lane satellite compound, B5013 satellite compound and the Moreton Brook viaduct satellite

compound, which are described in Section 2.3 and shown on maps CT-05-207, CT-05-208 and CT-05-209a in the Volume 2 CA1 Map Book.

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 would be commissioned; and
- an indicative construction programme.

2.3.2 The construction arrangements described in this section provide the basis for the assessment presented in this working draft EIA Report.

2.3.3 Land would be required permanently for the key features of the Proposed Scheme described in Section 2.2. Land would also be required temporarily for construction. Key temporary construction features are illustrated on the construction Maps Series CT-05, Volume 2, CA1 Map Book. Land required temporarily would be prepared for its eventual end use once the construction works in that area are complete. Land would be returned to its pre-construction use, wherever appropriate, or to a condition as agreed with the owners of the land and the relevant planning authority.

2.3.4 During the construction phase, public roads and PRoW routes would be retained wherever reasonably practicable. Where such routes would cross the Proposed Scheme and require diversion, the alternative road or PRoW crossing the Proposed Scheme would normally be constructed prior to any closure of existing roads or PRoW wherever reasonably practicable. Where they would 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 would be provided where it is safe and reasonably practicable to do so.

2.3.5 Volume 1, Section 5 and Section 6 provide details of the permanent features of the Proposed Scheme and typical construction techniques. For the purposes of the environmental assessment, standard construction techniques as provided in Volume 1, Section 6 have been used.

Code of Construction Practice

2.3.6 All contractors would be required to comply with a Code of Construction Practice (CoCP). In addition, Local Environmental Management Plans (LEMPs) would 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, with the objective of ensuring that the effects of the works on people and the natural environment are reduced as far as reasonably practicable. The CoCP will contain

generic control measures and standards to be implemented throughout the construction process.

2.3.7 A draft CoCP has been prepared and is published alongside this document, as an appendix to Volume 1. It will remain under review as the design of the Proposed Scheme develops and further engagement with stakeholders is undertaken.

Overview of the construction process

2.3.8 Building and preparing the Proposed Scheme for operation will comprise the following general stages:

- advance works including: further site investigations; preliminary mitigation works; and preliminary enabling works;
- civil engineering works including: establishment of construction compounds; haul roads; 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;
- site finalisation works; and
- systems testing and commissioning.

2.3.9 General information about the construction process is set out in more detail in Volume 1, Section 6, including:

- the approach to environmental management during construction and the role of the CoCP;
- working hours;
- management of construction traffic; and
- handling of construction materials.

Advance works

2.3.10 General information about advance works can be found in Volume 1, Section 6. Advance works would be required before the main construction works commence and typically include:

- further detailed site investigations and surveys for proposed construction compounds;
- further detailed environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, habitat creation and translocation, landscape planting and built heritage survey and investigation;

- site establishment with temporary fence construction, along with soil strip and vegetation removal; and
- utility diversions and new utility connections for facilities associated with the Proposed Scheme.

Engineering works

Introduction

2.3.11 Construction of the Proposed Scheme would 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, such as earthworks and erection of bridges and viaducts; and
- works to install, test and commission railway systems, which would include track, overhead line equipment, communications equipment and traction power supply.

2.3.12 The installation of track in open areas would comprise the laying of ballast and/or slab tracks, sleepers and rail.

2.3.13 The construction of the Proposed Scheme would be subdivided into sections, each of which would be managed from compounds. The compounds would act as the main interface between the construction work sites and the public highway, as well as performing other functions as described below. Compounds would either be main compounds or satellite compounds. Satellite compounds are generally smaller. Compounds would either be used for civil engineering works, for railway installation works, or for both.

2.3.14 Ten civil engineering satellite compounds would be located in the Fradley to Colton area, three of which would continue to be used as railway installation satellite compounds following the completion of civil engineering works at those compounds.

2.3.15 All satellite compounds for civil engineering works within the Fradley to Colton area would be managed from the A51 main compound (see CA2, Colwich to Yarlet). All satellite compounds for railway systems works would be managed from the Stone railhead main compound (see CA3, Stone and Swynnerton).

2.3.16 Figure 3 shows the management relationship for civil engineering works compounds and Figure 4 for the railway installation works. Details about individual compounds are provided in subsequent sections of this report.

General overview of construction compounds

2.3.17 The main compound would be used for core project management staff (i.e. engineering, planning and construction delivery) and commercial and administrative staff. These teams would directly manage some works and coordinate the works at the satellite compounds. In general, main compounds would include:

- space for the storage of bulk materials;
- space for the receipt, storage and loading/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.

2.3.18 Satellite compounds would 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 limited numbers of staff, local storage for plant and materials, limited car parking for staff and site operatives, and welfare facilities.

2.3.19 The storage of soil, stripped as part of the works prior to it being used when the land is reinstated, requires land for the duration of construction. The location of top soil storage areas would generally be adjacent to compounds and areas of construction activity.

2.3.20 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 and transfer nodes

2.3.21 The movement of construction vehicles to carry materials, plant, other equipment and workforce (or moving empty) would take place within the construction compounds, on public roads and between compounds and worksites. Construction movements would also utilise the existing rail network. The construction compounds would provide the interface between the construction works and the public road or rail network. The likely road routes to access compounds in the Fradley to Colton area are described in subsequent sections of this report.

2.3.22 Where reasonably practicable, movements between the construction compounds and the work sites would be on designated haul roads within the site, often along the line of the route or running parallel to it.

2.3.23 Areas of land are also required for the storage and loading and unloading of bulk earthworks materials that are moved to and from the site on public roads. These areas are referred to as 'transfer nodes' and are shown on maps CT-05-201 to CT-05-209a in the Volume 2 CA1 Map Book.

Figure 3: Construction compounds showing key indicative civil engineering works within the Fradley to Colton Area

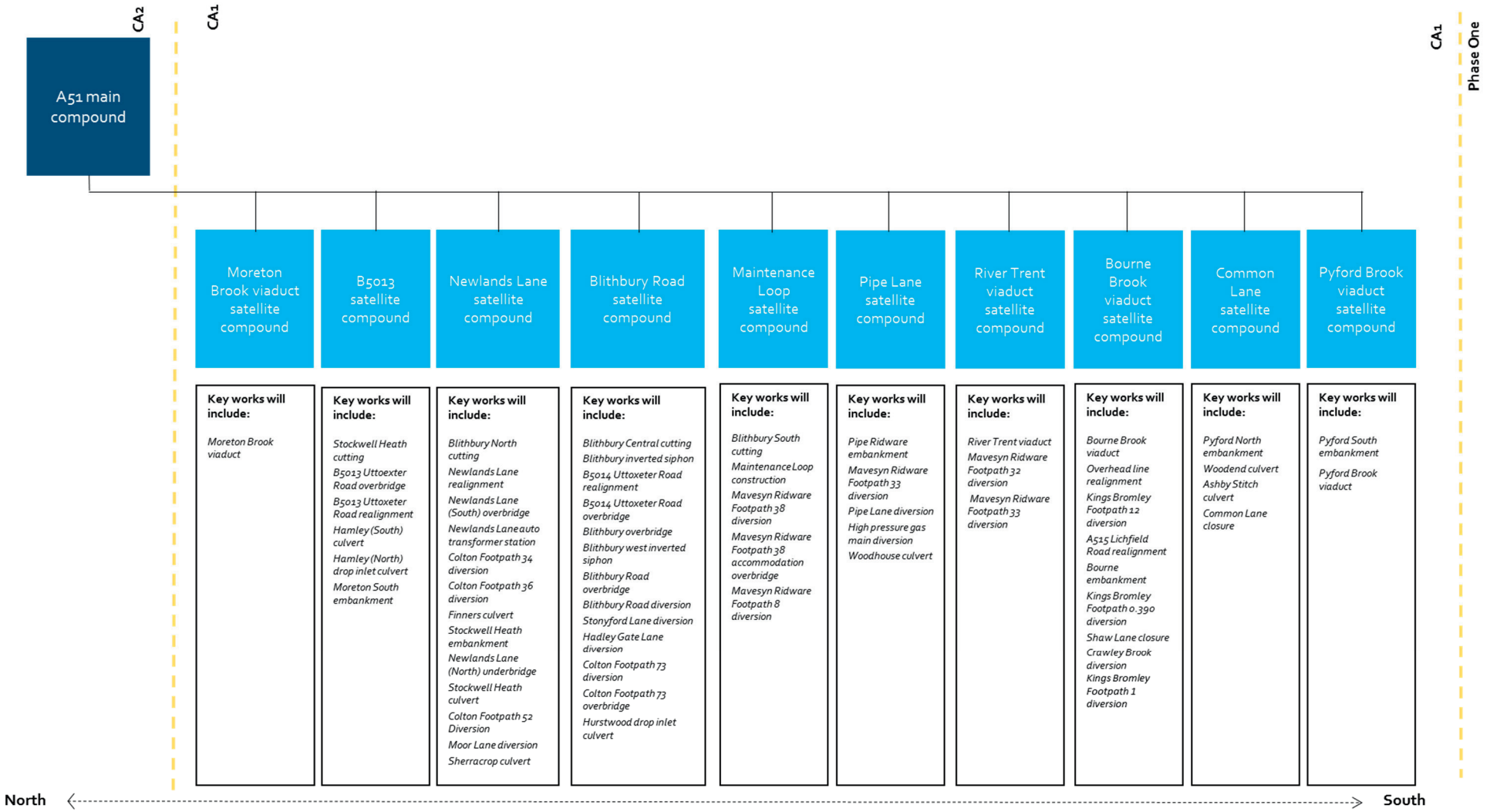
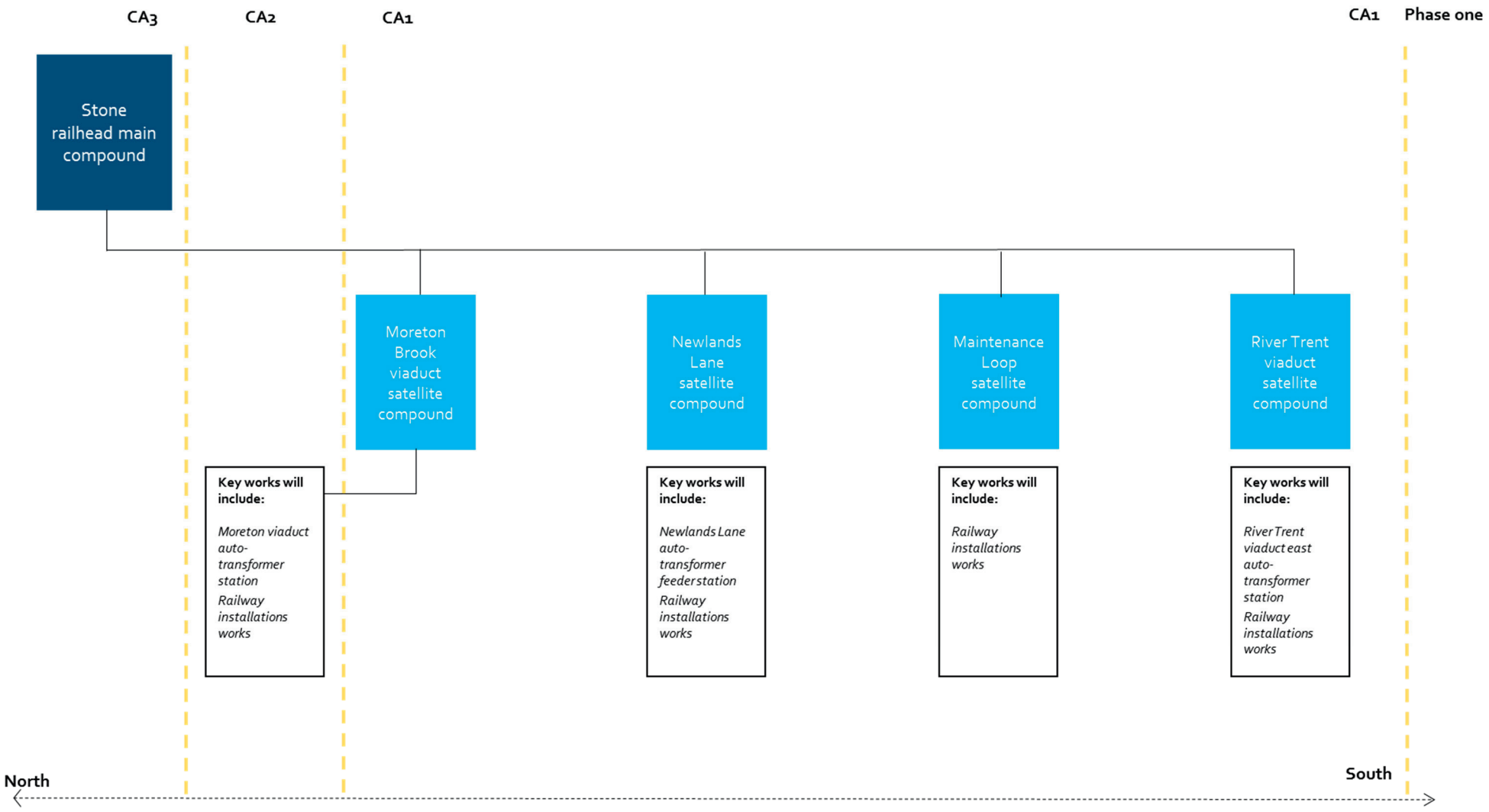


Figure 4: Construction compounds showing key indicative railway installation works within the Fradley to Colton area



Pyford Brook viaduct satellite compound

2.3.24 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 25 workers at peak times) throughout much of the works period;
- be accessed off the A515 Lichfield Road or Common Lane (South) and then via the site haul road constructed to the south of the route; and
- be managed from the A51 main compound.

2.3.25 The compound would be used to manage the construction of the following:

- Pyford South embankment;
- Pyford Brook viaduct; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.26 It is currently anticipated that demolition of a disused farm building close to the beginning of the route within the Pyford South embankment would be required as a result of the works to be managed from this compound.

2.3.27 It is currently anticipated that no temporary or permanent diversions of public highways, PRoW, watercourses or utilities would be required as a result of the works to be managed from this compound.

Common Lane satellite compound

2.3.28 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months, commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 30 workers at peak times) throughout much of the works period;
- be accessed via the A515 Lichfield Road or Common Lane (South); and
- be managed from the A51 main compound.

2.3.29 The compound would be used to manage the construction of the following works:

- Pyford North embankment;
- Woodend culvert;
- Ashby Stitch culvert;
- permanent closure of part of Common Lane; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.30 It is currently anticipated that the demolition of electricity pylon(s) would be required to realign the overhead power line as a result of the works to be managed from this compound.

2.3.31 Permanent closure of Common Lane would be required as a result of the works to be managed from this compound.

2.3.32 It is currently anticipated that no temporary or permanent diversions of public roads or PRoW would be required as a result of the works to be managed from this compound.

2.3.33 Permanent diversion of the Ashby Stitch watercourse via the Ashby Stitch culvert would be required as a result of the works to be managed from this compound. It is currently anticipated that no temporary diversions of watercourses would be required as a result of the works to be managed from this compound

2.3.34 It is currently anticipated that no temporary or permanent diversions of utilities would be required as a result of the works to be managed from this compound.

Bourne Brook viaduct satellite compound

2.3.35 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months, commencing during 2020;
- support approximately 40 civil engineering workers per day (approximately 60 workers at peak times) throughout much of the works period;
- be accessed via the A513 Rugeley Road or the diverted Shaw Lane; and
- be managed from the A51 main compound.

2.3.36 The compound would be used to manage the construction of the following works:

- Bourne Brook viaduct;
- realignment of an overhead power line;
- Kings Bromley Footpath 12 diversion;
- A515 Lichfield Road realignment;
- Bourne embankment;
- Kings Bromley Footpath 0.390 diversion;
- permanent closure of part of Shaw Lane;
- Crawley Brook diversion;
- Kings Bromley Footpath 1 diversion; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.37 It is currently anticipated that the demolition of three residential buildings, two of which are at Shaw Lane Farm, would be required as a result of the works to be managed from this compound.

2.3.38 Permanent realignment of the A515 Lichfield Road would be required. A temporary diversion of the A515 Lichfield Road during the realignment works would be required to allow the formation of construction access to Common Lane satellite compound, requiring intermittent lane restrictions.

2.3.39 Permanent closure of Shaw Lane would be required as a result of the works to be managed from this compound.

2.3.40 Permanent diversion of Kings Bromley Footpath 1 and accommodation access would be required as a result of the works to be managed from this compound, diverting under the River Trent viaduct.

2.3.41 Temporary diversion of the Kings Bromley Footpath 12 and Kings Bromley Footpath 0.390 around the Bourne Brook viaduct would also be required.

2.3.42 Permanent diversion of the Crawley Brook watercourse to pass under the Bourne Brook viaduct would be required as a result of the works to be managed from this compound.

2.3.43 It is currently anticipated that a permanent diversion of Kings Bromley Footpath 12 would be required to pass underneath the Bourne Brook viaduct and also Kings Bromley Footpath 1 and accommodation access would be required diverting under the River Trent viaduct.

2.3.44 It is currently anticipated that the realignment of an overhead power line above the Bourne Brook viaduct would also be required.

River Trent viaduct satellite compound

2.3.45 This compound would provide for civil engineering and railway systems works and would:

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 55 civil engineering workers per day (approximately 80 workers during peak times) throughout much of the works period; and
- approximately 30 railway systems workers per day (approximately 40 workers during peak times) throughout much of the works period;
- be accessed via the A513 Rugeley Road;
- be managed from the A51 main compound for civil engineering works and the Stone railhead main compound for railway systems works.

2.3.46 The compound would be used to manage the construction of the following works:

- River Trent viaduct;
- River Trent viaduct east auto-transformer station;
- permanent diversion of Mavesyn Ridware Footpath 32; and

- finalisation works including site reinstatement, landscaping and planting.

2.3.47 It is currently anticipated that there would be no requirement for demolitions or diversions of utilities as a result of the works to be managed from this compound.

2.3.48 Temporary diversion of A513 Rugeley Road, potentially requiring lane restrictions as well as overnight and weekend closures over the construction period, would be required as a result of the works to be managed from this compound.

2.3.49 Permanent diversion of Mavesyn Ridware Footpath 32 and Mavesyn Ridware Footpath 33 would be required as a result of the works to be undertaken from this compound, diverting users around the proposed River Trent viaduct.

2.3.50 A temporary diversion of the Mavesyn Ridware Footpath 30 would also be required, diverting users around the land required for construction works.

2.3.51 It is currently anticipated that no diversions of watercourses or utilities would be required as a result of the works to be managed from this compound.

Pipe Lane satellite compound

2.3.52 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months, commencing during 2020;
- support approximately 25 civil engineering workers per day (approximately 40 workers at peak times) throughout much of the works period;
- be accessed via the diverted Pipe Lane; and
- be managed from the A51 main compound.

2.3.53 The compound would be used to manage the construction of the following works:

- Pipe Ridware embankment;
- Pipe Lane diversion;
- permanent diversion of Mavesyn Ridware Footpath 33;
- diversion of a high pressure gas main;
- Woodhouse culvert; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.54 It is currently anticipated that no demolitions would be required as a result of the works to be managed from this compound.

2.3.55 Permanent diversion of Pipe Lane would be required as a result of the works to be undertaken from this compound. The diversion would require approximately 1.5km of Pipe Lane to be diverted to the north-eastern side of the route, and then tie in with the current alignment of Pipe Lane to the east of River Trent viaduct.

2.3.56 Permanent diversion of a high-pressure gas main approximately 50m from its current alignment and under the River Trent viaduct would be required as a result of the works to be managed from this compound.

2.3.57 It is currently anticipated that no diversions of PRoW and watercourses would be required as a result of the works to be managed from this compound.

Maintenance loop satellite compound

2.3.58 This compound would provide for civil engineering and railway systems works and would:

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 25 civil engineering workers per day (approximately 40 workers at peak times) throughout much of the works period; and
- approximately 25 railway systems workers per day throughout much of the works period;
- be accessed via Quintons Orchard and the proposed haul road;
- be managed from the A51 main compound for civil engineering works; and
- be managed from the Stone railhead main compound for railway systems works.

2.3.59 The compound would be used to manage the construction of the following works:

- Blithbury South cutting;
- maintenance loop construction;
- Mavesyn Ridware Footpath 38 diversion;
- Mavesyn Ridware Footpath 38 accommodation overbridge;
- Mavesyn Ridware Footpath 8 diversion;railway installation works; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.60 It is currently anticipated that no demolitions would be required as a result of the works to be managed from this compound.

2.3.61 Permanent diversion of Mavesyn Ridware Footpath 38 would be required as a result of the proposed works to be undertaken from this compound. The diversion would cross the route via Mavesyn Ridware Footpath 38 accommodation overbridge.

2.3.62 Temporary diversion of Mavesyn Ridware Footpath 8 would be required as a result of the works to Pipe Lane, with a permanent diversion post-construction along the eastern side of the Proposed Scheme, also crossing the route via the Mavesyn Ridware Footpath 38 accommodation overbridge.

2.3.63 It is currently anticipated that no diversions of public roads, watercourses or utilities would be required as a result of the works to be managed from this compound.

Blithbury Road satellite compound

2.3.64 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months, commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 30 workers at peak times) throughout much of the works period;
- be accessed via Blithbury Road; and
- be managed from the A51 main compound.

2.3.65 The compound would be used primarily to manage the construction of the following works:

- Blithbury Central cutting;
- Blithbury inverted siphon;
- B5014 Uttoxeter Road realignment;
- B5014 Uttoxeter Road overbridge;
- Blithbury accommodation overbridge;
- Blithbury West inverted siphon.
- Blithbury Road overbridge;
- Blithbury Road diversion;
- Stonyford Lane diversion;
- Hadley Gate Lane diversion;
- Colton Footpath 73 diversion;
- Colton Footpath 73 overbridge;
- Hurstwood drop inlet culvert; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.66 It is currently anticipated that the demolition of three two-storey brick residential buildings accessed from Hadley Gate would be required as a result of the works to be managed from this compound.

2.3.67 The B5014 Uttoxeter Road would be permanently realigned over the route via the B5014 Uttoxeter Road overbridge with temporary lane closures for traffic control and to allow formation of construction access to this compound.

2.3.68 The Blithbury Road would be permanently diverted via the Blithbury Road overbridge with temporary lane closures for traffic control during the construction period. Hadley Gate Lane and Stonyford Lane would also be permanently diverted to meet the new Blithbury Road alignment.

2.3.69 Permanent diversion of Colton Footpath 73 would be required as a result of the works to be undertaken from this compound. The diversion would cross the route via the Colton Footpath 73 overbridge.

2.3.70 Blithbury Road would be diverted via the Blithbury Road overbridge with temporary lane closures for traffic control during the construction period. Hadley Gate Lane would also be diverted to meet the new Blithbury Road alignment.

2.3.71 Permanent diversion of tributaries of Bentley Brook via the Blithbury and Blithbury West inverted siphons would be required as a result of the works to be undertaken from this compound.

2.3.72 It is currently anticipated that no diversions of utilities would be required as a result of the works to be undertaken from this compound.

Newlands Lane satellite compound

2.3.73 This compound would provide civil engineering and railway systems support and would:

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 40 civil engineering workers per day (approximately 60 workers at peak times) throughout much of the works period; and
- approximately 40 railway systems workers per day (approximately 75 during peak times) throughout much of the works period;
- be accessed via Newlands Lane;
- be managed from the A51 main compound for civil engineering works; and
- be managed from the Stone railhead main compound for railway systems works.

2.3.74 The compound would be used to manage the construction of the following works:

- Blithbury North cutting;
- Newlands Lane realignment;
- Newlands Lane (South) overbridge;
- Newlands Lane auto transformer feeder station;
- Colton Footpath 34 diversion;
- Stockwell Heath embankment;
- Colton Footpath 36 diversion;
- Finners culvert;
- Newlands Lane (North) underbridge;
- Stockwell Heath culvert;

- Colton Footpath 52 diversion;
- Moor Lane diversion;
- Sherracop culvert;
- railway systems installations; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.75 It is currently anticipated that no demolitions would be required as a result of the works to be managed from this compound.

2.3.76 Newlands Lane would be permanently diverted over the route, via Newlands Lane (South) overbridge, with temporary lane closures for traffic control during the construction period.

2.3.77 Permanent diversion of Moor Lane would be required, and would be diverted under the route via the Newlands Lane (North) underbridge to meet at a junction to the west of Newlands Lane (North) underbridge.

2.3.78 Permanent diversion of Colton Footpath 34 would be required via Newlands Lane (South) overbridge, to direct users to the south-east of the route.

2.3.79 Permanent diversion of Colton Footpath 36 would also be required, directing users north-west to cross beneath the route via Newlands Lane (North) underbridge.

2.3.80 Colton Footpath 52 would be permanently diverted, directing users under the route via the Newlands Lane (North) underbridge.

2.3.81 Permanent diversion of tributaries of Moreton Brook via Finners culvert, Stockwell Heath culvert and Sherracop culvert would be required as a result of the works to be managed from this compound.

2.3.82 It is currently anticipated that no diversions of utilities would be required as a result of the works to be managed from this compound.

B5013 satellite compound

2.3.83 This compound would provide for civil engineering works and would:

- be operational for approximately four years and six months, commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 30 workers at peak times) throughout much of the works period;
- be accessed via the B5013 Uttoxeter Road; and
- be managed from the A51 main compound.

2.3.84 The compound would be used primarily to manage the construction of the following works:

- Stockwell Heath cutting;
- B5013 Uttoxeter Road overbridge;

- B5013 Uttoxeter Road realignment;
- Hamley (South) culvert;
- Hamley (North) drop inlet culvert;
- Moreton South embankment; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.85 It is currently anticipated that demolition of one single-storey brick outbuilding would be required as a result of the works to be managed from this compound.

2.3.86 The B5013 Uttoxeter Road would require permanent realignment over the B5013 Uttoxeter overbridge, with temporary lane closures for traffic control and to allow the formation of construction access to this compound.

2.3.87 It is currently anticipated that no diversions of PRoW, watercourses or utilities would be required as a result of the works to be undertaken from this compound.

Moreton Brook viaduct satellite compound

2.3.88 This compound would provide for civil engineering and railway systems support and would:

- be operational for approximately six years and nine months, commencing during 2020;
- support up to 30 civil engineering workers per day (approximately 40 workers at peak times) throughout much of the works period;
- and approximately 30 railway systems staff on average per day (approximately 40 workers peak times);
- be accessed via the B5013 Uttoxeter Road and then via an access road constructed to the north of the route; and
- be managed from the A51 main compound for civil engineering works; and
- be managed from the Stone railhead main compound for railway systems works.

2.3.89 The compound would be used primarily to manage the construction of the following works:

- Moreton Brook viaduct;
- Moreton viaduct auto-transformer station (in the Colwich to Yarlet area (CA2));
- railway systems installation works; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.90 It is currently anticipated that no demolitions would be required as a result of the works to be managed from this compound.

2.3.91 Permanent diversion of tributaries of Moreton Brook via Hamley (South) culvert and Hamley (North) drop inlet culvert would be required as a result of the works to be managed from this compound.

2.3.92 It is currently anticipated that no diversions of public roads, PRoW or utilities would be required as a result of the works to be managed from this compound.

Construction waste and material resources

2.3.93 Excavated material generated across the Proposed Scheme would be reused as engineering fill material or in the environmental mitigation earthworks for the Proposed Scheme, where suitable and reasonably practicable, either with or without treatment.

2.3.94 Forecasts of the amount of construction, demolition and excavation waste (CDEW) that would be produced during construction of the Proposed Scheme are reported in Volume 3, Route-wide effects.

Commissioning of the railway

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

Construction programme

2.3.96 A construction programme illustrating indicative periods for the construction activities described above is provided in Figure 5.

Figure 5: Indicative construction programme

Construction activity	2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters				2026 quarters				2027 quarters			
	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
Preparatory and enabling works																																
Site compound set up, clearance, enabling works																																
Drainage and watercourse diversions																																
Road, footpath and utility diversions																																
Main construction works - Earthworks																																
Cuttings																																
Embankments																																
Mitigation earthworks																																
Main construction works - Structures																																
Retaining walls																																
Viaducts, underbridges and culverts																																
Overbridges and accommodation structures																																
Auto-transformer and sub-stations																																
Reinstatement, soft landscaping and finishes																																
Rail infrastructure fit-out																																
Track laying and overhhead line equipment																																
Commissioning																																
Commissioning																																

Key	
	Construction activity that takes place at one or more locations for the majority of the quarter highlighted
	Construction activity that takes place at discrete locations for intermittent periods during the quarter highlighted

2.4 Operation of the Proposed Scheme

Operational specification

Introduction

2.4.1 Volume 1, Section 4.5 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 would be up to six trains per hour in each direction upon opening in 2027, rising to up to 12 trains per hour each way passing through the Fradley to Colton area when the full Phase Two route is operational. Services are expected to operate between 05:00 and 24:00 from Monday to Saturday and between 08:00 and 24:00 on Sundays.

2.4.3 In this area, trains would run at speeds up to 360kph (225mph). The trains would be either single 200m-long trains or two 200m-long trains coupled together, depending on demand and time of day.

Maintenance

2.4.4 Volume 1, Section 4.5 describes the anticipated maintenance regime for the Proposed Scheme.

2.4.5 The intention is that inspections of the route would take place on a regular basis when the railway is not operating. There would be routine preventative maintenance, including grinding of the rails in line with the maintenance strategy to keep them in good condition, and more periodic heavy maintenance as necessary.

2.4.6 Railway maintenance vehicles would be parked either at the defined maintenance loops at Pipe Ridware or at the HS2 infrastructure maintenance depot (IMD), currently proposed at Crewe in the South Cheshire area (CA5). The maintenance loops would enable maintenance trains to be stabled temporarily during the day when maintenance activities are being undertaken over a number of nights without returning to the HS2 Crewe IMD.

Operational waste and material resources

2.4.7 Forecasts of the amount of waste arising from track maintenance and ancillary infrastructure and any associated potential significant environmental effects are provided in Volume 3, Section 15.

2.5 Route section alternatives

Introduction

2.5.1 The strategic and route corridor alternatives to the Proposed Scheme are presented in the Alternatives report as an appendix to the Volume 1. The local alternatives considered for the Proposed Scheme within the Fradley to Colton area are described in this section.

2.5.2 Since November 2015, as part of the design development process, a series of potentially feasible local alternatives has been reviewed within workshops attended by engineering, planning and environmental specialists. The potential environmental impacts of each design option have been reviewed during these workshops. The purpose of the reviews has been to ensure that the Proposed Scheme draws the appropriate balance between engineering requirements, cost and potential environmental impacts.

2.5.3 The following sub-paragraphs describe the main local alternatives considered in this area and includes a comparison of the environmental effects associated with each option and the main reasons for selecting the option to be taken forward into the Proposed Scheme. In considering the environmental effects, all topics have been taken into account; however, only those topics where there is potential for a moderate or major effect are reported below.

Bourne Brook viaduct and River Trent viaduct

2.5.4 As part of the design development process, since the announcement of the route in November 2015, consideration has been given to the length of the Bourne Brook and River Trent viaducts. Viaducts are required along this section of the route to enable it to cross over the Bourne Brook and the River Trent and associated floodplain. The route would pass over these watercourses on viaducts which would be approximately 730m and 1.9km in length respectively.

2.5.5 At the time of the comparisons being undertaken, detailed flood modelling was not available. As part of the next phase of design development, hydraulic modelling of the Bourne Brook and the River Trent will be undertaken to better define the flood zone and the potential impacts.

2.5.6 The following options were identified, analysed and impacts assessed against the route announced in November 2015 (Option A1.0):

- Option A1.0 (the route announced in November 2015): two viaducts spanning across the Bourne Brook and the River Trent and associated flood plain. The Bourne Brook viaduct and the River Trent viaduct would be approximately 730m and 1.9km in length respectively;
- Option A1.1a: a single viaduct, approximately 2.8km in length, spanning across both the Bourne Brook and the River Trent. A 230kph crossover[14] would be located on an extended section of embankment at the northern end of the viaduct;
- Option A1.1b: a single viaduct, approximately 3km in length, spanning across both the Bourne Brook and the River Trent. A 130kph crossover would be located on an extended section of embankment at the northern end of the viaduct; and
- Option A1.2: the length of the Bourne Brook viaduct would be reduced from 730m to 720m and the River Trent viaduct from 1.9km to 895m, with a

[14] A crossover is a pair of switches that connects two parallel rail tracks, allowing a train on one track to cross over to the other.

consequential increase in embankment lengths on either side of the respective viaducts.

2.5.7 Option A1.0 would introduce infrastructure into the landscape that would be visible within the low-lying area of the Trent valley and affect the setting of the Kings Bromley Conservation Area. The embankment associated with the viaducts would result in loss of agricultural land and habitat fragmentation, would introduce a barrier to the movement of wildlife and would result in the loss of Tomlinson's Spinney LWS. There are likely to be noise impacts on the residents of Pipe Ridware. The A513 would be temporarily closed resulting in the need to divert traffic, which could result in congestion and/or delay.

2.5.8 Option A1.1a would remove the need for an embankment between the Bourne Brook and River Trent and as such would reduce the visual prominence of the viaduct and reduce impacts on the setting of Kings Bromley Conservation Area. Loss of agricultural land and habitat fragmentation would be reduced as would the loss of Tomlinson Spinney LWS. This option would also reduce the requirement to divert roads in the area. However, due to the extension of the embankment into the River Trent floodplain, this option would increase flood levels in this location and replacement floodplain storage area compensation would need to be provided.

2.5.9 Option A1.1b would increase the length of the viaduct when compared to Option A1.1a. The impacts would be similar to those reported for Options A1.1a. However, increasing the length of the viaduct would reduce the loss of floodplain.

2.5.10 Option A1.2 would have a greater potential visual impact, as it would comprise a series of embankments and bridges. This would cause fragmentation in the landscape character and affect the setting of Kings Bromley Conservation Area. This option would result in increased loss of agricultural land, fragmentation of habitat and severance of communities as there would be a need to lower the alignment of the existing A513. This option would increase flood levels in this location due to the extent of embankment located in the floodplain.

2.5.11 Option A1.0 has been taken forward into the Proposed Scheme. The preferred environmental option is Option A1.1b, as it would provide greater environmental benefits when compared with the other options. However, on balance it was determined that the environmental benefits of Option A1.1b were not considered sufficient to justify the disproportionately higher cost and the introduction of the environmental impacts of potentially increasing flood levels compared with Option A1.0.

2.5.12 At this time it is considered that retaining the embankment between the viaducts enables flexibility for adjusting viaduct lengths in the future and minimising the flood risk. Any changes in the design will be reported in the formal EIA Report.

Maintenance loops at Pipe Ridware

2.5.13 As part of the design development process, since the announcement of the route in November 2015, consideration has been given to the route alignment at the location of the maintenance loops within the Proposed Scheme. The maintenance loops could also be used in the event that a passenger train could not continue unassisted to its

destination. The Proposed Scheme includes maintenance loops, approximately 1.25km in length located on an embankment adjacent to Pipe Ridware.

2.5.14 A study undertaken prior to the announcement of the scheme considered alternative locations for the maintenance loops at Great Haywood, Marston, Pirehill and Yarlet. The alternative locations were not taken forward into the Proposed Scheme as they were considered to be located too far north to allow for efficient maintenance operations, given the main maintenance facilities would be located at Basford, near Crewe.

2.5.15 The following options were identified, analysed and the impacts assessed:

- Option A2.0: (the route announced in November 2015) maintenance loops, approximately 1.15km in length, located on an embankment, up to 13m in height, adjacent to Pipe Lane;
- Option A2.1a: maintenance loops, approximately 1.35km in length, located on an embankment, up to 13m in height, adjacent to Pipe Lane;
- Option A2.1b: maintenance loops, approximately 1.25km in length, located on an embankment, up to 16m in height, adjacent to Pipe Lane; and
- Option A2.1c: maintenance loops, approximately 1.15km in length, located on an embankment, up to 12m in height, adjacent to Pipe Lane.

2.5.16 Option A2.0 would introduce visual and noise impacts on residents of Pipe Ridware, Rugeley School and isolated farmsteads and affect the overall amenity of the area. There would be an impact on the setting of Woodhouse Farmhouse and Bentley Hall Farmhouse, both of which are Grade II listed. There would be a requirement to realign a number of PRoW and there would be loss of agricultural land and loss and fragmentation of habitats. A proposed mineral safeguarding area (MSA) for sand and gravel would be sterilised.

2.5.17 Option A2.1a and A2.1b would change the length of the embankment when compared to Option A2.0 and Option 2.1b would change the height. The impacts would be similar to those reported for Option A2.0.

2.5.18 Option A2.1c would reduce the height of the embankment, and therefore, its prominence in the landscape. The depth of the adjacent cutting would be increased which, combined with the lower embankment height, would reduce visual and noise impacts on residents of Pipe Ridware, Rugeley School and isolated farmsteads and the setting of Woodhouse Farmhouse and Bentley Hall Farmhouse. The lower alignment and deeper cutting would generate greater quantities of excavation waste.

2.5.19 Option A2.1b has been taken forward into the Proposed Scheme. The preferred environmental option is Option A2.1c, as it would provide greater environmental benefits when compared with the other options. However, a review of the route as announced in November 2015 identified that a constant gradient would be required as the route transitions from the River Trent viaduct to the Pipe Ridware embankment.

2.5.20 An option to relocate the permanent maintenance facilities near to Stone, in the Stone and Swynnerton area (CA3), is being considered as part of the design

development. Locating the permanent maintenance facilities near to Stone could also mean that the maintenance loops located at Pipe Ridware may not be required.

Embankment at Stockwell Heath and Colton

2.5.21 Prior to the route announcement in November 2015 options, were reviewed to reduce the impact of the route on the village of Stockwell Heath. Options considered the location and height of the route and the impact this would have on the village, including assessments of the required cutting depth to the north and south of Stockwell Heath, the presence of the maintenance loops at Pipe Ridware and a straighter route alignment.

2.5.22 As part of the design development process, since the announcement of the route in November 2015, consideration has been given to the form of structure which would carry the route between Stockwell Heath and Colton. The route would pass between Stockwell Heath and Colton on an embankment of approximately 900m length with a height of up to 11m and a number of culverts located within the embankment.

2.5.23 The sensitivity of the residential areas of Stockwell Heath and Colton, in terms of visual impacts, noise and community severance, has been instrumental in considering the form of structure.

2.5.24 The following options were identified, analysed and impacts assessed against the route announced in November 2015 (Option A3.0):

- Option A3.0 (the route announced in November 2015): embankment of approximately 900m in length and up to 10m in height;
- Option A3.1a: multi-span viaduct of approximately 540m in length and up to 11m in height;
- Option A3.1b: multi-span viaduct of approximately 540m in length and up to 13m in height; and
- Option A3.2: embankment of approximately 580m in length and up to 8m in height.

2.5.25 Option A3.0 would act as a physical and visual barrier between Colton and Stockwell Heath and would be likely to result in permanent isolation for residential properties. Access would be reduced to a single crossing under the route, with the diverted Moor Lane and Newlands Lane being permanently realigned and combined. Changes to the local road network would also potentially result in congestion and delays. This option would result in noise impacts on the residents of Stockwell Heath. This option would also sever the historic landscape and result in the loss of agricultural land and loss and fragmentation of habitats. The culverts required for this option would result in hydraulic and hydro-geomorphology impacts and there would be an impact on an upstream tributary of the Moreton Brook.

2.5.26 Option A3.1a and A3.1b would both reduce the severance between Colton and Stockwell Heath and avoid the need to divert Moor Lane and realign Newlands Lane. In Option A3.1a Moor Lane would, however, need to be lowered, which could result in severance during construction. The viaduct would reduce the loss of agricultural land and also reduce severance of the historic landscape. Option A3.1b would increase the

height of the viaduct when compared to Option A3.1a. However, there would be no requirement to lower Moor Lane. Increasing the height of the viaduct would increase the height of the embankments on the approach to the viaduct, which would require more land and have a greater visual impact during construction.

2.5.27 Option A3.2 would reduce the length and height of the embankment when compared to Option A3.0. The impacts would be similar to those reported for Option A3.0. This option would reduce visual impacts; however, there would be a need for a higher noise barrier due to the reduction in embankment height (all other matters remaining equal, the taller an embankment (or viaduct), the smaller the noise barrier required on the shoulder of the embankment (or viaduct parapet) to provide the same noise reduction for a receptor at ground level).

2.5.28 Option A3.0 has been taken forward into the Proposed Scheme. The preferred environmental option is Option A3.1b, as it would provide greater environmental benefits, most notably in reducing severance, when compared with the other options. However, an earthwork embankment is more cost effective than a viaduct and the method of construction is easier. There is also less maintenance required. On balance, the potential environmental benefits of Option A3.1b were not considered sufficient to justify the additional complexity, length of construction and significant increase in cost.

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 This section summarises the engagement and consultation that has been undertaken within the Fradley to Colton area, since the route announcement in November 2015. It identifies the stakeholders who have been engaged during this process and how they have informed the design and assessment of the Proposed Scheme to date.

3.1.3 These stakeholders include:

- technical and specialist groups / stakeholders;
- local authorities and parish councils;
- communities; and
- directly affected individuals and landowners.

3.1.4 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.

3.1.5 Whilst stakeholders have informed the design and assessment of the Proposed Scheme to-date, it is important to note that this is an ongoing process. Feedback from the consultation on the working draft EIA Report and emerging scheme design and ongoing engagement will continue to be considered as part of the ongoing design and assessment of the Proposed Scheme ultimately presented in the formal EIA Report.

3.2 Key stages of Phase 2a engagement and consultation

3.2.1 The process of engagement began in 2009, and remains ongoing. A summary of engagement undertaken or underway since the route announcement in November 2015 is provided in Table 1 and reported in this section. This has included the draft SMR, property consultation and a series of meetings with national and local environmental stakeholders, local authorities, parish councils, individual landowners and organisations.

Table 1: Mechanisms and timeline of stakeholder engagement since route announcement

Date	Engagement and consultation activity and mechanisms	Stakeholders engaged/consulted
December 2015-ongoing	Commencement of direct engagement for the development of the Proposed Scheme and assessment.	Direct engagement with local authorities and councils, and with technical and specialist stakeholders.

Date	Engagement and consultation activity and mechanisms	Stakeholders engaged/consulted
8 March-13 May 2016	Consultation on the draft EIA and Equality Impact Assessment (EQIA) SMR to inform the EIA and EQIA.	Published and made available nationally on the HS2 website[15] Technical and specialist stakeholders, and councils, directly invited to participate.
January 2016 ongoing	Site visits with farmers and growers.	Direct engagement with individual farmers and growers.
November 2015-February 2016	Consultation on property compensation with owners and occupiers.	Direct engagement with owners and occupiers.
September-November 2016	Consultation on the working draft EIA Report, EQIA Report and design refinements.	Direct engagement with communities through public events and documents available at a range of community locations across the route.

3.3 Technical and specialist groups

3.3.1 Engagement has also been undertaken with technical and specialist groups to provide appropriate specialist input, as and where appropriate. Stakeholders engaged in this context include:

- Environment Agency;
- Natural England;
- Historic England;
- Canal & River Trust;
- Staffordshire Wildlife Trust;
- Department of Environment Food and Rural Affairs (Defra);
- Food and Environment Research Agency (FERA);
- Woodland Trust;
- British Geological Survey (BGS);
- National Farmers Union;
- Country Land and Business Association;
- Highways England; and
- Cannock Chase AONB.

[15] UK Government: HS2 Phase Two: 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

3.3.2 Engagement with these stakeholders has been instrumental in providing detailed specialist baseline information to inform the working draft EIA Report and the design development of the Proposed Scheme.

3.3.3 Local organisations with a specialist interest in the area - for example, Staffordshire Wildlife Trust and Cannock Chase Area of Outstanding Natural Beauty Unit - have been engaged and have informed individual technical assessments, such as the ecological assessment.

3.3.4 Further information about topic-specific engagement is provided in Sections 4 - 15.

3.3.5 Engagement is also ongoing with utility companies and statutory stakeholders, such as Network Rail and the Oil and Pipelines Agency, to establish what infrastructure exists in the Fradley to Colton area and how it may need to be modified as part of the Proposed Scheme.

3.4 Local authorities and parish councils

3.4.1 The Fradley to Colton area is represented by the following county, district and parish councils:

- Staffordshire County Council;
- Lichfield District Council;
- Kings Bromley Parish Council;
- Mavesyn Ridware Parish Council;
- Fradley and Streethay Parish Council; and
- Armitage with Handsacre Parish Council.

3.4.2 Direct engagement has been undertaken with these councils to collate appropriate local baseline information, identify and understand issues and concerns, and provide a mechanism for ongoing dialogue and discussion on the emerging assessment.

3.4.3 Engagement has focused on the technical areas which inform the assessment, including: cultural heritage; ecology and biodiversity; land quality; landscape and visual; sound, noise and vibration; traffic and transport; water and flood risk.

3.4.4 Some key discussion and inputs gained from engagement with Staffordshire County Council and Lichfield District Council include:

- discussions with regard to the planned highways and PRoW routes, noting local conditions and concerns regarding traffic, congestion and community impact;
- understanding and gathering information on listed buildings and local sites of archaeological interest;
- gathering information on the potential contamination of local sites to inform the development of the Proposed Scheme and the land quality assessment;

- collating information regarding water, flood risk and groundwater issues within the local area and identifying vulnerabilities to flooding or groundwater issues, to inform the environmental impact assessment;
- agreeing appropriate viewpoints for assessing impacts for the landscape and visual assessment;
- identifying local locations for surveying and data collection to inform the sound, noise and vibration assessment; and
- understanding the local community and any particular sensitivities or vulnerabilities of its members, to inform the assessment of community, health and wellbeing, and a separate equality impact assessment.

3.4.5 Councils will continue to be engaged as part of the design development of the Proposed Scheme with ongoing dialogue on key topics such as highways, PRoW and the draft CoCP.

3.5 Communities

3.5.1 Community stakeholders in the area include a range of local interest groups, local facility and service providers, schools and educational establishments. Engagement on the Proposed Scheme has been undertaken with the Kings Bromley, Colton and Ridware Action Group and residents of Stockwell Heath.

3.5.2 The purpose of this engagement has been to give affected communities the opportunity to raise issues and opportunities in relation to the Proposed Scheme. Community stakeholders have been provided with information on the development of the Proposed Scheme, as a basis from which to identify potential impacts and opportunities for mitigation within the local area, reflecting local conditions and issues.

3.5.3 Engagement has been, and will continue to be, undertaken with schools and educational establishments, in particular, with those within close proximity to the Proposed Scheme and those with specialist interests or catering to the needs of vulnerable people within the community. This has informed the assessment of community and health in the working draft EIA Report, whilst also informing the separate equality impact assessment (EQIA) being undertaken in parallel with the EIA.

3.5.4 As part of the consultation process for this working draft EIA Report and on refinements to the design, public events are being held in communities across the route of the Proposed Scheme. Communities have been notified of these events through a range of publicity, including a mail out to properties along the line of route, newspaper adverts, and posters sent to local venues. Documents have been made available online and in community libraries.

3.6 Directly affected individuals and landowners

3.6.1 This group includes farmers, growers and those with residential property potentially affected by the Proposed Scheme.

Farmers and growers

3.6.2 Engagement is ongoing with farmers and growers whose land or property would be directly affected by the Proposed Scheme, whether permanently or temporarily. The purpose of this engagement has been to obtain baseline information and provide them with the opportunity to raise issues and discuss mitigation in relation to the Proposed Scheme. For example, the location of environmental mitigation has been refined to reduce the loss of agricultural land and the location of accommodation overbridges across the route have been refined to better reflect the need of farmers.

3.6.3 Twenty farm visits have been undertaken in this area and these will continue, as appropriate, as the Proposed Scheme develops.

3.6.4 Engagement is also continuing with key representatives for the farmers and growers industry, in particular with the National Farmers Union and Country Land and Business Association.

Property consultation

3.6.5 A property consultation took place between 30 November 2015 and 25 February 2016. Its purpose was to inform the Government's decision on whether the compensation and assistance schemes in place for Phase One would be altered for Phase 2a, based on the views of those individuals and organisations who expressed their opinions on the proposals.

3.6.6 The analysis of consultation responses was summarised in "HS2 Phase Two: West Midlands to Crewe Property Consultation 2015. A Report to HS2 Ltd and the Department for Transport"[16] and the Government response issued in the "Decision Document HS2 Phase Two: West Midlands to Crewe Property Consultation 2015[17].

3.6.7 A programme of property consultation events has been undertaken route-wide, in parallel with the working draft EIA process. Within the local area, a property consultation event was held for landowners and individuals at Kings Bromley Village Hall on the 15 January 2016. The purpose of the property consultations was to give members of the public the opportunity to speak with property, environment and engineering specialists about the details of the Government's proposals for compensation and assistance for property owners living in the Fradley to Colton area.

3.7 SMR consultation

3.7.1 The draft SMR was formally consulted on in March to May 2016. As set out in Volume 1, the draft SMR 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.

3.7.2 Twenty-six responses to the draft SMR were received, as a result of which changes were made to the SMR. These are set out in the SMR Consultation Report published

[16] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526063/HS2_Phase_2a_Property_Consultation_2015_Response_Summary_Report.pdf

[17] UK Government: 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

alongside this working draft EIA Report and will be used to inform the assessment methodologies applied for the formal EIA Report.

3.8 Informing the Proposed Scheme

3.8.1 The main purpose of stakeholder engagement and consultation at this early stage is to inform the Proposed Scheme. Volume 1 details the engagement and consultation undertaken prior to route announcement in November 2015.

3.8.2 The main themes to emerge from stakeholder engagement in the Fradley to Colton area since the route announcement in November 2015, and which are informing the Proposed Scheme are:

- potential impacts on landscape character and visual receptors, with a key consideration being the impact of the Proposed Scheme on the Trent and Mersey Canal at Fradley Junction;
- the importance of maintaining accessibility of local roads for agricultural and business use as well as everyday use;
- mitigation measures for increased pressure on local roads as a result of road closures or construction traffic;
- mitigation to address existing flooding issues at Kings Bromley and Stockwell Heath;
- refining the location of balancing ponds and environmental mitigation to minimise the loss of agricultural land;
- retention or realignment of PRoW;
- provision of access to severed agricultural land, including access under viaducts and the provision of farm access tracks; and
- amending the proposed realignment of the A515 Lichfield Road and the proposed diversion of Pipe Lane.

3.8.3 Stakeholder feedback will continue to be considered as part of the ongoing design of the Proposed Scheme and will be reported in the formal EIA Report.

3.9 Consultation on the working draft EIA Report and ongoing engagement

3.9.1 As set out in Volume 1, the working draft EIA Report is being formally consulted upon between September and November 2016. Parallel consultations on the working draft EQIA and refinements to the design are also being undertaken during this period. As part of the process of consultation, stakeholders are invited to comment on the Proposed Scheme and the working draft EIA and EQIA Reports which inform it.

3.9.2 These consultations and wider feedback from ongoing stakeholder engagement will continue to be considered as part of the ongoing design of the Proposed Scheme, the assessment and identification of mitigation opportunities for the Fradley to Colton area. A consultation summary report will be published with the formal EIA Report explaining how the responses have been taken into consideration.

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 construction and operation of the Proposed Scheme in 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 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC)[18] system, which classifies agricultural land into 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 best and most versatile (BMV) agricultural quality (Grades 1, 2 and 3a) is affected by the Proposed Scheme.

4.1.3 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.

4.1.4 Soil attributes, other than for food and biomass production, are identified in this section but the resulting functions or services provided are assessed in other sections, notably Section 7, Cultural heritage ; Section 8; Ecology and biodiversity; and Section 11, Landscape and visual.

4.1.5 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. 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. Engagement with farmers and landowners will continue as part of the development of the Proposed Scheme, with progress documented in the Farmer's Pack[19] for each farm holding.

4.1.6 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

[18] 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.
[19] HS2 Guide for Farmers and Growers (2016). Available online at: https://www.gov.uk/government/publications/hs2-guide-for-farmers-and-growers

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 the draft SMR and Volume 1.

4.2.2 The study area for the agriculture, forestry and soils assessment covers all of the open and undeveloped land that would be 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 BMV land and forestry land in the general locality, taken as 2km either side of the centre line of the Proposed Scheme.

4.2.3 Common assumptions that have been used in assessing the effects of the Proposed Scheme are set out in Volume 1. These assumptions include the restoration of agricultural land that is required temporarily for construction to agricultural use, the handing back of land used temporarily to the original landowner and the non-replacement of capital items demolished. There are no assumptions or limitations that are specific to the assessment in this study area.

4.3 Environmental baseline

Introduction

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 The principal bedrock geology mapped by the BGS[20] is that of the Mercia Mudstone Group, which consists of mudstone with subordinate siltstone. There is also an outcrop of the Helsby Sandstone Formation to the east of Rugeley, which comprises pebbly sandstone interbedded with siltstone and mudstone. A full description of the geological characteristics of this area is provided in Section 10, Land Quality.

4.3.3 Superficial glaciofluviual sheet deposits of sand and gravel overlie the bedrock geology in the south of the area. Within the Trent Valley, River Terrace Deposits of sand and gravel are extensive. These are dissected by deposits of alluvium, which typically comprise consolidated silty clay, but may also contain silt, sand, peat and gravel.

4.3.4 The mudstone bedrock is overlain by superficial deposits of glacial till across the plateau and shallower slopes at higher elevations. These deposits comprise unsorted material ranging in size from clay to boulders (hence also commonly referred to as Boulder Clay), deposited by glaciers.

[20] British Geological Survey (2016). Geology of Britain viewer, Available online at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

4.3.5 The Mercia Mudstone is largely free of superficial deposits in the north-west of this area, except for alluvium deposited across low-lying land now associated with Moreton Brook.

Topography and drainage

4.3.6 The River Trent and its valley and river terraces, and the River Blithe, which feeds into the River Trent from the north at Kings Bromley, are the main topographical and drainage features within this area. Two flooded former gravel pits are located close to the confluence of the two rivers.

4.3.7 Gradients are shallow within the valley and on the terraces of the River Trent between Fradley and Hill Ridware at around 60m to 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, but slopes are steeper around Colton, reaching elevations of around 100m AOD.

4.3.8 In the north of the area, to the south of Admaston, the valley associated with the Moreton Brook has moderate gradients, with altitudes falling from 100m to 80m AOD. Flood risk in the area is greatest between Rileyhill and Pipe Ridware, across the low-lying floodplain of the River Trent and also in association with the Bourne Brook. 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 Wales[21,22] and shown on the National Soil Map[23].

4.3.10 There are three groups of soil associations in this area. The first comprises coarse-textured soils derived from the Helsby Sandstone Formation bedrock and glaciofluvial drift. This group includes coarse loamy and sandy soil profiles of the Newport 1, Wick, 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 associations are freely drained, such that the profiles are affected by soil droughtiness[24], whereas the Blackwood and Wigton Moor associations are variably affected by groundwater and may be of Wetness Classes[25] (WC) III to IV.

4.3.11 The detailed soil surveys undertaken by the Ministry of Agriculture, Fisheries and Food (MAFF) at Fradley, Ravenshaw, Kings Bromley and Rydal Farm, Rugeley identified soils that were developed primarily on the Terrace Gravels, and include medium sandy loam topsoils with moderately high stone contents over stony loamy sand, sand and sandy clay loam subsoils. As ALC surveys are concerned primarily with the long-term

[21] Soil Survey of Great Britain - England and Wales (1964), The Soils of the West Midlands, Bulletin No. 2, Harpenden.
[22] 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.
[23] Cranfield University (2001), The National Soil Map.
[24] 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.
[25] 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.

physical characteristics of land, the classifications will not have changed since the surveys were undertaken.

4.3.12 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 Brockhurst soils were identified by MAFF in the detailed survey undertaken at Colton Farm.

4.3.13 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, Midelney and Whimple 3 associations. These soils are found predominantly in floodplains and on 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. The MAFF survey at Echills Farm, Kings Bromley identified heavy clay soils on riverine alluvium, whilst profiles similar to Whimple 3 soils were identified in the survey at Colton.

4.3.14 Soils of each of the three groups have been identified in detailed soil surveys undertaken for the Proposed Scheme around Stockwell Heath, although only associations of the second and third groups are mapped in the areas surveyed.

4.3.15 These detailed surveys have found topsoils to comprise mostly sandy clay loam or occasionally medium clay loam, with a clay topsoil in one instance. These lie over three subsoil variants, which are gleyed[26] and slowly permeable clay of WC III or IV; gleyed but permeable sandy clay loam or clay loam of WC II; and permeable sandy loam of WC I.

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. The MAFF ALC surveys at Fradley and Ravenshaw (on the river terrace gravels) identified topsoil stone content as the main limitation to agricultural land quality, which downgraded the land to Subgrade 3a.

4.3.18 Climate within this 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 droughtiness limitations of the land.

4.3.19 The local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point dataset[27] for three points within the area. The data show

[26] 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.
[27] Meteorological Office (1989), Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations.

climate in the area to be moderately cool and moderately moist. The number of Field Capacity Days (FCD) (when the soil moisture deficit is zero) ranges from 161 to 172 days. This is higher than average for lowland England (150 days) and generally constrains agricultural cultivation and soil handling for relatively long periods over winter. Crop moisture deficits are moderate.

4.3.20 Site factors include gradient and microrelief, which are likely to be limiting to agricultural land quality in the north of this area, particularly around Colton and Moreton Farm. Flooding of low-lying land is a potential limitation in the south, particularly in the vicinity of Rileyhill, Kings Bromley and Handsacre. Much of this land represents the functional 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.

4.3.21 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. Each soil can be allocated a WC based on soil structure, evidence of waterlogging and the number of FCDs. The topsoil texture then determines its ALC Grade.

4.3.22 The well-drained, coarse loamy and sandy soil variant (comprising the Newport 1, Wick, Blackwood and Wigton Moor associations) is most likely to be affected by soil droughtiness, the severity of which will be determined by factors such as stone content and depth to the sandstone bedrock. As crop moisture deficits are moderate, droughtiness limitations are likely to be moderate to slight.

4.3.23 The MAFF survey at Echills Farm, Kings Bromley classified most of the sandy river terrace soils as Subgrade 3b due to droughtiness associated with a sandy and moderately to very stony subsoil encountered at shallow depth. Elsewhere, for example at Kings Bromley and at Rydal Farm, Rugeley, the river terrace soils have been classified as mostly Subgrade 3a due to soil droughtiness, with some areas of Subgrade 3b where subsoils have higher sand and stone contents.

4.3.24 Coarse-textured profiles within this group that are affected by groundwater (particularly the Blackwood and Wigton Moor associations) will be affected by a soil wetness limitation. These soils were identified during the detailed survey at Stockwell Heath. Although the coarse subsoils were well drained, the profiles were often gleyed indicating waterlogging of the subsoil. These profiles have sandy clay loam or medium clay loam topsoils, and are limited to Grade 2 by wetness and workability.

4.3.25 The second and third groups of soil associations will be limited mostly by soil wetness. These comprise the medium clay loams over clay loams and clays in the Salwick, Brockhurst 1, Flint and Salop associations, and the clay soils in the Fladbury 2, Midelney and Whimple 3 associations. Imperfectly drained profiles of WC III with medium loamy topsoils will be limited to Subgrade 3a (as shown by the MAFF ALC survey at Colton), whilst those with heavier loamy topsoils will be limited to Subgrade 3b. All profiles of WC IV will be limited to Subgrade 3b (as shown by the MAFF ALC survey at Colton, where these soils predominate, and at Rydal Farm, Rugeley).

4.3.26 These gradings are also confirmed by the survey undertaken at Stockwell Heath. Profiles comparable with the Flint, Whimple 3 and Fladbury 2 associations were found to have medium loamy topsoils (including sandy clay loams) over gleyed and slowly

permeable clay subsoils (of WC III or IV) and are classified as Subgrades 3a and 3b respectively.

4.3.27 The heavy clay soils of the floodplain alluvium on part of the land at Echills Farm, Kings Bromley were classified as Grade 4 by MAFF 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 Other profiles identified in the survey at Stockwell Heath contained permeable sandy clay loam or clay loam subsoils. These profiles are moderately well drained (WC II) and classified as Grade 2.

4.3.29 Department for Environment, Food and Rural Affairs (Defra) mapping[28] shows that there is generally a high likelihood of encountering BMV agricultural land in the locality, which makes such land a resource of low sensitivity in this study area.

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 England[29] and The Natural Choice: securing the value of nature[30], and include:

- the storage, filtration and transformation of water, carbon and nitrogen in the biosphere;
- support of ecological habitats, biodiversity and gene pools;
- support for the landscape;
- protection of cultural heritage;
- providing raw materials; and
- providing 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 floodplain of the River Trent occupies land where water has to flow or be stored in times of flood, as set out in Section 15, Water resources and flood risk. Environment Agency mapping indicates the low-lying land around Rileyhill, Kings Bromley and Handsacre to be at significant risk of flooding from the River Trent and its tributaries, limiting agricultural land quality to Subgrade 3b and Grade 4. The soils in these areas function as water stores for flood attenuation, as well as providing a habitat for ecology and biodiversity.

[28] Defra (2005), Likelihood of Best and Most Versatile Agricultural Land.
[29] Defra (2009), Soil Strategy for England.
[30] HM Government (2011), The Natural Choice: securing the value of nature.

Land use

Land use description

4.3.33 Most of the land in the Fradley to Colton area is in commercial agricultural use, with medium to large farm holdings throughout the area. Agricultural land use is predominantly arable, with blocks of pasture in the Trent Valley and to the north of this area around Stockwell Heath.

4.3.34 Woodland is sparse within the area, and found mainly in the south, around and to the north of Lichfield; woodland blocks include Brokendown Copse, Ravenshaw Wood and Rice's Spinney. Further north, the woodlands are generally smaller and include Tomlinson's Spinney, Hurst Wood and Hurst Wood Pit.

4.3.35 A number of environmental designations potentially influence land use within the 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. Some agricultural land is also subject to agri-environment management prescriptions, which 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, which has replaced Environmental Stewardship. Holdings that have land entered into an agri-environment scheme are identified in Table 2.

Number, type and size of holdings

4.3.36 Table 2 sets out the current understanding of the main farm holdings within this area. The details of holdings have been obtained from face-to-face interviews with the farm owners and occupiers. Other farm holdings may be identified as survey work continues and the design develops.

4.3.37 Table 2 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. Smaller (less intensively used) units, such as pony paddocks associated with residential properties, have a low sensitivity.

Table 2: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
Land farmed by J D L Estate	Arable, pigs, beef cattle and sheep	1,620	Commercial property, shipping containers, equipment scrappage contracts	ELS	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
Woodend Farm	Arable	40	Residential let, forestry operations, floristry	ELS	Medium
Common Farm	Arable	100	Commercial forestry (Rice's Spinney), B & B, buildings let for office and retail uses	ELS	Medium
Barn Farm	Beef cattle	43	None	ELS	Medium
Common Lane Farm	Dairy and beef cattle	385	Commercial, industrial and residential lets	ELS	Medium (affected land not part of grazing block)
Echills Farm	Arable	120	Birdseed producer, DIY livery	None	Medium
Trentside Meadows	Beef cattle	39	Care Farm, nature conservation	ELS and HLS	Medium
Pipe Hall Farm	Dairy, arable, beef cattle	405	None	ELS	High
Church Farm	Beef cattle	12	None	None	Medium
Blythe House Farm	Arable (contracted)	49	Caravan site/rallies. 16 commercial units. On-farm shoot	HLS	Medium
Woodhouse Farm	Arable, potatoes (irrigated), beef cattle, sheep	1,680	Potato marketing companies; agricultural chemical and fertiliser supplier	HLS	High
Quintin's Orchard Farm and Longacre Farm	Arable, beef cattle, sheep, equestrian, fishery	316	Shoot, forestry plantation	ELS and HLS	Medium
Bentley Hall Farm	Arable	134	On-farm shoot	Mid-tier Countryside Stewardship	Medium
Manor Farm, Blithbury	Dairy, arable, beef cattle (organic)	225	None	Mid-tier Countryside Stewardship	High

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
Hadley Gate Field Farm	Pigs and arable	33	Public weighbridge	None	Medium
Hadley Gate Cottage	Grassland (haylage)	1	Landscape gardening, plant hire and maintenance	None	Low
Hurstwood Farm	Dairy and sheep	27	None	None	High
Town End Farm	Dairy (accommodation land only)	324	On-farm shoot	ELS	Medium
Border Collie Trust (GB)	Grassland	2	Dog kennels	None	Low
Hamley House Farm	Sheep	16	Barn conversion underway	None	Medium
Lea Hall Farm	Beef cattle and arable	182	Farm shoot run by a third party. Farm cottage rented out	ELS	Medium
Lount Farm	Store cattle	36	Meadows are made available to the Upper Moreton care farm (see CA2)	HLS to 2020 for species-rich semi-natural pasture	Medium

4.4 Effects arising during construction

Avoidance and mitigation measures

4.4.1 In addition to design features that would be included in the Proposed Scheme to mitigate the impacts on farm holdings, 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 would be stripped and stored. This would enable agricultural land that is required temporarily for construction to be returned to agricultural use.. It would also enable soils to be returned to other uses, such as to support landscape planting and biodiversity, and to a suitable condition whereby they would be able to fulfil the proposed function.

4.4.2 Compliance with the draft CoCP would avoid or reduce environmental impacts during construction. Those measures that are particularly relevant relate to: the handling of soils and their reinstatement to subsequent agricultural, forestry and other open land uses; and arrangements to ensure that agriculture can continue to function adjacent to the works during and following the construction period.

4.4.3 There would be no reduction in the long-term capability or quality of land where agricultural or forestry uses are to be resumed, provided good practice techniques are

used to handle, store and reinstate soils. Some land with heavier textured soils (particularly the Fladbury 2, Midelney and Whimple 3 association soils) may also require careful management during the aftercare period to achieve this outcome.

Assessment of impacts and effects

Introduction

4.4.4 The acquisition and use of land for the Proposed Scheme would interfere with existing uses of that land and, in some locations, would preclude existing land uses, and in places, sever and fragment individual fields and operational units of agricultural and forestry land. This would result in potential effects associated with the ability of affected agricultural interests to continue 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 design seeks, however, to minimise this disruption, and where appropriate and reasonably practicable, to incorporate inaccessible severed land as part of environmental mitigation works.

4.4.5 Land used to construct the Proposed Scheme would 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, to be undertaken normally by the owner and/or occupier, except where remedial operations are required which may be undertaken by the nominated undertaker);
- used for drainage or replacement floodplain storage, which may also retain some agricultural use; or
- used for ecological and/or landscape mitigation; the ownership and responsibility for managing agricultural land reinstated to landscape planting, new woodland and new ecological habitats would be the subject of agreements with existing land owners.

Temporary effects during construction

Impacts on agricultural land

4.4.6 ALC surveys are ongoing; however, current indications show that the Proposed Scheme is likely to require approximately 310ha of agricultural land during the construction phase in the Fradley to Colton area, of which about 150ha (48%) is likely to be classified as BMV land (Grades 2 and 3a). In addition, there are approximately 12ha of woodland within the area required for construction in the Fradley to Colton area.

4.4.7 As BMV land in this local area is a receptor of low sensitivity, the potential effect on BMV land during the construction phase is assessed as a likely minor adverse effect of the Proposed Scheme, which is not significant.

4.4.8 Following completion of construction, temporary facilities would be removed and the topsoil and subsoil would be reinstated in accordance with the agreed end use for the

land. Overall for Phase 2a, it is estimated that there would not be any significant surplus of topsoil or subsoil material arising from the Proposed Scheme. Some permanently displaced soils may be used to restore land to agriculture with slightly deeper topsoil and subsoil layers, or other uses 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 that would be prepared during the detailed design stage.

Nature of the soil to be disturbed

4.4.9 The sensitivity of the soils that would be disturbed by construction activity reflects their textural characteristics, in the light of local rainfall conditions, as set out in the draft SMR. Soils with high clay and silt fractions in areas of heaviest rainfall 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 are the least susceptible.

4.4.10 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 Soils[31]. These principles would be followed throughout the construction period.

4.4.11 The disturbance of peat soils has implications for carbon emissions and biodiversity. Design development of the Proposed Scheme would seek to reduce disturbance of any deep peat soils as far as possible. Where disturbance cannot be avoided, the peat soils would be handled with particular care and when reinstated, opportunities would be taken to use them to create habitats and enhance biodiversity.

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

Impacts on holdings

4.4.13 Land may be required from holdings both permanently and temporarily (i.e. the latter just during the construction period). In most cases, the temporary and permanent land requirement would occur simultaneously at the start of the construction period and it is the combined effect of both that would have the most impact on the holding. In due course, some agricultural land would be restored and the impact on individual holdings would be reduced.

4.4.14 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period will be reported in the formal EIA Report. The assessment will consider the total area of land required on a particular holding during the construction phase in absolute terms and as a percentage of the total area farmed. It will also show the area of land that would be returned to the holding following the

[31] Defra (2009), Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

construction period. The scale of effect will be based on the proportion of the holding required rather than the absolute area of land.

4.4.15 The effects of severance during construction will be judged on the ease and availability of access to severed land. These would mostly be the same during and post construction, but occasionally they would differ between the two phases. The disruptive effects, principally of construction noise and dust, will be assessed in the formal EIA Report according to their effects on land uses and enterprises.

Permanent effects of construction

Impacts on agricultural and forestry land

4.4.16 The extent of land required permanently for the Proposed Scheme by ALC grade, following construction and restoration to the agreed end use, is not yet known but will be reported in the formal EIA Report.

Impacts on holdings

4.4.17 Table 3 sets out the current understanding of the main farm holdings within this area. The details of holdings have been obtained from face-to-face interviews with the farm owners and occupiers. Other farm holdings may be identified as survey work continues. The scale of effect of the land potentially required is based on the likely proportion of land required from the holding. The potential 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 potential loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises.

Table 3: Summary of potential permanent effects on holdings from construction

Holding reference/name	Land potentially required	Potential severance impact	Potential impact on farm infrastructure	Potential scale of effect
Land farmed by J D L Estate	Negligible	Low	Low	Minor adverse
Woodend Farm	Low	Medium	Negligible	Moderate adverse
Common Farm	Negligible	Negligible	Negligible	Negligible
Barn Farm	Medium	Medium	Low	Moderate adverse
Common Lane Farm	Negligible	Low	Negligible	Minor adverse
Echills Farm	Medium	Negligible	Low	Moderate adverse
Trentside Meadows	Negligible	Negligible	Negligible	Negligible
Pipe Hall Farm	Low	Negligible	Low	Moderate adverse

Holding reference/name	Land potentially required	Potential severance impact	Potential impact on farm infrastructure	Potential scale of effect
Church Farm	Medium	Medium	Low	Moderate adverse
Blythe House Farm	Low	Negligible	Negligible	Minor adverse
Woodhouse Farm	Negligible	Low	Low	Moderate adverse
Quintin's Orchard Farm and Longacre Farm	Low	Low	Low	Minor adverse
Bentley Hall Farm	Low	Medium	Low	Moderate adverse
Manor Farm, Blithbury	Medium	Medium	Low	Major/moderate adverse
Hadley Gate Field Farm	Low	Negligible	Negligible	Minor adverse
Hadley Gate Cottage	Negligible	Negligible	High	Moderate adverse
Hurstwood Farm	Negligible	Negligible	Negligible	Minor adverse
Town End Farm	Negligible	Medium	Negligible	Moderate adverse
Border Collie Trust (GB)	Negligible	Negligible	Negligible	Negligible
Hamley House Farm	Medium	High	Negligible	Major/moderate adverse
Lea Hall Farm	Medium	Low	Low	Moderate adverse
Lount Farm	Low	Negligible	Negligible	Minor adverse

4.4.18 Overall, the construction of the Proposed Scheme could potentially affect 22 holdings in the Fradley to Colton area. On the basis of information currently available, 12 could experience moderate or major/moderate adverse permanent effects from construction, which would be significant.

4.4.19 No holdings are currently anticipated to incur high impacts arising from the proportion of land required, although high severance impacts are currently anticipated at Hamley House Farm, a small livestock farm, which would give rise to major/moderate adverse effects. The other holding currently anticipated to experience major/moderate adverse effects is Manor Farm, Blithbury due to medium land and severance impacts.

4.4.20 Although financial compensation would be available, there can be no certainty that this would be used to reduce the above adverse effects by the purchase of replacement land or 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

4.4.21 No other mitigation measures have been identified at this stage.

Summary of likely residual significant effects

4.4.22 Although the extent of land required permanently by ALC grade is unknown, current indications are that the effect on best and most versatile agricultural land during construction would not be significant in the Fradley to Colton area.

4.4.23 Twelve of the 22 farm holdings identified are anticipated to experience moderate or major/moderate adverse permanent effects from construction. Two of these holdings would experience major/moderate adverse effects, whilst the remaining ten would experience moderate adverse effects.

4.5 Effects arising from operation

Avoidance and mitigation measures

4.5.1 No measures are currently anticipated to be required to mitigate operational effects of the Proposed Scheme on agriculture, forestry and soils, although further work may be required to assess potential noise effects on livestock units.

Assessment of impacts and effects

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

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

4.5.3 The potential for significant effects on sensitive livestock receptors from noise will be assessed and reported in the formal EIA Report. Farm buildings at Barn Farm, Woodhouse Farm and Hamley House Farm lie close to (within 100m of) the Proposed Scheme. The buildings at Barn Farm and Hamley House Farm house livestock and further work will be required to identify if any significant effects on the use of these buildings are anticipated.

4.5.4 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.

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

Other mitigation measures

4.5.6 No other mitigation measures have been identified at this stage.

Summary of likely residual significant effects

4.5.7 No residual significant effects on agriculture, forestry and soils have been identified at this stage as a result of the operation of the Proposed Scheme.

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 in the Fradley to Colton area.

5.1.2 Nitrogen dioxide (NO_2), oxides of nitrogen (NOx), fine particulate matter (PM10, PM2.5) and dust[32] were considered in the assessment. Emissions of these air pollutants are likely to arise from construction activities, demolition, site preparation works and the use of haul routes. Emissions would also arise from road traffic during construction and operation of the Proposed Scheme.

5.1.3 Engagement with LDC has been undertaken. The purpose of this engagement has been to obtain relevant baseline information. Engagement with LDC will continue as part of the development of the Proposed Scheme.

5.1.4 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

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 and the draft SMR.

5.2.2 The study area for the air quality assessment has been determined on the basis of where impacts on local air quality may occur from construction activities, from changes in the nature of traffic during construction and operation, or where road alignments have changed.

5.3 Environmental baseline

Background air quality

5.3.1 The main sources of air pollution in the Fradley to Colton area are emissions from road vehicles, agricultural activities and emissions from industrial processes. The main roads within the area are the A513 Rugeley Road, the A515 Lichfield Road, the A51 Stafford Road and the A38 Lichfield Road. There are two industrial installations (regulated by the Environment Agency) with permits for emissions to air (the Lichfield sewage treatment works and the Rugeley power station). The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

5.3.2 Estimates of background air quality have been obtained from the Department for Environment, Food and Rural Affairs (Defra) for the baseline year of 2015. The data is

[32] PM2.5 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.

estimated for 1km grid squares for NOx, NO2, PM10 and PM2.5. Background concentrations are within the air quality standards for all pollutants within the area.

Local monitoring data

5.3.3 There are currently seven diffusion tube sites and one continuous monitoring site located within the area, for monitoring NO2 concentrations. Measured NO2 concentrations in 2014[33] were within the air quality standard except for one monitoring site in Fradley.

Air quality management areas

5.3.4 There are no air quality management areas (AQMAs) within the Fradley to Colton area.

Receptors

5.3.5 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, traffic routes during construction or operation of the Proposed Scheme.

5.3.6 Most of the receptors located close to the route are residential. However, other receptors include Rugeley School, Toll House Nursery and Kings Bromley Care home.

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 Emissions to the atmosphere would be controlled and managed during construction through the route-wide implementation of the CoCP. The draft CoCP 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 draft CoCP also makes provision for the preparation of LEMPs. These plans would set out how, during construction of the Proposed Scheme, the environmental and community protection measures required for each area would be delivered, including through the implementation of specific measures required to control dust and other emissions from activities in the area.

5.4.3 The assessment has assumed that the general measures detailed in the draft CoCP would be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring after engagement with the local authorities to assess the effectiveness of the measures taken to control dust and air pollutant emissions;

[33] Monitoring data for 2015 is not yet available. This will be included in the formal EIA Report.

- cleaning (including watering) of haul routes and designated vehicle waiting areas to suppress dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- using enclosures to contain dust emitted from construction activities; and
- undertaking soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

Assessment of impacts and effects

Temporary effects

5.4.4 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 soiling and exposure to NO2 and particulate matter concentrations.

5.4.5 Construction activities, such as demolition, earthworks, construction and trackout[34], have been assessed for their risk to have an effect on dust soiling and human health[35]. There are residential receptors located within 350m of these activities in this area.

5.4.6 In the absence of mitigation, there is a low risk of dust effects and negligible risk of human health effects arising from demolition activities at receptors around Blithbury, Hurst Wood and Stockwell Heath. For earthworks, there is a low risk of dust and human health effects at receptors close to the works along the route. There is also a low risk of dust and human health effects from construction activities at receptors close to the proposed compounds locations and other areas of construction. For trackout, there is a medium risk for dust and low risk for human health effects at receptors along the construction traffic routes and close to the works.

5.4.7 With the application of the mitigation measures contained in the draft CoCP, no significant effects are anticipated from these dust-generating activities.

5.4.8 Construction activity could also affect local air quality through the additional traffic generated on local roads as a result of construction traffic routes and through changes to traffic patterns arising from temporary road diversions and realignments.

5.4.9 It is expected that the A51 Stafford Road, A515 Lichfield Road, A513 Rugeley Road and B5014 Uttoxeter Road would provide the primary access for construction vehicles in this area. An increase in traffic flows as a result of construction traffic, temporary closures or diversions is anticipated on the A38 Lichfield Road, the A51 Stafford Road, the A515 Lichfield Road, the A513 Rugeley Road, the A5192 Eastern Avenue, Wood End Lane, the B5014 Uttoxeter Road and the B5013 Uttoxeter Road.

5.4.10 Direct and indirect effects from changes in air quality, such as those arising from increased levels of construction traffic, will be considered for sites within 200m of

[34] 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.
[35] Human health effects relate mainly to short-term exposure to particles of size between 2.5µm to 10µm, measured as PM_{10}.

affected roads. These will include human receptors and those ecological habitats considered to be sensitive to changes in air quality. Any effects will be reported in the formal EIA Report.

Permanent effects

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

Other mitigation measures

5.4.12 No other mitigation measures during construction of the Proposed Scheme are proposed in relation to air quality in this area.

Summary of likely residual significant effects

5.4.13 The methods outlined within the draft CoCP are considered effective at reducing dust emissions and no significant residual effects are considered likely from dust emissions.

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 due to changes in the volume, composition and distribution of traffic in the area.

5.5.3 Where the changes in traffic emissions require it, a detailed assessment of air quality impacts will be undertaken and reported in the formal EIA Report.

Other mitigation measures

5.5.4 In the event that significant effects on local air quality are identified from the assessment of traffic emissions during operation of the Proposed Scheme, relevant mitigation measures will be proposed and reported in the formal EIA Report.

Summary of likely residual significant effects

5.5.5 A summary of the likely residual significant effects on local air quality will be reported in the formal EIA Report.

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 in the Fradley to Colton area.

6.1.2 Engagement with relevant stakeholders will be undertaken as part of the development of the Proposed Scheme.

6.1.3 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 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 the draft SMR and Volume 1.

6.2.2 The assessment of in-combination effects will draw upon the findings of other technical disciplines (e.g. air quality, sound, noise and vibration, landscape and visual and traffic and transport). Likely significant in-combination effects on community facilities and resources will be reported in the formal EIA Report.

6.2.3 The study area includes the area of land required both temporarily and permanently for the construction and operation of the Proposed Scheme. It also includes a wider corridor within which receptors or resources could be affected by a combination of significant residual effects arising from, for example, noise, vibration, poor air quality, HGV traffic and visual intrusion. These in-combination effects will be identified in the formal EIA Report. 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.

6.3 Environmental baseline

6.3.1 The Fradley to Colton area covers approximately 14km of the Proposed Scheme in Staffordshire. It extends from the connection with Phase One near Fradley in the south, north-west to Colton, passing close to the settlements of Kings Bromley, Pipe Ridware, Blithbury and Colton.

6.3.2 The area is predominantly rural, made up of a few small settlements with limited community facilities. In general, the majority of community facilities such as GP surgeries, schools and community meeting places lie within the village centres, with the majority of these facilities found at Kings Bromley, Handsacre or Rugeley, which are outside the study area. The area is also characterised by small clusters of dwellings and individual dwellings within rural areas close to the Proposed Scheme.

6.3.3 Stockwell Heath is a small rural village located north of Colton with 12 residential properties. Stockwell Heath is closely linked with Colton with the majority of local services for the residents located in Colton. Moor Lane and Newlands Lane link the two villages. The residential properties in Stockwell Heath are predominantly

detached in various styles. There is a duck pond located at the centre of the village between Newlands Lane and Moor Lane.

6.3.4 Tomlinson's Spinney is a publicly accessible woodland area of approximately 3.5ha located west of Shaw Lane and south of the A513 Rugeley Road. The spinney is located south of Kings Bromley.

6.3.5 Trentside Meadows is a local wildlife site owned and managed by Conservation, Horticulture and Agriculture for the Disabled Society (CHADS). The site is an area of approximately 27.5ha, located between the River Trent and the A513 Rugeley Road, west of Kings Bromley.

6.3.6 Hurst Wood is an area of woodland of approximately 2ha located to the east of Colton and Stockwell Heath and west of Blithbury. The Rugeley to Colton Circular Walk runs around part of the perimeter of the site and can be used to access the edge of the wood. The remainder of the wood is not easily accessible due to a steep change in level from the footpath to the wood.

6.3.7 There are four promoted[36] PRoW in the area: Rugeley to Colton Circular Walk; Millennium Way; the Staffordshire Way; and Macmillan Way.

6.4 Effects arising during construction

Avoidance and mitigation measures

6.4.1 As part of design development, the area required for construction around the Bourne Brook viaduct satellite compound has been considered, to reduce isolation impacts on a residential property located to the south of the A513 Rugeley Road.

6.4.2 PRoW routes would be maintained and would remain operational wherever reasonably practicable.

Assessment of impacts and effects

Temporary effects

Residential properties

6.4.3 No temporary effects at a community level on residential properties have been identified as a result of the land required for construction or due to isolation.

Community facilities

6.4.4 No temporary effects on community facilities have been identified as a result of the land required for construction or due to isolation.

Recreational facilities

6.4.5 No temporary effects on recreational facilities have been identified as a result of the land required for construction or due to isolation.

[36] Promoted PRoWs refers to those PRoWs which are a "promoted" destination in their own right as a recreational resource.

Open space and PRoW

6.4.6 Part of Trentside Meadows (approximately 7.5ha) is located within land required for the construction and operation of the River Trent viaduct. An additional area of approximately 4ha would also be isolated from the rest of the nature reserve during the construction period. Overall, approximately 40% of Trentside Meadows, including the area lost and the area isolated, would be inaccessible to the public during the construction period. Trentside Meadows is owned and managed by CHADS, who focus on developing the site to help the less able to enjoy the countryside and wildlife. Due to this, users of this open space are more likely to have mobility issues, and therefore, would be less able to access the nearby alternatives. A moderate adverse effect has been identified at Trentside Meadows due to the temporary loss of approximately 40% of the open space, which would be significant.

6.4.7 Hurst Wood is located within land that would be required for landscape mitigation planting associated with Blithbury Central cutting. Hurst Wood would be lost temporarily during construction, but would be reinstated as part of the Proposed Scheme following construction. Based on the constraints of the site it is not yet known whether the open space is well used. However, in the absence of mitigation the temporary loss of this open space would result in a moderate adverse effect, which would be significant.

6.4.8 Land required for the construction and operation of the Proposed Scheme would result in severance of four promoted PRoW, which are considered to provide a recreational resource. The Proposed Scheme would include permanent, and as required, temporary realignments for each PRoW. The effect on these PRoW would not be significant.

Permanent effects

Residential properties

6.4.9 Bourne embankment and associated landscape earthworks would require the demolition of three residential properties off Shaw Lane. These residential properties would be permanently lost.

6.4.10 Blithbury Central cutting and Hadley Gate Lane diversion would require the demolition of three residential properties on Hadley Gate Lane. These residential properties would be permanently lost.

6.4.11 Stockwell Heath embankment would be located between the villages of Colton and Stockwell Heath, crossing Moor Lane and Newlands Lane. Residents in Stockwell Heath rely on Colton for all services, and so connection to Colton is very important. Moor Lane would be diverted and Newlands Lane would be permanently realigned, and combined into one crossing point under the route at the Newlands Lane (North) underbridge. This would ensure that access between the villages is retained; however, access would be reduced to a single crossing point. The physical disruption to access as a result of construction activities and the presence of the Proposed Scheme acting as a visual barrier between the settlements would be likely to result in permanent isolation for the residential properties in Stockwell Heath. A major adverse effect has been identified, which would be significant.

Community facilities

6.4.12 It is currently anticipated that there would be no permanent effects on community facilities as a result of the Proposed Scheme.

Recreational facilities

6.4.13 It is currently anticipated that there would be no permanent effects on recreational facilities as a result of the Proposed Scheme.

Open space and PRoW

6.4.14 Land would be required from Tomlinson's Spinney woodland area due to the construction of Bourne embankment. As a result, the open space would be permanently lost. User surveys of the woodland have not yet been undertaken and it is not yet known whether the open space is well used. However, in the absence of mitigation the loss of the open space has been identified as a moderate adverse effect, which would be significant.

6.4.15 Land required for the construction and operation of the Proposed Scheme would result in severance of four promoted PRoW, which provide a recreational resource. The Proposed Scheme would include permanent, and as required, temporary realignments for each PRoW. The effect on these PRoW would not be significant.

Other mitigation measures

6.4.16 Other mitigation measures, where required, will be described in the formal EIA Report.

Summary of likely residual significant effects

6.4.17 There would be a major adverse permanent isolation effect on the residential properties in Stockwell Heath due to the Proposed Scheme acting as a visual barrier between Stockwell Heath and Colton.

6.4.18 There would be a moderate adverse permanent effect on Tomlinson's Spinney due to the loss of land for the construction and operation of the Proposed Scheme. There would be a temporary moderate adverse effect on Trentside Meadows and Hurst Wood due to the loss of land for the construction of the Proposed Scheme.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 No relevant avoidance and mitigation measures have been identified at this stage.

Assessment of impacts and effects

6.5.2 Operation of the Proposed Scheme could lead to in-combination effects on the community in this area which will be reported in the formal EIA Report.

Other mitigation measures

6.5.3 Other mitigation measures, where required, will be described in the formal EIA Report.

Summary of likely residual significant effects

6.5.4 A summary of the likely residual significant effects will be reported in the formal EIA Report.

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 of 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 heritage value (significance) of heritage assets including archaeological and palaeo-environmental remains, historic buildings and the built environment.

7.1.2 The assessment focuses on the extent to which the Proposed Scheme affects designated and non-designated heritage assets. Impacts on heritage assets as a result of the Proposed Scheme will occur largely through the physical removal and alteration of assets and changes to their setting.

7.1.3 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book. Only designated heritage assets within the Fradley to Colton area are shown on maps CT-10-101 to CT-10-106a. Non-designated heritage assets have also been assessed as part of this work, although they are not illustrated on these maps. A gazetteer of designated and non-designated heritage assets with accompanying maps will be included in the formal EIA Report.

7.1.4 Engagement has been undertaken with Historic England and SCC. The purpose of this engagement has been to understand the local environment, discuss the assessment approach and obtain relevant baseline information. Engagement will continue as part of the development of the Proposed Scheme.

7.2 Scope, assumptions and limitations

7.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are set out in Volume 1 and the draft SMR.

7.2.2 Detailed assessment of effects on the historic landscape will be considered in the formal EIA Report.

7.2.3 A detailed assessment of all heritage assets, designated and non-designated, has been carried out within a study area defined as the land required, temporarily or permanently, to construct and operate the Proposed Scheme plus 500m.

7.2.4 The setting of all designated heritage assets up to 2km from the land required, temporarily or permanently, to construct and operate the Proposed Scheme has been considered.

7.2.5 In undertaking the assessment the following limitations were identified:

- the LiDAR[37] data examined covers the majority of the study area although there were some areas for which data was unavailable; and

[37] Light detection and ranging (LiDAR) is a high-resolution, remote sensing technique to capture 3D data.

- not all areas within the study area were available for field survey (due to limited land access and site conditions), such as site reconnaissance visits and geophysical survey. This work is ongoing and will be included as part of the formal EIA Report.

7.2.6 Information from other sources of data, including the Historic Environment Record (HER) and local archives, has been used to provide information relating to the potential heritage assets that may be present.

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 visit the area.

7.3 Environmental baseline

7.3.1 Documentary baseline data were collected from a variety of sources in compiling this assessment, including:

- Staffordshire HER;
- Staffordshire Record Office collections;
- material held at the William Salt Library, Stafford;
- historic Ordnance Survey mapping; and
- other published sources.

7.3.2 In addition to collating this baseline data, the following surveys were undertaken:

- detailed and systematic transcription of remote sensing data including LiDAR and aerial photographs;
- walkover and site reconnaissance from areas of public access. This was undertaken to understand the character and form of heritage assets and the historic landscape; and
- settings assessments of all designated heritage sites within 2km of the Proposed Scheme.

Designated assets

7.3.3 Designated heritage assets are set out below under three categories: those located partially or wholly within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme; those within 500m of the land required for construction and operation and those between 500m and 2km away.

7.3.4 There are no designated heritage assets located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme.

7.3.5 The following designated heritage assets are located partially or wholly within 500m of the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme (from south to north):

- Fradley Junction Conservation Area. This lies approximately 500m to the north-east of the route and encloses the junction of the Trent and Mersey Canal and the Coventry Canal. It contains a series of Grade II listed locks, bridges, cottages and former canal buildings, one of which is located within 500m of the land required for the construction and operation of the Proposed Scheme. The Conservation Area includes:
  - Trent and Mersey Canal Bridge 52 and Shade House Lock, Grade II listed building;
- Trent and Mersey Canal Conservation Area. The Trent and Mersey Canal is 93.5km long; it joins the River Trent at Derwent Mouth in Derbyshire and the River Mersey, via the Bridgwater Canal, at Preston Brook, in Cheshire. It contains listed locks, bridges, mileposts, cottages and former canal buildings, including three designated heritage assets within 500m of the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. The Conservation Area includes:
  - Trent and Mersey Canal Milepost located 290m south-east of Woodend Lock Grade II listed building;
  - Trent and Mersey Canal Bridge Number 53 and Woodend Lock, Grade II listed building;
  - Trent and Mersey Canal Woodend Lock Cottage, Grade II listed building;
- Kings Bromley Conservation Area, encloses the historic core of Kings Bromley and contains numerous Grade II listed buildings and a Grade I listed church. Four designated heritage assets located within the conservation area lie within 500m of the land required for the construction and operation of the Proposed Scheme. The Conservation Area includes:
  - 2-10 Alrewas Road, Grade II listed buildings;
  - 26 and 28 Alrewas Road, Grade II listed buildings;
  - School House, Grade II listed building;
  - Garden Walls and Pavilions at on the site of the former Kings Bromley Manor, Grade II listed building;
- Pipe Ridware Hall, and associated Garden Walls, Gate Piers and Dovecote Remains, Grade II listed buildings;
- Wheelwright Cottage and attached Workshop, Grade II listed building;
- Hunger Hill Farmhouse, Grade II listed building;
- Woodhouse Farmhouse, Grade II listed building;
- Bentley Hall Farmhouse, Grade II listed building;
- Bentley Hall Cottage, Grade II listed building;

- Chimney Stack approximately adjacent to Littlehay Manor Farmhouse, Grade II listed building;
- Hamley House, and attached gate piers and garden wall to the south-west, Grade II listed buildings;
- Lea Hall Farmhouse, Grade II listed building;
- Lea Hall Farm Cottage, Grade II listed building;
- Admaston and Blithfield Conservation Area. This contains 21 listed buildings, four of which lie within 500m of the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. The Conservation Area includes:
  - Friary Lodge and Bagot Lodge, and attached Iron Railings and Gate Piers, Grade II listed buildings;
  - Sedge Cottage and The Smithy, Grade II listed building; and
  - Blythe Moor, Grade II listed building.

7.3.6 The following designated heritage assets are located between 500m and 2km from the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme (from south to north):

- three scheduled monuments: Causewayed enclosure at Fradley and Streethay, Moated site of Handsacre Hall, and Manor House, at Hamstall Ridware;
- six Grade I listed buildings: Church of All Saints, Kings Bromley; Church of St Nicholas, Mavesyn Ridware; Gatehouse at Old Hall, Mavesyn Ridware; Church of St Michael and All Angels, Hamstall Ridware; Blithfield Hall; and Church of St Leonard, Blithbury;
- twelve Grade II* listed buildings: Hanch Hall, Old Hall, Mavesyn Ridware; High Bridge, Mavesyn Ridware and Armitage with Handsacre; The Old Rectory and attached Walls and Gate Piers, Rake End; Hamstall Hall, Hamstall Ridware; Gatehouse and attached Courtyard Walls at Hamstall Hall, Hamstall Ridware; Tower and attached Walls at Hamstall Hall; Church of St Mary, Colton; Colton House, Colton; Brindley Bank Pumping Station; Main Gateway to Blithfield Hall with flanking Walls; and The Orangery, Blithfield Hall;
- eighty-three Grade II listed buildings, predominantly within the settlements of Kings Bromley, Armitage with Handsacre, Mavesyn Ridware, Hill Ridware, Rake End, Hamstall Ridware, and Colton, but also associated with grand houses, namely Hanch Hall,Blithfield Hall and the former Kings Bromley Manor; dispersed farmsteads; eight locks, bridges, cottages and former canal buildings contained within Fradley Junction conservation area, two further canal bridges that fall within the Trent and Mersey Canal conservation area; and one road bridge and roadside milepost; and
- three conservation areas: Mavesyn Ridware, Hamstall Ridware, and Colton.

Non-designated assets

7.3.7 The following non-designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme:

- Bronze Age round barrows and Iron Age and possibly Roman boundaries defined by rows of pits ("pit alignments") and continuous ditches, visible as cropmarks on aerial photographs to the east of Rileyhill Farm, Kings Bromley;
- Bronze Age round barrows, a field system of Iron Age and possibly Roman date, defined by pit alignments and continuous ditches, a possible late-prehistoric ditched enclosure and post-medieval field boundaries, visible as cropmarks on aerial photographs between Barn Farm and Common Lane Farm to the south and Bourne Brook to the north;
- Bronze Age round barrows; curved and rectangular enclosures, linear trackways and field boundaries defined by pit alignments and of probable Iron Age date; rectangular enclosures defined by continuous ditches and of probable Iron Age or Roman date; and other field ditches and ditched enclosures of probable medieval and post-medieval date, visible as cropmarks on aerial photographs to the north of Bourne Brook and to the east of Lichfield Road, Kings Bromley;
- Bronze Age round barrows, an Iron Age square-ditched enclosure and curved enclosure defined by pit alignments, other late-prehistoric curved enclosures and medieval or post-medieval ditched trackways and field boundaries, visible as cropmarks on aerial photographs between Shaw Lane and Lichfield Road, Kings Bromley;
- cropmark remains of a possible pre-enclosure road visible on aerial photographs running south-west from Crawley towards Rileyhill, Kings Bromley;
- cropmark remains of a former field system of probable medieval date visible on aerial photographs to the south of Echills, Kings Bromley;
- cropmark remains of a former field system, the form of which suggests an origin in post-medieval piecemeal enclosure, visible on aerial photographs to the north-east of Echills, Kings Bromley;
- a complex of "linear features" (likely to be former field boundaries) of uncertain date visible as cropmarks on aerial photographs north-west of Echills, Kings Bromley;
- a group of two adjacent Bronze Age round barrows visible as cropmarks on aerial photographs to the west of Kings Bromley;
- a group of five Bronze Age round barrows visible as cropmarks on aerial photographs to the north-east of Glebe Farm, Kings Bromley;
- a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs to the north of Kings Bromley Lane;

- a rectangular enclosure of probable prehistoric date visible as a cropmark on aerial photographs to the north of Kings Bromley Lane;
- a complex of field boundaries of probable medieval date visible as cropmarks on aerial photographs to the north and south of Kings Bromley Lane;
- field boundaries of probable post-medieval date visible as cropmarks on aerial photographs to the west of Kings Bromley;
- potential ancient environmental or other archaeological remains sealed below or within terraces of sand and gravel that flank the River Trent and which were laid down during the ice ages, between 400,000 and 10,000 BC (the Pleistocene), and similar material sealed within clay, silt and peat (alluvium) dating from 10,000 BC to the present day (the Holocene) that flanks Pyford Brook, Bourne Brook, the River Trent and Moreton Brook;
- partially surviving earthwork remains of carrier drains forming component parts of a water meadow visible as cropmarks on aerial photographs on the southern side of the Trent south of Pipe Ridware. Such water meadows were in use between the 17th and 19th centuries;
- a Bronze Age round barrow visible as a cropmark on aerial photographs to the east of Pipe Ridware;
- pits, linear features (likely to be former field boundaries) and a ring ditch (remains of either a Bronze Age round barrow or an Iron Age roundhouse), visible as cropmarks on aerial photographs at Pipe Ridware;
- a square enclosure of possible Iron Age or Roman date enclosing 0.38ha, visible as a cropmark on aerial photographs at the north-western end of the proposed Pipe Ridware maintenance loops site;
- the earthwork remains of a medieval or post-medieval hollow way running parallel to and west of the B5013, to the east of Lea Hall Farmhouse and at Hamleyheath, Colton listed in the Staffordshire HER;
- a former water meadow at Lount Farm, Colton listed in the Staffordshire HER; and
- extensive remains of former medieval ridge and furrow earthworks visible as earthworks and cropmarks on aerial photographs, and limited extant earthwork remains of the same, present at Pipe Ridware, Blithbury and particularly at Colton.

7.3.8 The following non-designated heritage assets are located partially or wholly within 500m of the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme:

- RAF Lichfield / Fradley Airfield;
- two possible Bronze Age round barrows visible as cropmarks on aerial photographs to the north-west of Fradley Wood;

- two enclosures of possible Iron Age or Roman date, and probable post-medieval field boundaries, visible as cropmarks on aerial photographs to the south-west of Common Lane Farm, Kings Bromley;
- a rectangular enclosure of probable Iron Age or Roman date visible as a cropmark on aerial photographs to the south of Ashby Sitch, Kings Bromley;
- three possible Bronze Age round barrows and a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs east of Kings Bromley Wharf;
- Bronze Age round barrows, pit alignments of probable Iron Age date, other late-prehistoric boundaries and trackways, and post-medieval field systems visible as cropmarks on aerial photographs west of Common Lane Farm, Kings Bromley;
- a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs to the east of Crawley, Kings Bromley;
- a possible Bronze Age round barrow intersected by an undated linear feature visible as cropmarks on aerial photographs to the south of Victory Farm, Kings Bromley;
- Crawley deserted settlement and adjacent trackway and field boundaries, identified as earthworks and cropmarks on aerial photographs;
- a rectangular enclosure of probable prehistoric or Roman date visible as a cropmark on aerial photographs to the west of Shawlane Farm, Kings Bromley;
- a possible Bronze Age round barrow visible as a cropmark on aerial photographs to the west of Shawlane Farm, Kings Bromley;
- a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs to the south-east of the Vicarage, Kings Bromley;
- a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs to the west of Echills;
- a field system, of uncertain date, visible as cropmarks on aerial photographs to the west of Echills;
- a field system, of probable post-medieval date, visible as cropmarks on aerial photographs to the north-west of Echills;
- three Bronze Age round barrows, and two sub-rectangular enclosures and linear boundaries of possible Iron Age or Roman date, visible as cropmarks on aerial photographs near Glebe Farm, Kings Bromley;
- a pit alignment of probable Iron Age date and an undated linear feature, visible as cropmarks on aerial photographs to the east of Bromley Lane Farm, Kings Bromley;
- two Bronze Age round barrows visible as cropmarks on aerial photographs to the west of Kings Bromley;

- two possible Bronze Age round barrows and linear boundaries visible as cropmarks to the north of Echills;
- remains of Manor Park, a former landscaped park around Kings Bromley Manor, established in the post-medieval period and substantially lost to quarrying in the 20th century, after the manor house had been demolished in 1928 - listed in the Staffordshire HER;
- an extant post-medieval milestone within the former Manor Park - listed in the Staffordshire HER;
- the site of three small oval enclosures visible as cropmarks on aerial photographs within in the former Manor Park and found to be of early Roman date when investigated ahead of removal by gravel extraction in the 1970s;
- former post-medieval field boundaries or water meadow drains visible as cropmarks on aerial photographs to the north of Rookery Plantation, Kings Bromley;
- a former medieval moat and adjoining field boundaries to the immediate west of Pipe Ridware Hall now visible only as cropmarks on aerial photographs;
- Pipe Ridware deserted settlement, perhaps represented by earthworks observed to the north-west of the moat, which may represent house platforms - listed in the Staffordshire HER;
- a probable Bronze Age round barrow visible as a cropmark on aerial photographs to the west of Wheelwright Cottage, Pipe Ridware;
- Bronze Age round barrow, ditched track and boundaries of probable Iron Age or Roman date, and possible pits perhaps indicative of a cemetery visible as cropmarks on aerial photographs to the west of Pipe Ridware;
- a Bronze Age round barrow, visible as a cropmark on aerial photographs to the east of Pipe Ridware Hall;
- a field boundary and other linear features visible as cropmarks on aerial photographs to the east of Pipe Ridware Hall;
- Church of St James, Pipe Ridware, its churchyard and the remains of a churchyard cross of probable 14th century date - listed in the Staffordshire HER;
- Parva House, Pipe Ridware, an historic farmstead of 19th-century date - listed in the Staffordshire HER;
- linear boundaries and a three-sided square enclosure measuring 5x5m internally, which is possibly an Iron Age square barrow, visible as cropmarks on aerial photographs to the west of Parva House, Pipe Ridware;
- the earthwork remains of a medieval moated site and fishpond at Quinton's Orchard, north-west of Pipe Ridware, which may have been the site of the

medieval manor house of Pipe Ridware, home of Ralph de Linacre- listed in the Staffordshire HER;

- the earthwork remains of a track and field boundaries of probable medieval or post-medieval date visible on aerial photographs to the south, west and north of Quinton's Orchard;
- a Bronze Age round barrow visible as a cropmark on aerial photographs to the south of Bentley Hall Cottage, Mavesyn Ridware;
- a cast iron milepost of hollow triangular section with chamfered front edges, dated to 1893 and located on the north-western side of the B5014 at Blithbury - listed in the Staffordshire HER;
- the site and remains of a medieval deer park at Colton. A substantial park pale survives in good condition in places - listed in the Staffordshire HER;
- the site of Littlehay Manor House, Colton - listed in the Staffordshire HER;
- Littlehay Manor Farm, a 19th century farmstead comprising farmhouse and farm buildings arranged around a regular farmyard - listed in the Staffordshire HER;
- the remains of a post-medieval water meadow to the north of Colton, which survives well in places and which forms part of a larger water meadow system - listed in the Staffordshire HER;
- two of four possible Bronze Age burnt mounds identified at Lount Farm, Colton in 1995, listed in the Staffordshire HER;
- the site of an outfarm at Lower Barn, Colton, which existed by the 1830s but had been demolished by the 1880s, listed in the Staffordshire HER;
- the site and remains of a probable medieval glassworks at Lount Farm, Colton, listed in the Staffordshire HER; and
- extensive remains of former medieval ridge and furrow earthworks visible as earthworks and cropmarks on aerial photographs, and limited extant earthwork remains of the same, present at Pipe Ridware, Blithbury and particularly at Colton.

Cultural heritage overview

7.3.9 There are a number of river and stream valleys along the route containing Pleistocene (Ice Age) 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. The upper Trent Valley is known to contain Pleistocene terrace gravels dating back to around 450,000 years ago, which have the potential to contain stone tools as well as important palaeo-environmental information. Holocene alluvium and waterlogged peat have the potential to contain exceptionally well-preserved prehistoric archaeological and palaeo-environmental remains dating back over 10,000 years.

7.3.10 There are no known Mesolithic or Neolithic sites within the study area, however there are cropmark remains of two early Neolithic causewayed enclosures within 2km of it,

at Mavesyn Ridware and at Fradley and Streethay. There are also cropmark remains of a possible Neolithic mortuary enclosure to the immediate west of the study area at Pipe Ridware, and a polished Neolithic axehead was recovered from within the study area at Alrewas Hayes.

7.3.11 Dense cropmark remains of Bronze Age funerary activity (in the form of the sub-surface remains of round barrows), and settlement remains and agricultural boundaries likely to date to the Iron Age and Roman period have been identified on aerial photographs within the land required for the construction and operation of the Proposed Scheme, and extending across the wider study area and beyond. These remains run along the gravel terraces of the River Trent, from Rileyhill on the southern side of the river to the northern extent of the valley floor at Pipe Ridware.

7.3.12 There is no physical evidence of early medieval activity within the study area, although place-name evidence indicates that there was settlement in one or more of the Ridwares (Mavesyn, Pipe or Hamstall) at a time when Anglo-Saxon culture was spreading across Staffordshire, but was, as yet, coexisting with, rather than displacing, the indigenous British culture; these conditions are likely to have existed during the sixth and seventh centuries. The evidence for this is the place name "Ridware", the first element of which ("Rid") is a British word meaning "ford", while the second element ("ware") is Anglo-Saxon, meaning "dwellers", hence "dwellers by the ford". Pipe Ridware (along with Handsacre and 13 other named locations) was named as a dependency of the Manor of Lichfield in Domesday Book. This confirms that there was a settlement at Pipe Ridware by 1086, and suggests that Pipe Ridware may have been a component part of a large multiple estate thought to have been centred upon Lichfield by the mid-7th century. This suggests that the dwellers by the ford may have been focussed on the low ground at Pipe Ridware.

7.3.13 The Domesday Book suggests that villages existed by 1086 at Kings Bromley and Handsacre, while two adjacent hamlets that would merge as they expanded likely existed at Colton, one centred on each of the two manors there. Settlement at Hamstall Ridware and perhaps Mavesyn Ridware would appear to have comprised a collection of hamlets and/or dispersed farmsteads. By the 12th or the 13th century, there may have been two settlement foci at Pipe Ridware, one centred upon the remains of a moat located to the west of Pipe Ridware Hall, and a second upon the remains of a moat at Quinton's Orchard, formerly known as Pipehalle. Pipehalle would seem to be the site of the medieval manor house at Pipe Ridware, even though the church is close to Pipe Ridware Hall. The settlements at Fradley, Curborough and Blithbury are not mentioned in the Domesday Book, and would appear to have been founded in the 12th or the 13th centuries, a time of population growth and concomitant conversion of waste (principally woodland) to agricultural land; Staffordshire had 32% of its land area under woodland in 1086, but only 5.3% in 1895.

7.3.14 There is documentary evidence that all settlements within the study area practiced communal open-field agriculture[38] during the medieval period, although some land newly converted from woodland to arable use is likely to have been enclosed and farmed individually. All of the land within the study area to the south of the Trent lay within Alrewas Hay (a compartment of Cannock Forest) in the medieval period, while

[38] Under which each village had two or three large fields divided into strips, each of which was cultivated by individual householders

two manorial deer parks existed at Colton, one to the north-east of the village and partially within the study area, and one to its south-west and a short distance outside of it. There is evidence of medieval glassmaking at Colton.

7.3.15 In the later medieval period, from 1300 until about 1550, adverse climatic conditions, referred to as the 'mini ice-age', and a series of outbreaks of the plague, the most virulent of which was the Black Death of 1348, led to population decline, which increased labour costs and reduced the demand for grain. As a consequence, much arable land was enclosed piecemeal by agreement, and was laid down to grass; many rural settlements shrank or were deserted at this time. The deserted settlements of Curborough (which lies a short distance beyond the study area), Crawley south of Kings Bromley, Pipe Ridware to the west of Pipe Ridware Hall and the former moated manor house of Pipehalle at Pipe Ridware (all of which lie within the study area) are likely to have been deserted at this time.

7.3.16 In the post-medieval period, the enclosure of the former open fields crossed by the study area was completed, principally by agreement. Many farmsteads hitherto located within villages or hamlets will have dispersed to their now-consolidated landholdings, and it is to the post-medieval period that the dispersed farmsteads within the study area date. This period also saw the rise of Staffordshire's country houses, including Kings Bromley Manor, Mavesyn Ridware Old Hall, Hanch Hall, Bishton Hall and Blithfield Hall. This period also witnessed the construction of the Trent and Mersey Canal, authorised in 1766 and completed in 1777, and the Trent Valley Line railway, which opened in 1847 and which runs to the south-west of and adjacent to the study area.

7.3.17 The 20th century witnessed significant changes in landscape character within the study area. Some of Staffordshire's country houses ceased to be domestic residences at this time, and their designed landscapes were converted to agricultural or other use. Kings Bromley Manor was demolished in 1928, and its former park was substantially lost to gravel extraction in the late 20th century. In the middle and later years of the 20th century, the increased mechanisation of farming led to the amalgamation of many previously small fields and the consequential loss of historic hedgerows, particularly at and to the north of Pipe Ridware.

7.3.18 A number of military establishments were built along the Proposed Scheme in the middle decades of the 20th century; at the southern end of the study area, RAF Lichfield operated between 1940 and 1958. Finally, most of the villages and many of the hamlets within the study area expanded within the 20th and 21st centuries, as settlements previously serving the rural economy transitioned to dormitory settlements, housing people who increasingly worked in the region's towns, such as Lichfield, Rugeley and Stafford.

7.4 Effects arising during construction

Avoidance and mitigation measures

7.4.1 The draft CoCP sets out the provisions that would be adopted to control effects on cultural heritage assets. The provisions include the following:

- management measures that would be implemented for assets that are to be retained within the land required for the construction of the Proposed Scheme;

- route-wide principles, standards and techniques for works affecting heritage assets; and
- 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.

7.4.2 The design of the Proposed Scheme avoids the following impacts on heritage assets within the Fradley to Colton area::

- physical impacts on any scheduled monuments, registered parks or gardens, registered battlefields or listed buildings;
- physical impacts upon Fradley Junction, Kings Bromley, Mavesyn Ridware, Hamstall Ridware, and Colton, and Admaston and Blithfield conservation areas; and
- physical impacts on the Trent and Mersey Canal and associated structures during temporary works.

Assessment of impacts and effects

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

Temporary effects

7.4.4 Impacts would occur to heritage assets within the land required for the construction of the Proposed Scheme. In addition, heritage assets in the wider study area may be affected due to the visibility of plant, cranes and equipment, or the presence of other construction elements. The duration of construction impacts has yet to be confirmed and will be reported in the formal EIA Report.

7.4.5 The following significant effects are currently expected to occur as a result of temporary impact on the setting of designated or non-designated heritage assets.

7.4.6 Woodhouse Farmhouse, Mavesyn Ridware, a Grade II listed building of mid-18th century date with a possible 17th-century core, a heritage asset of moderate value, would be subject to a change in its setting. Views south across open fields that 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, would be obstructed during construction. The land required for the construction and operation of the Proposed Scheme, and the temporary material stockpile, would lie approximately 30m to the south of the asset, while the landscape earthworks associated with the Pipe Ridware embankment would be constructed approximately 65m to the south of Woodhouse Farmhouse. Construction activities would also introduce noise into the rural sound environment of Woodhouse Farmhouse, affecting its rural character. This would constitute a medium adverse impact and a moderate adverse effect.

7.4.7 Bentley Hall Farmhouse, a Grade II listed building of mid-to-late 18th century date with a 19th-century rear extension, a heritage asset of moderate value, would be subject to

change in its setting. Views across open fields farmed from the farmhouse would be interrupted by works associated with the construction of the Blithbury cutting, and by the presence of the associated satellite compound. The land required, temporarily or permanently, for the construction and operation of the Proposed Scheme, would be located approximately 55m from the Farmhouse. Construction activities would also introduce noise into the rural sound environment of Bentley Hall Farmhouse, affecting its rural character. This would constitute a medium adverse impact and moderate adverse effect.

7.4.8 Hamley House and attached gate piers and garden wall to the south-west, a Grade II listed building and a heritage asset of moderate value, would be subject to change in its setting. Hamley House, which is a 17th century rural farmstead in a peaceful rural environment, would experience noise impacts associated with the construction of the Stockwell Heath embankment to the north and with the realignment of the B5013 Uttoxeter Road to the west and of Moor Lane to the east. Visual effects would be limited, owing to the fact that the principal views from the house are across the Trent Valley to the south-west, away from the scheme. This would constitute a medium adverse impact and moderate adverse effect.

7.4.9 The Church of St James, Pipe Ridware, its churchyard and the remains of a churchyard cross of probable 14th century date, a non-designated heritage asset group of moderate value, would be subject to a change in setting. The Church of St James has been the spiritual centre of a quiet rural parish since the medieval period, and its quiet setting is directly connected with its historical character and significance. The asset group would experience noise impacts associated with the construction of the Trent Valley viaduct, as the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme, would be located approximately 70m from the asset group. This would constitute a medium adverse impact and a moderate adverse effect.

Permanent effects

7.4.10 The following significant effects are currently expected to occur as a result of permanent physical impacts on heritage assets within the land required for the construction and operation of the Proposed Scheme.

7.4.11 Archaeological remains of prehistoric date (including Bronze Age round barrows and Iron Age pit alignments) represented by cropmarks visible on aerial photographs to between Barn Farm and Common Lane Farm to the south and Bourne Brook to the north, Kings Bromley, a heritage asset of moderate value, would be substantially removed during the construction of the railway line, the A515 Lichfield Road realignment, and the overhead power line diversion. Approximately 75% of the asset lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a high adverse impact and a major adverse effect.

7.4.12 Archaeological remains of prehistoric and medieval date (including Bronze Age round barrows and Iron Age pit alignments, trackways and enclosures) represented by cropmarks visible on aerial photographs to the north of Bourne Brook and to the east of the A515 Lichfield Road, Kings Bromley, a heritage asset of moderate value, would be partially removed during the construction of the railway line and the works

associated with the diversion of the overhead power line. Approximately 20% of the known extent of the heritage asset, including large parts of two enclosures defined by pit alignments, lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a medium adverse impact and a moderate adverse effect.

7.4.13 Archaeological remains of prehistoric date (including Bronze Age round barrows and Iron Age pit alignments, trackways and enclosures) represented by a cropmarks visible on aerial photographs between Shaw Lane and Lichfield Road, Kings Bromley, a heritage asset of moderate value, would be substantially removed during the construction of the railway line, the A515 Lichfield Road realignment, and the works associated with the diversion of the overhead power line. Approximately 90% of the known extent of the heritage asset lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a high adverse impact and a major adverse effect.

7.4.14 Archaeological remains of former field boundaries of probable post-medieval date visible as crop marks on aerial photographs to the north-east of Echills, Kings Bromley, a heritage asset of low value, would be substantially removed during construction. Almost all of the known extent of the heritage asset lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a high adverse impact and a moderate adverse effect.

7.4.15 Archaeological remains of a group of two adjacent Bronze Age round barrows visible as cropmarks on aerial photographs to the west of Kings Bromley, heritage assets of moderate value, would be completely removed during construction. This would constitute a high adverse impact and a major adverse effect.

7.4.16 Archaeological remains of a group of five Bronze Age round barrows visible as cropmarks on aerial photographs to the north-east of Glebe Farm, Kings Bromley, heritage assets of moderate value, would be almost entirely removed during construction. Four of the five barrows lie completely within while the fifth lies partially outside the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a high adverse impact and a major adverse effect.

7.4.17 Archaeological remains of a pit alignment of probable Iron Age date visible as cropmarks on aerial photographs to the north of Kings Bromley Lane, a heritage asset of moderate value, would be substantially removed during construction. Approximately 50% of this 300m-long asset lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a high adverse impact and a major adverse effect.

7.4.18 Archaeological remains of a rectangular enclosure of probable prehistoric date visible as a cropmark on aerial photographs to the north of Kings Bromley Lane, an asset of moderate value would be partially removed during construction. Approximately 30% of the asset lies within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme. This would constitute a medium adverse impact and a moderate adverse effect.

7.4.19 Archaeological remains of a Bronze Age round barrow visible as a cropmark on aerial photographs to the east of Pipe Ridware, an asset of moderate value lies almost entirely within the land required, temporarily or permanently, for the construction and operation of the Proposed Scheme, and would be almost completely removed during construction. This would constitute a high adverse impact and a major adverse effect.

7.4.20 The following significant effects would occur as a result of permanent impact on the setting of designated or non-designated heritage assets.

7.4.21 The Church of St James, Pipe Ridware, its churchyard and the remains of a churchyard cross of probable 14th century date, a non-designated asset group of moderate value, would be subject to a change in its setting. Currently the church sits in a rural village context with open fields to the north and east, which form an important part of its historic significance as the centre of a rural parish. The Trent Valley viaduct, which would be located approximately 130m to the east of the asset, would curtail these views, permanently changing the church's historic character. This would constitute a medium adverse impact and a moderate adverse effect.

7.4.22 Woodhouse Farmhouse, a Grade II listed building and a heritage asset of moderate value, would be subject to a change in its setting. The farmhouse is located on Pipe Wood Road, and faces south-west across the surrounding fields towards Quinton's Orchard and into the Trent Valley beyond. These elements of the surrounding landscape are directly connected with its historical character and significance. The landscape earthworks associated with Pipe Ridware embankment would be approximately 65m from the main aspect of the asset, and would curtail these views. As a consequence, the Proposed Scheme would create a medium adverse impact and moderate adverse effect.

7.4.23 Bentley Hall Farmhouse, a Grade II listed building of mid-to-late 18th century date with a 19th-century rear extension, a heritage asset of moderate value, would be subject to change in its setting. Its character is currently entirely rural and agrarian – the focus of a historic farm that has been a feature of this landscape for more than 200 years. It lies on the north slopes of the Trent Valley surrounded by the fields, which form an important part of its historic context and significance. These relationships would be disturbed by the construction of Blithbury cutting. The land required, temporarily or permanently, for the construction and operation of the Proposed Scheme, would be located approximately 55m from the Farmhouse. Construction activities would also introduce noise into the rural sound environment of Bentley Hall Farmhouse, affecting its rural character. This would constitute a medium adverse impact and moderate adverse effect.

Other mitigation measures

7.4.24 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme and the draft CoCP will continue to be made through the development of the design to seek 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 settings of assets; and

- locations where the physical impact on below-ground assets can be reduced through the design of earthworks.

Summary of likely residual significant effects

7.4.25 The temporary effects of construction activity on the setting of heritage assets are largely reversible in nature and last for the duration of the construction works, and therefore are not considered to result in residual significant effects. The physical impacts of construction on heritage assets are permanent and not reversible where heritage assets would be removed. This would result in significant effects on a number of archaeological remains, namely the extensive remains of prehistoric to medieval date visible as cropmarks on aerial photographs across the sand and gravel terraces flanking the River Trent, as well as on the slopes overlooking the valley to the north. There would also be permanent residual effects on the settings of the Church of St James, Pipe Ridware, a non-designated heritage asset, and on Woodhouse Farmhouse and Bentley Hall Farmhouse, Grade II listed buildings, due to the presence of the constructed Proposed Scheme.

7.5 Effects arising from operation

Avoidance and mitigation measures

7.5.1 The following measures, as shown on the CT-06 maps within the Volume 2, CA1 Map Book, have been incorporated into the design of the Proposed Scheme to reduce the impacts and effects on heritage assets:

- noise mitigation measures (including noise barriers) to reduce potential impacts on identified assets; and
- landscape planting, which would, as it matures, increasingly reduce impacts on the setting of the designated assets within the study area.

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 would be no physical impacts on buried archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on the setting of heritage assets 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 would 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 Proposed Scheme and its operation, this is reported in the assessment of operation.

7.5.3 It is expected that significant effects would occur as a result of permanent changes to the setting of the following heritage assets arising from the impacts of railway operation.

7.5.4 The Church of St James, Pipe Ridware, its churchyard and the remains of a churchyard cross of probable 14th century date, a non-designated asset group of moderate value, will be approximately 130m from the land permanently required for the Proposed Scheme, which will be on the River Trent viaduct in that location. Operating trains will be visible and will further obstruct views to and from the asset across those parts of its

historic parish that lie to the east and north of the Proposed Scheme. There would also be effects on the heritage significance of the church as a result of operational noise from the railway. This would result in a medium adverse permanent construction impact as a result of changes to the physical setting of the asset. In combination with the permanent construction impacts of the Proposed Scheme this would result in a medium adverse impact resulting in a moderate adverse effect.

7.5.5 Woodhouse Farmhouse a Grade II listed building and a heritage asset of moderate value, would be approximately 90m from operational trains running on the Pipe Ridware embankment. Operational trains would be visible from Woodhouse Farmhouse and would further curtail views across agricultural fields to Quinton's Orchard, the site of Pipe Ridware manor house and subsequent historic farmhouses on the same site. There would be potential noise impacts upon Woodhouse farmhouse once the Proposed Scheme becomes operational. There would also be a medium adverse permanent construction impact as a result of changes to the physical setting of the heritage asset. In combination with the permanent construction impacts of the Proposed Scheme this would result in a high adverse impact resulting in a major adverse effect.

7.5.6 Bentley Hall Farmhouse, a Grade II listed building, a heritage asset of moderate value, would be subject to change in its setting as a result of the operation of the Proposed Scheme. Operating trains will be visible approximately 150m away from the 18th century farmhouse and there will also be noise effects. There would also be a medium adverse permanent construction impact as a result of changes to the physical setting of the heritage asset. In combination with the permanent construction impacts of the Proposed Scheme, this would result in a medium adverse impact resulting in a moderate adverse effect.

Other mitigation measures

7.5.7 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 at the current time, although potential opportunities for further mitigation will continue to be considered through the design process.

Summary of likely residual significant effects

7.5.8 The settings of the Church of St James, Pipe Ridware, a non-designated heritage asset, and on Woodhouse Farmhouse and Bentley Hall Farmhouse, Grade II listed buildings, are expected to be permanently significantly affected once the Proposed Scheme becomes operational. This would be the result of their heritage significance being adversely affected by noise and visual impacts on their setting. In due course, some visual effects would reduce as planting matures and the new railway assimilates into the landscape.

8 Ecology and biodiversity

8.1 Introduction

8.1.1 This section of the report provides a summary of the predicted impacts and significant effects upon species and habitats in the Fradley to Colton area as a consequence of the construction and operation of the Proposed Scheme. This includes effects upon sites recognised or designated on the basis of their importance for nature conservation.

8.1.2 Engagement with stakeholders including Natural England, Environment Agency, Forestry Commission, Staffordshire Wildlife Trust, Royal Society for the Protection of Birds (RSPB), Woodland Trust, LDC, SCC and landowners has been undertaken. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, obtain relevant baseline information and consider alternative locations for environmental mitigation. Engagement with these stakeholders and other local groups will continue as part of the development of the Proposed Scheme.

8.1.3 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

8.2 Scope, assumptions and limitations

8.2.1 The scope, methodology and key assumptions for the ecological assessment are set out in the draft SMR and Volume 1. The assessment methodology is summarised in Section 8 of Volume 1, along with route-wide assumptions and limitations. In the absence of field surveys and fully developed mitigation, the assessment has been undertaken on a precautionary basis.

8.2.2 Field surveys are ongoing, but are limited to locations where landowner permission has been obtained and to areas accessible to the public. The surveys include (but are not limited to) broad habitat and detailed plant surveys, great crested newt surveys, wintering and breeding bird surveys, bat surveys, dormouse surveys, otter and water vole surveys. The findings from these ongoing surveys will be reported in the formal EIA Report.

8.3 Environmental baseline

Existing baseline

8.3.1 This section presents the environmental baseline that is relevant to the consideration of impacts and effects reported in Sections 8.4 and 8.5.

8.3.2 Land in and adjacent to the Proposed Scheme in this section consists mainly of agricultural land, woodland and floodplain. The topography is undulating and crosses floodplain grazing marsh in the Trent Valley near Kings Bromley. There are direct effects on seven woodlands.

8.3.3 Statutory and non-statutory designated ecological sites are shown on the CT-10 Map Series, Volume 2, CA1 Map Book.

8.3.4 No internationally important sites would be affected by the Proposed Scheme. The nearest is Cannock Chase Special Area of Conservation (SAC) which is approximately 4.5km to the west.

8.3.5 There are three LWS located within the extent of the Proposed Scheme, adjacent to it, or with the potential to be subject to significant effects, which are therefore relevant to the assessment (see below). Due to the habitats and species present, these sites are considered to be of up to county/metropolitan value.

8.3.6 Trentside Meadow LWS, which lies partially within the land required for the Proposed Scheme, is a floodplain meadow that is designated for species-rich grassland.

8.3.7 Newlands Lane LWS, which lies partially within the land required for the Proposed Scheme, is a hedge with good connectivity to the surrounding landscape and good hedge structure.

8.3.8 Lount Farm LWS is designated for its unimproved neutral grassland. The site is partially within the land required for the Proposed Scheme. Part of the site is within CA2 (Colwich to Yarlet).

8.3.9 Pipe Wood Ancient Woodland Inventory Site (AWIS) is plantation ancient woodland approximately 200m north of the Proposed Scheme.

8.3.10 A review of woodlands not currently listed on the Ancient Woodland Inventory (AWI), but that are either within the land required for construction of the Proposed Scheme or within 500m of it, has been undertaken based on historical mapping. This review identifies Westfield Covert near Kings Bromley as having potential ancient woodland. It is adjacent to the land required for the Proposed Scheme. The status of this woodland will be confirmed prior to completion of the ecological assessment in the formal EIA Report.

8.3.11 On a precautionary basis, pending the findings of field surveys, Pipe Wood and Westfield Covert are considered to be of up to county/metropolitan value.

8.3.12 There are six areas of woodland (which may qualify as habitats of principal importance, and local BAP habitats), which are within or partly within the land that would be required for construction of the Proposed Scheme. These are areas of semi-natural lowland deciduous woodland: Rice's Spinney near Fradley; Tomlinson's Spinney near Kings Bromley; and four unnamed woodlands. One area of broadleaved plantation woodland known as Spencer's Plantation near Stockwell Heath will also be affected. None of these are ancient woodland. On a precautionary basis, pending the findings of field surveys, each of these woodlands are considered to be of up to district/ borough value.

8.3.13 Watercourses that are outside the designated sites but relevant to the assessment include Pyford Brook, Bourne Brook, the River Trent, Moreton Brook, and several smaller watercourses, which would be crossed by the Proposed Scheme. The larger watercourses may qualify as habitats of principal importance and local biodiversity action plan (BAP[39]) habitats, and on a precautionary basis in the absence of survey

[39] Staffordshire Biodiversity Action Plan (BAP).

information are considered to be of up to county/metropolitan value, whilst the smaller watercourses are considered to be of up to district/borough value. These require compliance assessment under the Water Framework Directive (WFD)[40] and relevant surveys, such as fish, invertebrate and invasive plant species will be undertaken.

8.3.14 There are 16 existing ponds that would be located within, or partly within, the land required for construction of the Proposed Scheme, and a further 71 ponds within 250m of the area required for construction of the Proposed Scheme. It is assumed that all ponds are of district/ borough value unless they are found to be habitats of principal importance or local BAP habitats, in which case, on a precautionary basis, they would be assumed to be of up to county/metropolitan value.

8.3.15 Many of the hedgerows are likely to qualify as a habitat of principal importance and a local BAP habitat. Some may also meet the wildlife and landscape criteria for important hedgerows specified in the Hedgerows Regulations 1997[41]. In addition they could also provide commuting corridors for wildlife and nesting and feeding habitat. On a precautionary basis, in the absence of surveys, the hedgerow network is considered to be of up to district/borough value.

8.3.16 Grasslands outside designated sites that are within the land required for the Proposed Scheme include lowland meadows alongside Moreton Brook and floodplain grazing marsh on the Trent valley floodplain near Handsacre. On a precautionary basis, these may qualify as habitats of principal importance and local BAP habitats. Unless the field surveys identify unimproved grasslands, these grasslands are considered to be of up to district/borough value.

8.3.17 A summary of the likely value of protected and/or notable species is provided in Table 4.

Table 4: Species potentially relevant to the assessment within the Fradley to Colton area

Resource/feature	Value	Rationale
Bats	Up to county/metropolitan	There are records of a soprano pipistrelle and a Brant's bat maternity roost in the same location approximately 1km to the south of land that would be required for the Proposed Scheme. Common pipistrelle, soprano pipistrelle, and brown long-eared bat roosts have been identified within 2km of the Proposed Scheme. Records confirm there are at least four other species of bat throughout the area: noctule, Daubenton's bat, Natterer's bat and whiskered bat.
Otter and water vole	Up to county/metropolitan	Populations of otter are rare in Staffordshire. Habitat suitable for this species is present along the watercourses and drainage ditches, and there are records of their presence along the River Trent and the Trent and Mersey Canal. There is one record within 100m of land that would be required for the construction of the Proposed Scheme. Populations of water vole are rare in Staffordshire and are declining. Habitat suitable for water vole is present along the watercourses and drainage ditches, there are records of presence along the Trent and Mersey Canal but no records within 100m of land that would be required for the construction of the Proposed Scheme.

[40] EU Water Framework Directive, Available online at: http://ec.europa.eu/environemt/water/water-framework/index_en.html
[41] *"Statutory Instrument 1997 No. 1160"* Hedgerow Regulations 1997

Resource/feature	Value	Rationale
Hazel dormouse	Up to county/metropolitan	Populations of hazel dormice are rare in Staffordshire. There are no previous records for the Fradley to Colton area, and there is little habitat suitable for this species
Polecat	Up to county/metropolitan	Populations of polecat are rare in Staffordshire. Habitat suitable for this species is present including hedgerows, farmland and woodland, and there are records of presence within this area.
Great crested newt	Up to county/metropolitan	There are records of great crested newt from two areas within 500m of land that would be required for the construction of the Proposed Scheme: approximately 100m east at Admaston, and approximately 270m south-east near Fradley.
Birds	Up to county/metropolitan	There are records of the following Schedule 1 bird species within 250m of the Proposed Scheme: Barn owl, hobby, kingfisher, little ringed plover and red kite. Birds associated with farmland that are present in the area include lapwing, barn owl, skylark, tree sparrow, yellow wagtail, linnet and yellowhammer. The woodlands are likely to support a range of common woodland species.
Aquatic and terrestrial invertebrates	Up to district/borough	Aquatic invertebrates are likely to be present in watercourses including the Pyford Brook, Bourne Brook, the River Trent, Moreton Brook, smaller watercourses, and in water bodies.
Fish	Up to district/borough	There are records of spined loach and European bullhead (which area listed on Annex II of the Habitats Directive [42]) within the river catchments affected by the Proposed Scheme. There are also records of eel and brown trout.
Reptiles	Up to district/borough	There are no records of reptiles within 2km of the Proposed Scheme, but there is likely to be suitable habitat for common reptiles, including grass snake, near the River Trent and Moreton Brook, and common lizard and slow worm in grassland and scrub habitats.
Badger	Up to local/parish	Badgers are widespread and common. There are records near Fradley, Netherton and Admaston and there is suitable habitat for badgers throughout this area.

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:

- landscape planting along the route shown on the CT-06 Map Series, Volume 2, CA1 Map Book, which would be largely a mixture of woodland, scrub and grassland, and would contribute towards offsetting the losses of habitat and effects on species

[42]The EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, Available online at: http://eur-lex.europa.eu/eli/dir/1992/43/2013-07-01)

- construction of viaducts over Pyford Brook, Bourne Brook Viaduct, the River Trent, Moreton Brook would avoid direct effects to these watercourses and allow free passage for wildlife beneath them including along the rivers and their banks;
- new woodland planting would help to offset the loss of semi-natural broadleaved woodland (e.g. Rice's Spinney near Fradley, Tomlinson's Spinney near Kings Bromley, and four unnamed woodlands) and to enhance connectivity between remaining woodlands;
- new wetland habitat creation would help to offset the losses of riparian habitats in the lowland meadows and floodplain grazing marsh;
- provision of new ponds for those lost if they support great crested newts (e.g. Ashby Stitch, near B5014 Uttoxeter Road, near Blithbury Road, near Stonyford Lane, Colton, near Newlands Land), would form part of the mitigation measures required for great crested newts;
- provision of new species-rich hedgerows, using appropriate native species, to help to offset the loss of hedgerows and re-connecting the ecological network in the surrounding areas, including along the margins of the rail corridor and along road realignments, but also in specific areas such as Bourne Brook and surrounding areas; and
- provision of new grassland habitats, including species rich grasslands to help offset the loss from the Proposed Scheme.

8.4.2 The assessment assumes implementation of the measures set out within the draft CoCP, which includes translocation of protected species where appropriate.

Assessment of impacts and effects

8.4.3 The following section considers the impacts and effects on ecological features as a consequence of construction of the Proposed Scheme. All assessments are based on a precautionary basis in the absence of survey information and take account of the baseline value as presented in Section 8.3 of this report.

8.4.4 Construction of the River Trent viaduct would result in the loss of approximately 7.5ha (25%) of predominantly species-rich grassland within Trentside Meadows LWS. Habitat loss would result in a permanent adverse effect on site integrity that would be significant at the county/metropolitan level.

8.4.5 Construction of the Newlands Lane overbridge would result in the loss of 0.1ha (9%) of hedgerow within Newlands Lane LWS. Habitat loss and loss of connectivity along the hedge would result in a permanent adverse effect on site integrity that would be significant at the county/metropolitan level.

8.4.6 The east embankment of the Moreton Brook viaduct would result in the permanent loss of approximately 3ha (28%) of unimproved grassland at Lount Farm LWS. This would comprise 1.6ha (15%) in this area and 1.4ha (13% of the LWS) in the adjacent CA2. Habitat loss would result in a permanent adverse effect on site integrity that would be significant at the county/metropolitan level.

8.4.7 Pipe Wood AWIS is the nearest AWIS to the land required for the construction of the Proposed Scheme. It lies approximately 200m to the north of the Proposed Scheme, and indirect effects on the site would not be significant.

8.4.8 Construction would result in the loss of approximately 7ha of other semi-natural lowland deciduous woodland and 0.2ha of broad-leaved plantation woodland from this section of the route. The permanent loss of these woodlands would result in an effect that would be significant at up to the district/ borough level.

8.4.9 The design includes viaducts that would carry the Proposed Scheme across Pyford Brook, Bourne Brook, the River Trent and Moreton Brook. These watercourses would not be directly affected, and indirect effects would not be significant as they would be controlled through the implementation of measures in the draft CoCP. However, the Proposed Scheme would result in the loss of sections of other smaller watercourses and severance of river corridors due to culverts, which would result in a permanent effect that would be significant at up to the district/borough level.

8.4.10 Sixteen ponds would be lost due to the Proposed Scheme. The loss of these ponds could result in an impact that would be significant at up to county/metropolitan level depending on the findings of field surveys (e.g. if they support great crested newts) otherwise up to district/borough level.

8.4.11 The Proposed Scheme would cross 190 hedgerows that are located throughout the area, some of which may be Important hedgerows. The land that would be required for construction of the Proposed Scheme would result in the permanent loss of approximately 33km of hedgerows and would result in severance of the network in many places, adversely affecting connectivity with the surrounding area. The Proposed Scheme includes areas of new hedgerow planting, which would help offset losses. Further hedgerow planting will be proposed as part of the design development. In the absence of this additional mitigation, the impact would result in a permanent adverse effect on the conservation status of the hedgerow network that would be significant at up to the district/borough level.

8.4.12 Construction of the Proposed Scheme would result in the loss of grassland outside designated sites, including 6.5ha of floodplain grazing marsh adjacent to the River Trent. In the absence of field survey information, it has been assumed that none of the grassland lost would be unimproved, and hence the loss would be significant at up to the district/borough level.

8.4.13 Otters and water voles have been recorded along the River Trent and the Trent and Mersey Canal and otters were recorded within 100m of the Proposed Scheme. The proposed viaducts over the Pyford Brook, Bourne Brook, the River Trent and Moreton Brook would avoid loss of habitat along the river corridor. Indirect effects from construction activities, such as increased light and noise, may result in disturbance to these species during the construction period, and prevent them from moving along the watercourses. However, it is anticipated that such indirect effects would be controlled through measures in the draft CoCP. Habitat loss would result from several smaller watercourses being crossed by the Proposed Scheme. On a precautionary basis in the absence of survey information, impacts to otters and water voles would result in an adverse effect on the conservation status of these species that would be significant up to the county/metropolitan level.

8.4.14 The loss of deciduous woodland and hedgerows could affect hazel dormouse if this species is found to be present. The loss of these habitats along with grassland and arable land could also affect polecat, a species that has been recorded in the area. On a precautionary basis in the absence of survey information, the effects of permanent habitat loss on these mammals are assumed to be of up to county/metropolitan significance.

8.4.15 Habitat loss may have impacts on bats as it would reduce the availability of foraging, and potentially result in the loss of roosts and fragmentation of commuting routes. This could particularly affect breeding populations of eight bat species within the area. Bats may also be affected by the lighting associated with construction works, although it is anticipated that this would be controlled through measures in the draft CoCP. On a precautionary basis in the absence of mitigation there could be impacts on significant populations of bats which may be up to regional level. However, the majority of impacts on bats would be expected to be at a lower level.

8.4.16 On a precautionary basis, it is assumed that all 16 ponds (and surrounding terrestrial habitat) within the land required for construction of the Proposed Scheme support great crested newts. The loss of ponds supporting great crested newts could result in the isolation and severance of breeding populations of great crested newts across this area. The design incorporates the creation of some new ponds at this stage, but additional ponds would also be required subject to the outcome of surveys. Suitable terrestrial habitat would also be required to fully mitigate the effects. In the absence of the full mitigation, the loss of the ponds and surrounding land would result in a permanent adverse effect on the conservation status of great crested newts that would be significant at up to the county/metropolitan level.

8.4.17 The Proposed Scheme would result in the loss of nesting and foraging habitat for a range of farmland and woodland birds. These are likely to include barn owl, a Schedule 1 species[43] which has been recorded within and adjacent to the Proposed Scheme. On a precautionary basis, in the absence of survey information, it has been assumed that the Proposed Scheme would result in a permanent adverse effect that would be significant at up to the county/metropolitan level.

8.4.18 The land that would be required for construction of the Proposed Scheme would result in loss of habitat suitable for aquatic and terrestrial invertebrates (including Section 41 species[44]). On a precautionary basis in the absence of survey information, it has been assumed that Proposed Scheme would result in a permanent adverse effect that would be significant at up to the district/borough level.

8.4.19 The Proposed Scheme would pass over main watercourses on viaducts, and indirect impacts to fish living in the watercourses would be controlled through measures set out in the draft CoCP, and will be assessed for compliance with the WFD[45]. However, other smaller watercourses would still be affected and require assessment under the WFD. On a precautionary basis in the absence of survey information, it has been

[43] The Wildlife and Countryside Act 1981 (1981 Chapter 69) – Schedule 1 – Birds which are Protected by Special penalties, HMSO London, Available online at: http://www.legislation.gov.uk/ukpga/1981/69

[44] Under Section 41 of the Natural Environment and Rural Communities Act 2006, HMSO, London, Available online at: http://www.legislation.gov.uk/ukpga/2006/16/contents

[45] The other elements of the WFD are assessed in the water resources and flood risk section.

assumed that the Proposed Scheme would result in a permanent adverse effect on fish that would be significant that would be significant at up to district/borough level.

8.4.20 On the precautionary basis, there may be permanent adverse effects on common reptiles that may be present along the River Trent and Moreton Brook and in areas of grassland and scrub that would be significant at up to the district/borough level.

8.4.21 Effects on all other habitats and species would be likely to be significant at the local/parish level during construction. These effects and consideration of the potential cumulative effects will be described in the formal EIA Report.

8.4.22 Indirect effects from changes in air quality from increased levels of construction traffic, will be considered for sites within 200m of construction routes where habitats are considered to be sensitive to air quality changes. These effects will be reported in the formal EIA Report.

Other mitigation measures

8.4.23 Further measures currently being considered, but which are not yet part of the design and which will be informed by the findings of the ongoing field surveys, include:

- provision of additional broadleaved woodland to replace those lost, and / or enhancement of remaining woodlands;
- provision of additional hedgerows, which would offset the losses and maintain the connectivity of the network including to offset the effects on Newlands Lane LWS;
- options to create new species-rich grasslands (including translocation where appropriate) to offset grassland losses, including at Trentside Meadows and Lount Farm LWS, and to offset losses of floodplain grazing marsh;
- provision of additional measures to facilitate connectivity where significant foraging or commuting routes of fauna species would be affected;
- use of temporary fencing or retention of existing habitat links to reduce the risk of disturbance to otters during construction;
- design of watercourse culverts and underpasses to allow the free passage of wildlife;
- provision of alternative roosting habitat for bats; and
- provision of additional ponds and suitable terrestrial habitat around these ponds with habitat links to allow dispersal.

8.4.24 Some of the above may also be achieved through strategic mitigation in locations outside of the land required for the Proposed Scheme, which are currently being discussed with relevant stakeholders and are subject to agreement.

Summary of likely residual significant effects

8.4.25 Taking into account mitigation proposed in the design of the Proposed Scheme set out above, anticipated significant residual ecological effects during construction are detailed in Table 5.

Table 5: Anticipated significant residual ecological effects during construction

Resource/feature	Residual effect	Level at which the effect would be significant
Trentside Meadows LWS	Permanent loss of approximately 7.5ha (25%) of site, which supports species rich grassland.	County/metropolitan
Newlands Farm LWS	Permanent loss of approximately 0.1ha (9%) of site, which supports a hedge with good connectivity and structure.	County/metropolitan
Lount Farm LWS	Permanent adverse effect on site integrity due to loss of approximately 3ha[46] (approximately 28%) of lowland meadows (unimproved grassland).	County/metropolitan
Broadleaved woodland	Permanent loss of approximately 7ha of woodland, and possible effects from air emissions from construction traffic	Up to district/borough
Watercourses	Permanent adverse effect to the smaller watercourses, due to habitat loss and severance of the river corridors.	Up to district/borough
Ponds	Permanent loss of 16 ponds.	Up to county/metropolitan
Hedgerows	Permanent loss of sections of 190 hedgerows some of which may be Important hedgerows, and approximately 33km in total. Adverse effects on connectivity with the wider area.	Up to district/borough
Grassland	Permanent loss of grassland including approximately 6.5ha of floodplain grazing marsh.	Up to district/borough
Bats	Potential permanent adverse effect on conservation status due to loss of roosts (including maternity roosts), foraging habitat and fragmentation.	County/metropolitan (up to regional for some species)
Otter and water vole	Potential adverse effect due to construction activities and disturbance along main rivers, and loss of habitat, and habitat fragmentation on smaller watercourses.	Up to county/metropolitan
Hazel dormouse	Loss of habitat suitable for hazel dormouse.	Up to county/metropolitan
Polecat	Loss of habitat suitable for polecat.	Up to county/metropolitan

[46] Total figure in CA1 and CA2. Loss within CA1 1.6ha. (15%). Loss within CA2 (Colwich to Yarlett) 1.4ha. (13%)

Resource/feature	Residual effect	Level at which the effect would be significant
Great crested newts	Loss of 16 ponds and surrounding terrestrial habitat, which may support great crested newts.	Up to county/metropolitan
Birds	Loss of nesting and foraging habitat for a range of birds, especially of farmland and woodland. Barn owl, a Schedule 1 species, may be affected.	Up to county/metropolitan
Aquatic and terrestrial invertebrates	Permanent loss of suitable habitat.	Up to district/borough
Fish	Permanent loss of habitat from smaller watercourses.	Up to district/borough
Reptiles	Permanent loss of habitat suitable for reptiles.	Up to district/borough

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 would avoid or reduce impacts on features of ecological value during operation: construction of viaducts over Pyford Brook, Bourne Brook Viaduct, the River Trent, and Moreton Brook would avoid direct effects to these watercourses and allow free passage for wildlife beneath them, including along the rivers and their banks.

Assessment of impacts and effects

8.5.2 The following section considers the impacts and effects on ecological features during operation of the Proposed Scheme. All assessments are made on a precautionary basis in the absence of survey information, and take account of the baseline value presented in Section 8.3 of this report.

8.5.3 Bats are at risk of mortality from passing trains, particularly at frequently used commuting/foraging routes across the Proposed Scheme. On a precautionary basis in the absence of mitigation there could be significant impacts on populations of bats which may be up to regional level. However, the majority of impacts on bats would be expected to be at a lower level.

8.5.4 Barn owls are slow moving and often hunt low over rough grassland habitats that occur along road and railway corridors. As a result, they may be killed by cars and trains. Mortality could affect the conservation status of this Schedule 1 species and the ongoing reduction in numbers would result in a permanent adverse effect that would also be significant at up to county/metropolitan level.

8.5.5 Effects on all other habitats and species would be likely to be significant at the local/parish level during operation. These effects and consideration of the potential cumulative effects will be described in the formal EIA Report.

Other mitigation measures

8.5.6 Additional mitigation measures currently being considered include:

- the development of a barn owl action plan to provide off-site mitigation to reduce the likelihood of barn owls foraging in proximity to the line (informed by dispersion modelling being undertaken for HS2 Ltd by the British Trust for Ornithology); and
- green bridges, culverts of sufficient size and underpasses to reduce the likelihood of bat mortality at key locations.

Summary of likely residual significant effects

8.5.7 Taking into account mitigation included as part of the Proposed Scheme design, the anticipated significant residual ecological effects during operation are detailed in Table 6.

Table 6: Residual significant effects on ecological resources/features during operation

Resource/feature	Residual effect	Level at which the effect would be significant
Bats	Potential permanent adverse effect on conservation status due to collision with trains.	County/metropolitan (up to regional for some species)
Barn owl	Potential permanent adverse effect on conservation status due to collision with trains.	Up to county/metropolitan

9 Health

9.1 Introduction

9.1.1 This section identifies the communities within the Fradley to Colton area that would be subject to impacts associated with the Proposed Scheme and describes how these may affect the health and wellbeing of people within these communities. The scope, assumptions and limitations for the health assessment are set out in Volume 1 and the draft SMR.

9.1.2 The assessment considers the potential for impacts on a range of environmental and socio-economic 'health determinants', which would result in adverse or beneficial effects on the health of communities. The geographic extent of the health assessment covers those areas where impacts on health determinants are predicted to occur.

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

9.1.4 No engagement has been undertaken with key public health bodies to date. Engagement with key public health bodies will be undertaken as part of the development of the Proposed Scheme. The purpose of the engagement will be to increase the understanding of health issues that may not be identified solely through a review of publicly available data.

9.2 Scope, assumptions and limitations

9.2.1 This section deals specifically with impacts that occur at a local level within the Fradley to Colton area. Health effects across the Proposed Scheme as a whole are assessed in the route-wide health assessment contained in Volume 3. The health determinants of relevance within this community area are:

- social capital;
- neighbourhood quality;
- access to green space, recreation and physical activity; and
- access to services.

9.2.2 The health assessment is based on a review of evidence linking changes in health determinants to potential health outcomes. This information will be presented in a literature review and included in the formal EIA report. The evidence that relates health outcomes to changes in determinants varies in its strength. For example, the evidence relating to health effects of physical activity is strong, whereas that relating to social capital is considered weak. The strength of evidence does not necessarily determine the importance of the health effect in the assessment.

9.2.3 The certainty that can be attached to any conclusion regarding effects on health will depend on the strength of the evidence for a given determinant and also the

confidence attached to the prediction of an impact on a determinant. There will be greater certainty for the existence of an impact than a consequent effect on health.

9.2.4 Potential health effects have been identified based on information that is available at this stage of the assessment. A full assessment of health effects, applying the assessment criteria set out in the SMR, will be provided in the formal EIA Report.

9.2.5 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

9.3 Environmental baseline

9.3.1 The Fradley to Colton area has a relatively small population, commensurate with the rural nature of the land use. Data provided by the Office of National Statistics[47] and the Association of Public Health Observatories[48] show that this population across all four wards[49] is, by comparison with national (England) averages, in good health and experiences low levels of deprivation.

9.3.2 The population as a whole is considered to be more resilient than average nationally, with regard to changes in the relevant health determinants, and with relatively few vulnerabilities. One such vulnerability is a slightly higher than average proportion of older people (the 65 – 84 years category). Another is that the population across all four wards is more deprived than the national average with regard to the indicator of 'barriers to affordable housing and social services'. In part, this reflects the rural nature of the area and the distance people have to travel to access such services.

9.3.3 The available data permits a profile to be made of the whole population of approximately 15,000 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. Stakeholder engagement will be undertaken and this will provide further information of relevance to the community profile.

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 effects on health determinants have been reduced as far as reasonably practicable, through embedded mitigation measures to reduce adverse effects on people. Examples of the mitigation measures incorporated into the design include the following:

[47] The Office of National Statistics (ONS) provides spatial data on levels of deprivation, using indicators of: 'multiple deprivation', 'employment', 'education', 'barriers to housing and social services',' crime' and 'living environment'. These data are based on the 2011 census and available by Lower Super Output area.
[48] http://www.apho.org.uk/
[49] Electoral wards are the spatial units used to elect local government councillors. National Census data are published at ward level.

- the Proposed Scheme alignment has been designed to reduce the loss of property and community assets as far as reasonably practicable;
- the vertical alignment has been designed to reduce visual intrusion and noise as far as reasonably practicable; and
- landscape design and screening have been incorporated into the design.

9.4.2 In addition, the locations of construction compounds and haul routes have been selected to reduce exposure to construction impacts as far as reasonably practicable.

9.4.3 HS2 Ltd would require its contractors to comply with the environmental management regime for the Proposed Scheme, which includes the following core documents:

- the draft CoCP, which provides a generic basis for route-wide construction environmental management; and
- the LEMPs, which apply the management strategies at a local level.

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 In the event of any loss of a community facility, the options for mitigating significant impacts resulting from the loss of a community facility to be explored by HS2 Ltd would include:

- improving or altering the remaining portion of the community facility;
- improving other existing community facilities in the area that could reduce the effect;
- improving accessibility to other community facilities; and/or
- identifying land owned by the relevant local authority that could be brought into use as a community facility with its agreement.

Assessment of impacts and effects

Social capital

9.4.6 The connections between the individuals within communities, and the inclination 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. Impacts on social capital can arise from changes to community facilities and community connectivity, and from changes in community demographics. Adverse effects on health from changes in social capital can 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.

9.4.7 When homes are lost from within a community, there is a potential for the remaining community to experience changes to their social environment and loss of social networks. For this to have an adverse effect on overall levels of social capital, the loss

of homes would need to make up a sizeable proportion of the community. Six residential properties would be demolished as a result of land requirements in the Fradley to Colton area. These are distributed throughout the area and are, therefore, not considered to affect social capital in any individual settlement. (The effects on residents directly affected by property demolitions are assessed in the health section in Volume 3).

9.4.8 Road closures and diversions temporarily required for the construction of the Proposed Scheme have the potential to reduce community connectivity by increasing journey times between rural communities. Potential impacts on connectivity have been identified in the following locations:

- access to three residential properties on Common Lane and the A515 Lichfield Road would be affected by the temporary closure of Common Lane. Access would be maintained via Lichfield Road, however, this route would be subject to construction activities and traffic management, possibly leading to delays;
- access to an isolated residential property known as Far End, close to Bourne Brook satellite compound, would be disrupted by the stopping up of Shaw Lane and the use of the A513 Rugeley Road by construction traffic; and
- temporary reduction in access to three residential properties on Blithbury Road at the junction with Stonyford Lane, during the construction of road diversions.

9.4.9 Permanent impacts on community connectivity would also occur as a result of the reduction in access between residential properties at Stockwell Heath and the nearby community of Colton, due to the construction of the Stockwell Heath embankment across Moor Lane and Newlands Lane. These roads would be permanently realigned and combined into a single crossing point under the alignment.

9.4.10 Residents of these properties would experience increased journey times to nearby social and/or family networks, as well as community facilities such as the public houses, church and village hall in Colton. This would cause inconvenience and may deter people from travelling, potentially reducing levels of social interaction, resulting in a reduction in the beneficial health effects that are gained through access to community facilities, social contact and support.

9.4.11 The temporary construction workforce could comprise a mixture of local people and workers from further afield. Where workers who live outside commuting distance of the site choose to seek accommodation within the local community this could mean that local communities see temporary changes to the local population size and demographics. An assessment of any adverse or beneficial effect these changes would have on social capital will be undertaken and reported on in the formal EIA Report. There is potential for the presence of the temporary workforce to have a beneficial effect on local communities through increased spending, thereby increasing income and employment opportunities.

Neighbourhood quality

9.4.12 The term 'neighbourhood quality' is used in this assessment to describe a combination of aspects that have the potential to affect residents' feelings about their local

environment and thereby affect their quality of life and mental health and wellbeing. Communities could experience a number of effects during the construction of the Proposed Scheme, including construction traffic, construction noise and dust, and visual effects of the temporary and permanent works. The environmental and community impacts of these changes are assessed in the relevant sections of this report. This section assesses how changes to neighbourhood quality may affect people's levels of satisfaction with their local environment and perceptions about issues such as personal safety and security, and considers how these issues may in turn affect wellbeing.

9.4.13 The link between health and the aesthetic value of the public realm is not well understood, but there is moderate evidence to suggest that an attractive environment can improve people's enjoyment and sense of wellbeing. Conversely, poor-quality environments have been shown to have negative effects on people's health. There is moderate evidence that people have a preference for views of natural environments over man-made environments, and that exposure to views of natural environments is associated with increased wellbeing. The construction works and permanent structures would be visible from a large number of locations due to the scale of the Proposed Scheme. Section 11, Landscape and visual, identifies locations that would experience changes in existing views, including country roads, PRoW and views from properties close to the Proposed Scheme. The Proposed Scheme would not be visible from town and village centres. Effects on views of the rural landscape may have negative effects on residents' perceptions of the quality and character of their local environment, which could lead to a reduction in wellbeing.

9.4.14 Temporary traffic and transport impacts would include:

- construction vehicle movements to and from the various worksites;
- temporary and permanent road closures and associated diversions; and
- temporary and permanent alternative routes for PRoW.

9.4.15 At this stage, it is not anticipated that construction traffic emissions (NO_2, NOx, PM_{10} and $PM_{2.5}$) would have adverse health effects. However, the presence of additional HGV traffic on the road network could raise concerns about potential health effects, and perceived concerns about safety and frustration resulting from increased journey times. These perceptions could have a negative effect on people's levels of satisfaction with their local environment.

9.4.16 Noise from construction traffic and construction activities can cause annoyance and disturbance and lead to temporary effects on quality of life. Section 13, Sound, noise and vibration, has identified locations where residential communities may be adversely affected by construction traffic noise, as follows:

- Wood End Lane between the A38 and the A515 (north of Lichfield and south of Rileyhill);
- Rileyhill properties adjacent to the B5014; and
- Stockwell Heath / Colton properties adjacent to the B5013.

9.4.17 Noise from construction sites could also cause annoyance and disturbance and contribute to a perceived reduction in neighbourhood quality. Section 13, Sound, noise and vibration, identifies communities that may be affected by construction noise, on the basis of their proximity to the proposed works. These include areas within the following settlements: Rileyhill; Kings Bromley; Pipe Ridware; Blithbury; Stockwell Heath; Colton; and Hamley Heath.

9.4.18 Construction sites have the potential to give rise to emissions of dust and particulate matter. Section 5, Air Quality, identifies no adverse effects with respect to the effects of construction activities on dust soiling and human health within the Fradley to Colton area, taking account of mitigation measures contained in the draft CoCP. Therefore it is not expected that any direct health and wellbeing effects would arise as a result of air quality around construction sites.

9.4.19 Construction sites are sometimes perceived as having the potential to attract activities such as vandalism, fly-tipping and theft of materials. Those living close to construction compounds may experience increased fear of crime and anti-social behaviour associated with the presence of the sites. Additionally, the diversion of footpaths around construction sites has the potential to affect actual or perceived personal safety, both in terms of road safety and environmental changes, such as sight lines and lighting. Fear of crime has been linked to health effects, such as anxiety, and changes in behaviour, such as reduced participation in activities that are beneficial to health. The effects of increased crime and anti-social behaviour resulting from the Proposed Scheme are likely to be extremely low, as construction sites would be appropriately fenced and secured, and the potential for crime and anti-social behaviour would be minimised through measures set out in the draft CoCP.

9.4.20 Overall, it is considered that the construction of the Proposed Scheme has the potential to affect wellbeing through changes to neighbourhood quality for the duration of the works. This will be assessed in the formal EIA Report.

Access to green space, recreation and physical activity

9.4.21 Environmental factors have been shown to influence participation in physical activity, which in turn affects health. This includes issues such as opportunities for active travel, the accessibility of facilities for physical exercise, perceived safety and amenity of outdoor areas and parks.

9.4.22 There is moderate evidence to suggest that physical activity can be encouraged by improving accessibility to green spaces, and by ensuring green spaces are attractive and of a high quality. Access to green space also contributes to good mental health and reduced stress. Section 6, Community, has identified impacts upon the following areas of green space within the Fradley to Colton area:

- approximately 40% of Trentside Meadows LWS would be inaccessible to the public for the duration of construction. The site, located between the River Trent and the A513 Rugeley Road west of Kings Bromley, is owned and managed by CHADS. It provides access to the countryside for less able people and hosts nature walks. The site makes a positive contribution to the wellbeing of local communities, particularly disabled people, through physical activity

and access to green space. The temporary loss of this facility is considered to have an adverse effect on health and wellbeing;

- Hurst Wood and part of the Rugeley to Colton Circular Walk would be lost temporarily during construction, but would be reinstated as part of the Proposed Scheme following construction; and
- Tomlinson's Spinney woodland would be permanently lost due to land requirements for construction of the Bourne embankment. This area of woodland, at the junction of the A513 Rugeley Road and Shaw Lane near Kings Bromley, is accessible via a public footpath. At this stage of the assessment it is not known how the site is used by the local community.

9.4.23 Fear of traffic is identified as the most common barrier to cycling, although the level of fear is often exaggerated in comparison with the likelihood of injury. Fear of walking on footpaths and crossing roads with increased HGV traffic is also likely to deter walkers, particularly those with young children. There is strong evidence for a link between physical activity and health benefits.

9.4.24 There may be some reduction in the number of active travel journeys (cyclists and pedestrians) during construction as a result of increased volumes of HGV traffic on parts of the road network. These issues have the potential to reduce levels of active travel during the construction period, particularly in rural areas where there are fewer alternative routes available. Any effects arising will be reported in the formal EIA Report.

9.4.25 It is expected that the A51 Stafford Road and the A515 Lichfield Road, the A513 Rugeley Road and the B5014 Uttoxeter Road, which broadly run parallel to the Proposed Scheme, would provide the primary HGV access routes for construction vehicles, from which large goods vehicles would access construction compounds via Blithbury Road and the B5013 Uttoxeter Road. Where reasonably practicable, HGVs would use the haul road along the Proposed Scheme alignment to reduce the impact on the local road network.

9.4.26 There would be temporary alternative routes for a number of PRoW during construction. Non-motorised users would be re-routed around construction compounds, which is likely to increase travel distances. Reduced amenity on PRoW due to the presence of construction sites may result in a temporary reduction in their use, resulting in some reduction in levels of physical activity.

Access to services, health and social care

9.4.27 Impacts on access to services may arise as a result of increased demand for services (e.g. from the construction workforce), direct impacts on local services and facilities, and changes in journey times due to road closures and diversions, which have the potential to affect access to services and emergency vehicle access.

9.4.28 There is strong evidence linking access to healthcare facilities with health outcomes, and there is also evidence to suggest that transport problems are a key barrier to people's ability to access these services. Therefore, changes in journey times to healthcare services have the potential to result in adverse health effects, if the delays are sufficient to deter people from attending appointments or seeking advice.

9.4.29 In the event that construction workers from outside the local area reside in the vicinity of the Proposed Scheme it is considered likely that the majority of these workers would continue to be registered with their existing GPs rather than registering with a GP in the local area. The small minority who may choose to relocate to the area and register with a GP would be accommodated within the existing healthcare funding systems, which allocates funds to local health authorities on the basis of population size. Workers choosing to live in the local area for the purpose of accessing construction employment would remain in the area on a temporary basis for the duration of the works, and would not contribute to long-term population growth.

9.4.30 As set out in the draft CoCP, HS2 Ltd or the nominated undertaker would provide occupational healthcare to temporary workers, including health assessment, health monitoring, preventative treatment where necessary, and first aid. This is expected to help to reduce additional demand for local services, including A&E services.

9.4.31 HS2 Ltd would work with emergency services to ensure that effects on emergency response times are reduced as far as reasonably practicable. This would include consideration of strategies for temporary and permanent traffic arrangements and construction routes, to reduce any potential effects.

9.4.32 There is weak to 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 (see assessment of social capital above), as well as accessing basic needs such as food shopping. The Fradley to Colton area is a rural area, where communities rely on shops and services in nearby towns and villages, and where opportunities for short alternative routes are limited, resulting in longer diversions. There is a potential for communities to experience increased difficulty in accessing shops and community services (such as post offices, banks, libraries) as a result of increased journey times during construction. This will be assessed in the formal EIA Report.

Other mitigation measures

9.4.33 Other mitigation identified to reduce adverse impacts on health determinants during the construction of the Proposed Scheme in this area will be described in the formal EIA Report.

9.5 Effects arising from operation

Avoidance and mitigation measures

9.5.1 As described in Section 9.4, 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. Mitigation measures will be described in the formal EIA Report.

Assessment of impacts and effects

9.5.2 Any health effects of operational train noise will be assessed in the formal EIA Report. No other operational effects additional to the permanent construction effects have been identified at this stage.

Other mitigation measures

9.5.3 Other mitigation identified to reduce adverse impacts on health determinants during the operation of the Proposed Scheme in this area will be outlined in the formal EIA Report.

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 area in relation to land quality, and reports the impacts and likely 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, either from a scientific, historical, mineral exploitation or mineral resources point of view, including geological Sites of Special Scientific Interest (SSSIs) and local geological sites (LGS), areas of historical brine extraction and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.

10.1.2 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 the 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. The potential effects from operation of the Proposed Scheme are expected to be mitigated by operational and management controls.

10.1.3 Engagement with BGS, SSCC, LDC, the Environment Agency and the Food and Environment Agency has been undertaken. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, and obtain relevant baseline information. Engagement with these stakeholders will continue as part of the development of the Proposed Scheme.

10.1.4 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

10.2 Scope, assumptions and limitations

10.2.1 The scope, assumptions and limitations for the land quality assessment are set out in the draft SMR and Volume 1.

10.2.2 In accordance with the draft SMR, a risk-based approach is being undertaken to identify contamination that may have an impact upon the construction of the Proposed Scheme. To support this, an initial 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, but in the case of groundwater data, this is increased up to 1km. Selected site visits will be used to supplement desk-based information.

10.2.3 A conceptual site model (CSM) approach has been used to provide an initial 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.

10.2.4 Baseline data collection is ongoing and the results of that work, in conjunction with ongoing engineering design development and further surveys, will inform the formal EIA Report and provide refinement, where necessary, to the assessment of effects during construction and operation.

10.3 Environmental baseline

Data collection

10.3.1 Baseline data has been collected from a range of sources including Ordnance Survey mapping, the BGS, Coal Authority, Stafford Borough Council (SBC), SCC, Public Health England, the Environment Agency, Natural England and the FERA records, as well as web sources such as local geological trusts.

Field surveys

10.3.2 A familiarisation visit to the study area was made in March 2016, where the route of the Proposed Scheme was viewed from points of public access only.

10.3.3 Following the familiarisation visit and review of the baseline data, it was apparent that for many historical infill areas identified from the data, there are few obvious signs of these features on the ground when viewed from publicly accessible areas. On this basis, further surveys are likely to be required to confirm the exact location and condition of the identified infill areas.

Geology

10.3.4 This section describes the underlying ground conditions within the Fradley to Colton area. Recent changes in lithostratigraphic classifications by the BGS have been incorporated where appropriate[50].

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 area, for example where ponds, sand or marl pits have been backfilled. There is evidence of historical and authorised landfilling within the area, which may comprise more significant deposits of made ground.

Superficial geology

10.3.6 Extensive alluvial deposits of clay, silt, sand and gravel occur along the courses of streams and rivers. Alluvium is present in the area associated with the River Trent and its tributaries in the vicinity of Pipe Ridware.

[50] 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

10.3.7 River Terrace Deposits, comprising sand and gravel, are present associated with the River Trent valley between Shaw Lane Farm and Pipe Ridware.

10.3.8 Glaciofluvial sheet deposits comprising sand and gravel are present between Fradley Wood and Shaw Lane Farm. Some of the sands and gravels within the area have been worked for construction materials, both historically and currently.

10.3.9 Glacial till is present between Hunger Hill and Blithbury. There are two further isolated outcrops located between Hadley Gate and Longley Barn, in the vicinity of Stockwell Heath. These deposits comprise sandy, silty clay and have historically been extracted in 'marl pits', with the material being used as a soil improver for agriculture.

Bedrock geology

10.3.10 The bedrock geology in this area comprises rocks of the Mercia Mudstone Group and the Sherwood Sandstone Group.

10.3.11 The majority of the route within the area is underlain by 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.

10.3.12 Across the majority of the southern section of the Fradley to Colton 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 route, from approximately Blithbury to Stockwell Heath.

10.3.13 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, and the Helsby Formation (formerly the Bromsgrove Sandstone Formation) of the Sherwood Sandstone Group is present.

10.3.15 The sandstone 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 wood Cottage. Glacial till overlies the sandstone to the north-east of the route near to Pipewood Cottage and alluvium is found over the bedrock along the tributaries of the River Trent.

10.3.16 The total thickness of the sandstone is estimated to be up to 120m.

Radon

10.3.17 Radon is a radioactive gas formed by the radioactive decay of naturally occurring uranium in rocks and soils. The section of the route in the vicinity of Stockwell Heath and Colton lies within a radon-affected area, as defined on Public Health England's UK Radon online maps[51].

10.3.18 The maps show that between 1% and 3% of homes have radon levels above the action level of 200 becquerels per cubic metre (Bq/m^3) of air for residential properties. For the

[51] www.ukradon.org/information/ukmaps

remainder of the area between Fradley and Colton, radon levels are reported to be less than 1% of homes above action level.

Groundwater

10.3.19 Four categories of aquifer have been identified within the Fradley to Colton area, as defined by the Environment Agency.

10.3.20 The Helsby Formation is designated as a Principal aquifer. The river terrace, alluvium and the glaciofluvial sand and gravel, within the southern section of the area, are designated as Secondary A aquifers. The glacial till is designated as a Secondary (undifferentiated) aquifer. The Mercia Mudstone Group underlying the majority of the area, has been designated as a Secondary B aquifer.

10.3.21 No groundwater source protection zones (SPZ[52]) have been identified within 1km of the route within the Fradley to Colton area.

10.3.22 There are four licensed groundwater abstractions located within 1km of the Proposed Scheme and an additional two outside the corridor, but within 250m of the area of land required for construction.

10.3.23 According to local authority records, there are no private groundwater abstractions which do not require a permit within the study area.

10.3.24 Groundwater bodies in the Fradley to Colton area are described in more detail in Section 15, Water resources and flood risk.

Surface water

10.3.25 The River Trent and the Trent and Mersey Canal are the most significant watercourses within the area. The River Trent would be crossed by the Proposed Scheme at Crawley Brook diversion and Luth Burn diversion. The Trent and Mersey Canal is crossed at Fradley Wood.

10.3.26 The Pyford Brook, the Bourne Brook and the Moreton Brook are also crossed by the Proposed Scheme, as well as some unnamed tributaries and drains.

10.3.27 There are seven licensed surface water abstraction locations within 1km of the Proposed Scheme. The majority of these are from the River Trent, but there is one abstraction from Moreton Brook, downstream of the Proposed Scheme. No unlicensed private water supplies from surface water sources have been identified within 1km of the Proposed Scheme. Surface water bodies in the Fradley to Colton area are described in more detail in Section 15, Water resources and flood risk.

Current and historical land use

10.3.28 Current potentially contaminative land uses within the study area include one authorised landfill at Blackflatts Farm, Kings Bromley Marina, and several farms along the route.

[52] 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 from the potable source.

10.3.29 Historical land uses identified within the study area with the potential to have caused contamination include several infilled extraction pits, flooded gravel workings, landfills and infilled water wells. The infilled pits and wells may have been filled with a variety of waste materials, but have not been licensed.

10.3.30 Historical mapping also shows evidence of a potential refuse heap between Blithbury Village and Rake End and a historical petrol filling station on the B5013 Uttoxeter Road at Bellamour, south-west of Stockwell Heath.

10.3.31 Contaminants commonly associated with landfill sites could include metals, semi-metals, asbestos, organic and inorganic compounds. Infilled pits could also give rise to landfill gases such as methane or carbon dioxide and leachate.

Other regulatory data

10.3.32 The regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control and Integrated Pollution Prevention and Control licences). Of note is a significant pollution incident (Category 2), which occurred on 23 March 2009 and involved the release of agricultural materials and waste to water at Woodhouse Farm.

10.3.33 There are no ecological designations as defined in the land quality section of the draft SMR[53] located within the study area.

Mining/mineral resources

10.3.34 SCC is responsible for the overall mineral and waste local plans for the county. The new Minerals Local Plan (MLP) for Staffordshire 2015 to 2030 (final draft June 2015)[54] is currently being reviewed and is expected to replace the current Staffordshire and Stoke-on-Trent Minerals Local Plan in 2016. It will set out the Council's policies aimed at controlling mineral-related developments within Staffordshire up to 2030.

10.3.35 There is a mineral safeguarded area (MSA) in the new MLP within the Fradley to Colton area covering a total area of 55,048ha of superficial sand and gravel. The MSA, which covers the majority of the area, extends from Fradley to Hunger Hill. A further area of the MSA extends across the village of Stockwell Heath.

10.3.36 There is a sand and gravel area of search between Fradley Junction and Kings Bromley that overlaps with the Proposed Scheme.

10.3.37 There are two mineral consultation areas (MCA): the first extends from Fradley to Kings Bromley; the second area is located at Pipe Ridware. Both were defined as sand and gravel drift workings.

10.3.38 There are no MLP allocations within the study area.

10.3.39 There are no mineral sites with permitted reserves within 300m of the route within the Fradley to Colton area.

10.3.40 Available records from the Coal Authority show that the route passes through areas of recorded historical underground coal mining activities extending from Echills, west of

[53] Sensitive ecological receptors are defined as national designations such as SSSIs.
[54] Staffordshire County Council, 2015. The new Mineral Local Plan for Staffordshire 2015 to 2030. Final Draft June 2015.

Kings Bromley to Finners Hill, north-east of Colton. In addition, abandoned underground roadways, associated with coal mining, are also recorded at Pipe Ridware with approximate depths ranging between 235m and 685m. The MLP identifies the coal reserves as areas of hydrocarbons resources, potential sources of gas.

Geo-conservation resources

10.3.41 No geological SSSI or LGS sites have been identified within the study area to date. An assessment of geo-conservation resources is, therefore, not required.

Receptors

10.3.42 The sensitive receptors that have been identified within this study area are summarised in Table 7.

Table 7: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents at existing properties	High
		Workers and visitors at nearby facilities	Moderate
		Public using PRoW	Low
	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	Underground structures and buried services	Low
		Buildings and property	Low to high
	Natural environment	SSSI, SAC, LGS (none identified at this stage)	n/a
Impacts on mining/mineral sites (isolation and sterilisation of mineral sites)	Mining/mineral sites	Sand and gravel MSAs Area of Search: West of A38 Coal deposits (extent of hydrocarbons)	Moderate Low Low

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP. The draft CoCP sets out the measures and standards of work that would be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas would ensure the effective management and control of the work.

10.4.2 The draft CoCP requires that prior to and during construction, a programme of further detailed investigations, which may include both desk-based and site-based work, would take place in order to confirm the full extent of areas of contamination and a risk assessment would 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 would be undertaken in accordance with guidance provided by Environment Agency CLR11[55] and British Standards BS10175[56] and BS 8576[57].

10.4.3 With the application of measures in the draft CoCP during the construction phase, no significant adverse effects on land quality are likely to result from the Proposed Scheme.

10.4.4 If remediation of contaminated soils or groundwater is required, there could be a beneficial effect for the environment in the long term, with respect to contamination

10.4.5 Where significant contamination is encountered, a remedial options appraisal would be undertaken to define the most appropriate remediation techniques. This appraisal would 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 UK[58]. The preferred option would then be developed into a remediation strategy.

Assessment of impacts and effects

10.4.6 Construction of the Proposed Scheme through this section of the route would require earthworks, utility diversions, deep foundations, 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 CT05 Map Series in Volume 2, CA1 Map Book.

Land contamination

10.4.7 In line with the assessment methodology, as set out in the draft SMR, an initial screening process has been undertaken to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. Sites which present low risk have

[55] Environment Agency, (2004), *CLR11 Model Procedures for the Management of Land Contamination*.
[56] British Standard, (2011), *BS10175+A1:2013 Investigation of Potentially Contaminated Sites*.
[57] British Standard, (2013) *BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)*
[58] Sustainable Remediation Forum UK, (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation.*

not been taken further in the process. Any moderate to higher 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 undergoing the more detailed risk assessments are historical or current landfills and infilled pits/ponds.

10.4.8 CSMs have been produced for those areas taken forward to detailed risk assessments. The following factors determine the need for detailed risk assessments:

- whether the site is on or off 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 nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

10.4.9 Clusters of potentially contaminated sites have been grouped, and assessed together, where appropriate.

10.4.10 A summary of the baseline CSM is provided in Table 8. The impacts and baseline risks represent those before any mitigation is applied. Further sites may be included in the formal EIA Report.

Table 8: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area ref[59]	Area name	Main potential impacts	Main baseline risk
CA1- 61	Potential Unlicensed Refuse Heap adjacent to B5014 Uttoxeter Road	Potential impact on human health on-site (direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and groundwater and inhalation of ground gases).	Moderate
		Potential impact on human health off-site (ground gases).	Moderate/low
		Potential impact on groundwater quality (leaching, vertical and lateral migration from soils and water).	Moderate/low
		Potential impact on surface water quality (lateral migration through groundwater, direct runoff from site).	Very low
		Potential impact on property receptors on-site and off-site (direct contact with soils and water, exposure to explosive gases).	Moderate/low
CA1-122 and	Rileyhill landfill and	Potential impact on human health on-site (direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and groundwater and inhalation of ground gases).	Moderate

[59] Each potentially contaminated site is allocated a unique reference number

Area ref[59]	Area name	Main potential impacts	Main baseline risk
CA1-123	Shaw Lane landfill	Potential impact on human health off-site (direct contact, ingestion, inhalation of dusts and vapours from contaminated soils and groundwater and inhalation of ground gases).	Moderate/low risk
		Potential impact on groundwater quality (leaching, vertical and lateral migration from soils and water).	Moderate
		Potential impact on surface water quality (lateral migration through groundwater, direct runoff from site).	Moderate/low
		Potential impact on property receptors on-site and off-site (direct contact with soils and water, exposure to explosive gases).	Moderate/low

10.4.11 A screening assessment of the effects of contamination has been completed by comparing the detailed CSM developed for potential contaminated areas at baseline, construction and post-construction stages.

Temporary effects

10.4.12 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.

10.4.13 A worsening risk at construction stage compared to baseline would result in a negative effect, and conversely, an improvement would result in a positive effect. The assessment assumes mitigation through both the application of the draft CoCP and any necessary site-specific remediation.

10.4.14 Table 9 presents the summary of the resulting construction effects. This shows that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination. The adoption of the draft CoCP makes it unlikely that there will be adverse consequences, but it is considered that there may still be temporary minor adverse effects during the construction period, particularly from ground disturbance in areas of localised backfilling.

Table 9: Summary of temporary (construction) effects

Area ref[60]	Main baseline risk	Main construction risk	Temporary effect and significance (Y/N)
CA1-61 Potential Unlicensed Refuse Heap adjacent to B5014 Uttoxeter Road	Potential impact on human health on-site = moderate	Moderate	Neutral effect (N)
	Potential impact on human health off-site = moderate /low	Moderate/low	Neutral effect (N)

[60] Each potentially contaminated site is allocated a unique reference number

Area ref[60]	Main baseline risk	Main construction risk	Temporary effect and significance (Y/N)
	Potential impact on groundwater quality = moderate /low	Moderate/low	Neutral effect (N)
	Potential impact on surface water quality = very low	Very low	Neutral effect (N)
	Potential impact on property receptors on-site and off-site = moderate /low	Moderate	Minor adverse (N)
CA1-122 Rileyhill landfill and CA1-123 Shaw lane Landfill	Potential impact on human health on-site = moderate	Moderate	Neutral effect (N)
	Potential impact on human health off-site = moderate/low risk	Moderate/low	Neutral effect (N)
	Potential impact on groundwater quality = moderate	Moderate	Neutral effect (N)
	Potential impact on surface water quality = moderate/low risk	Moderate/low	Neutral effect (N)
	Potential impact on property receptors on-site and off-site = moderate/low risk	Moderate/low	Neutral effect (N)

Permanent effects

10.4.15 In order to identify potential permanent effects, a screening assessment has been undertaken comparing the baseline and post-construction CSMs to assess the permanent (post-construction) effects. As noted above, worsening risk would result in negative effects and an improvement will result in positive effects.

10.4.16 Table 10 provides the summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts and whether these are significant. It also shows the receptors to be subject to detailed risk assessment in the formal EIA Report.

Table 10: Summary of permanent (post-construction) effects

Area ref	Main baseline risk	Main post-construction risk	Post-construction effect and significance (Y/N)
CA1-61 Potential Unlicensed Refuse Heap adjacent to B5014 Uttoxeter Road	Potential impact on human health on-site = moderate	Moderate	Neutral (N)
	Potential impact on human health off-site = moderate /low	Moderate/low	Neutral (N)
	Potential impact on groundwater quality = moderate /low	Moderate/low	Neutral (N)

Area ref	Main baseline risk	Main post-construction risk	Post-construction effect and significance (Y/N)
	Potential impact on surface water quality = very low	Very low	Neutral (N)
	Potential impact on property receptors on-site and off-site = moderate /low	Moderate/low	Neutral (N)
CA1-122 Rileyhill landfill and CA1-123 Shaw lane Landfill	Potential impact on human health on-site = moderate	Moderate	Neutral (N)
	Potential impact on human health off-site = moderate/low risk	Moderate/low	Neutral (N)
	Potential impact on groundwater quality = moderate	Moderate	Neutral (N)
	Potential impact on surface water quality = moderate/low risk	Moderate/low	Neutral (N)
	Potential impact on property receptors on-site and off-site = moderate/low risk	Moderate/low	Neutral (N)

10.4.17 Following remediation for sites located within the study area, there would generally be overall negligible effects (non-significant).

Mining/mineral resources

10.4.18 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 severance[61] or isolation that may occur during the construction phase of the Proposed Scheme, possibly continuing through to its operation.

Temporary effects

10.4.19 The majority of effects on mining and mineral sites would be permanent. However, temporary adverse effects (non-significant) may occur where construction compounds are proposed. In such cases there may be a temporary sterilisation of the resource during construction works but this is not considered to represent a significant effect, as there would only be a delay in being able to access the resource, and the resource would not be lost permanently.

[61] 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.

Permanent effects

10.4.20 The Proposed Scheme would cross an extensive MSA for sand and gravel extraction and an area of search at Kings Bromley. The route would be on sections of embankment/viaduct and cutting through this area. Effects on these mineral resources may occur unless mineral extraction could be undertaken either in advance or as part of the works for the Proposed Scheme. Mitigation measures (if any) would be discussed in advance of the works with the Mineral Planning Authority, SCC and the mineral owner.

10.4.21 The Proposed Scheme also crosses an area underlain by coal reserves of the South Staffordshire Coalfield. The MLP[62] identifies the deep coal areas as areas of hydrocarbons resources, specifically, potential sources of gas. Construction of the Proposed Scheme may require the sterilisation of a strip of land in which future gas extraction could be constrained.

10.4.22 Table 11 presents the assessment of effects from construction on the mining and mineral resources identified.

Table 11: Summary of effects for mining for mineral resources

Site name	Status	Description	Sensitivity / value	Magnitude of impact	Effect and significance (Y/N)
Sand and gravel	MSA	MSA for sand and gravel extraction, defined by SCC[63] e.g.: Kings Bromley	Moderate	Minor	Minor adverse (N)
Sand and gravel	MCA	MCA for sand and gravel, defined by SCC	Low	Minor	Negligible (N)
West of A38, along Trent Valley	Area of search	Sand and gravel extractions, defined by SCC[64].	Low	Minor	Negligible (N)
Staffordshire Coalfield, Lichfield District	Extent of Hydrocarbons	Extent of hydrocarbon resource. Deep coal defined as between 50m and 1,200m defined by SCC[63]	Likely to be of low sensitivity	Negligible	Negligible(N)

10.4.23 On this basis there are anticipated to be no significant permanent effects, with respect to mineral resources.

Other mitigation measures

10.4.24 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 instigated as part of site-specific remediation strategies, which would be developed at the detailed design stage if required. These measures would ensure

[62] Minerals Local Plan.
[63] Staffordshire County Council. (2015) The new Minerals Local Plan for Staffordshire 2015 to 2030.
[64] 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

that risks to people and property from contaminants in the ground would be controlled such that they would not be significant.

10.4.25 In addition to the excavation and/or treatment of contaminated soils, as described above, it may also be necessary to install ground (landfill) gas and leachate control systems within affected old landfill sites, on a temporary or permanent basis, to ensure that ground (landfill) gas and leachate migration pathways are controlled and do not adversely affect the Proposed Scheme or the wider environment as a consequence of the Proposed Scheme.

10.4.26 Mitigation of the effects on mineral resources within the proposed MSAs could include extraction of the resource, for use within the Proposed Scheme, or elsewhere. Extraction may be limited to landscaping areas within the Proposed Scheme adjacent to rather than beneath the trackbed, which would require good founding conditions. A plan will be discussed in advance of the construction works with the landowner, the mineral planning department at SCC, and any other relevant parties to assist in achieving an effective management of minerals within the affected location of the MSA.

Summary of likely residual significant effects

10.4.27 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.

10.5 Effects arising from operation

10.5.1 Users of the Proposed Scheme (i.e. rail passengers), whilst within trains, are at all routine times within a controlled environment and have, therefore, been scoped out of the assessment.

Avoidance and mitigation measures

10.5.2 Maintenance and operation of the Proposed Scheme would be in accordance with environmental legislation and good practice. Spillage and pollution response procedures similar to those to be outlined in the draft COCP would be established for all high risk activities and employees would be trained in responding to such incidents.

Assessment of Impacts and effects

10.5.3 The Proposed Scheme within this area includes River Trent viaduct east auto-transformer station and Newlands Lane auto-transformer feeder station, which are located near Kings Bromley Lane and Newlands Lane, respectively. An auto-transformer station 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 would 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, such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

10.5.5 It is unlikely that there would be any cumulative effects on land quality receptors due to the environmental controls that would be placed on operational procedures.

Other mitigation measures

10.5.6 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality in the study area. No significant residual effects associated with operation of the Proposed Scheme are anticipated.

Summary of likely residual significant effects

10.5.7 No significant residual effects are anticipated associated with operation of the Proposed Scheme.

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, based on known scheme information to date. It summarises the baseline conditions found within and around the route of the Proposed Scheme and describes the likely impacts and potential significant effects that may arise during construction and operation on landscape and visual receptors.

11.1.2 In this section, the operational assessment section refers not just to the running of the trains, vehicles on roads and associated lighting but also the presence of the new permanent infrastructure associated with the Proposed Scheme.

11.1.3 Principal landscape and visual issues in this area include:

- potential temporary effects to landscape and visual receptors during construction arising from the presence of construction plant and compounds, construction of viaducts, embankments, overbridges and underbridges, road diversions and realignments, the removal of existing trees and vegetation, excavation of cuttings and pedestrian diversions; and
- permanent landscape and visual effects during operation arising from moving trains and vehicles and the presence of new structures in the landscape, including the viaducts over the River Trent and associated tributaries, maintenance loops, embankments and noise barriers, as well as overbridges, auto transformer stations, overhead line equipment and PRoW diversions.

11.1.4 A separate, but related, assessment of effects on the setting of heritage assets is included in Section 7, Cultural heritage.

11.1.5 Winter surveys for the landscape and visual assessment were undertaken from January to March 2016 to inform the assessment. Further surveys will be undertaken to inform the assessment and will be reported in the formal EIA Report.

11.1.6 Engagement with SCC and LDC has been undertaken. The purpose of this engagement has been to discuss the extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages[65]. Engagement with these stakeholders will continue as part of the development of the Proposed Scheme.

11.1.7 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the LV-11 Map Series in the Volume 2, CA1 Map Book.

[65] The working draft EIA Report does not contain photomontages, these will be produced to inform the formal EIA Report

11.2 Scope, assumptions and limitations

11.2.1 The scope, key assumptions and limitations for the landscape and visual assessment are set out in Volume 1 and the draft SMR.

11.2.2 The extent of the study area has been informed by construction and operational phase zones of theoretical visibility (ZTV). The ZTVs have been produced in line with the methodology described in the draft SMR, and are an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover would mean the actual visibility is substantially less than that shown in the ZTVs and professional judgement on site has been used to refine the study area to focus on likely significant effects. 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 is excluded from the ZTV for the operational phase[66] as inclusion indicates widespread visibility; however, this rarely gives rise to significant effects if it is the only element visible. Overhead line equipment is described and taken into account in the assessment of effects on landscape character areas (LCA) and visual receptors. With the exclusion of overhead line equipment, the operational phase ZTV gives a better indication of the possible spread of significant effects and therefore better informs the assessment.

11.2.3 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 Little Haywood and Rugeley.

11.2.4 Trees would be retained where reasonably practicable, in line with the draft CoCP, and disturbance minimised.

11.2.5 This assessment is based on preliminary design information and makes reasonable worst-case assumptions on the likely nature of potentially significant effects where these can be substantiated, based on information known at present. The assessment covers the situation in winter and summer of year 1 and summer of year 15[67] of operation.

11.2.6 The assessment in this report does not consider cumulative impacts or future baseline. These will be addressed in the formal EIA Report. This will also be the case for consideration of night time visual effects, although where general night time visual effects can be substantiated they are discussed in the relevant part of this section. The findings from the night time surveys will be included in the formal EIA report.

11.2.7 Professional judgements on landscape value are summarised in the baseline descriptions. The draft assessment of sensitivity is summarised for each LCA; however, the judgements on susceptibility have been excluded from this report due to incomplete baseline survey data at the time. Full judgement on susceptibility and the resulting sensitivity assessment for each LCA will be provided in the formal EIA Report.

[66] Refer to Phase One Landscape and Visual Technical Note – Approach to ZTV. Technical notes specific to Phase 2a will be appended to the formal EIA Report.
[67] Discussion of potential impacts in relation to certain receptors at year 60 will be provided in the formal EIA Report.

11.3 Environmental baseline

Landscape baseline

11.3.1 The study area extends from Fradley Wood in the south to 200m north-west of Moreton Brook. The area includes a section of the WCML as well as sections of the Trent Valley and the Trent and Mersey Canal. The study area encompasses lowland and settled river valley landscapes, valley sides and more elevated plateaux, often defined by intact, small-scale field networks. A number of vernacular settlements are associated with the rural lane network that crosses the study area, notably The Ridwares and Colton.

11.3.2 The LCAs have been determined with reference to published landscape character assessments, supporting GIS data, aerial photography and Ordnance Survey mapping, plus desk study and fieldwork to confirm the appropriateness of area boundaries and subdivisions. Landscape character assessments reviewed include the relevant National Character Areas[68] (NCA) and Staffordshire Landscape Guidelines[69].

11.3.3 For the purposes of this assessment, the study area for Fradley to Colton has been subdivided into eight LCAs. A summary of these is provided below.

Curborough and Fradley Settled Heathlands

11.3.4 This LCA is a flat to gently undulating agricultural landscape of mixed arable and pastoral farmland. Field patterns are small to medium scale and bound by deciduous hedgerows, hedgerow trees and dispersed blocks of deciduous woodland. The majority of this landscape was formerly heathland and woodland, and known as Fradley Heath in the 18th century, although by the late 18th and early 19th century, there was little heathland remaining. This is a predominantly rural landscape that is comprised of mostly intact medium-scale field patterns with well-established hedgerow field boundaries and woodland, though the southern boundary of the LCA is influenced by the industrial and urban fringe of Fradley and Lichfield. Given the above, the LCA is assessed as having a medium landscape value.

Fradley Wood Industrial Estate

11.3.5 This LCA is a low-lying pastoral landscape that has experienced extensive industrial development. Large warehouses, office blocks and industrial units are prominent features that are dispersed within areas of open pasture, scrub and wetlands. Industrial buildings are connected by mature tree-lined roads. Repurposed aircraft hangers, now forming part of the industrial character, and the disused Fradley Airfield are also prominent features in the landscape, and provide a reminder of the landscape's military past. The landscape has a low level of intactness due to its industrial nature and little variation in character due to the loss of natural elements. The LCA is, therefore, assessed as having a low landscape value.

[68] 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

[69] 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

Kings Bromley Terrace Alluvial Lowlands

11.3.6 This LCA lies between the villages of Kings Bromley and Handsacre. It is a flat landscape with a regular field pattern. Intensive agricultural practices, such as the removal of hedgerows to increase crop yield and a lack of landform definition, combines to create a landscape with little complexity of landscape features. Distinctive historic villages within the landscape, containing many vernacular buildings of local value, with a lack of modern development, provides a medium-high level of intactness in the LCA. The LCA is, therefore, assessed as having a medium landscape value.

Trent Riparian Alluvial Lowlands

11.3.7 This LCA lies within the River Trent Valley, characterised by flat landform and the river, which follows a meandering course. The land use is predominantly pastoral grazing land due to the underlying marshy floodplain landscape. The field patterns comprise medium to large fields, dating from later medieval to modern. Hedgerows are mostly intact and there are dense areas of woodland cover. The Trent and Mersey Canal and canalside vegetation meander through the landscape and dispersed redbrick farmstead properties are connected by narrow lanes. There is an extensive network of PRoW providing access and recreation, including The Way for the Millennium (Mavesyn Ridware Footpath 21, Hamstall Ridware Footpath 3 and 2) long-distance PRoW that crosses the landscape from west to east. The landscape, therefore, has a high level of intactness and condition, and an overall medium landscape value.

Colton and Stockwell Heath Settled Farmlands

11.3.8 This LCA lies between Hill Ridware, Colton and Admaston and is a rolling and rural landscape divided by small-scale field patterns, with occasional woodland blocks. Settlement is largely defined by dispersed farmsteads, such as Church Farm at Pipe Ridware, with occasional linear villages, such as Hamstall Ridware, with the larger village of Hill Ridware bordering the LCA to the south. Settlements are linked by a traditional rural road and lane network. Due to the intimate small-scale field pattern and the presence of the human scale components, the landscape has a high level of intactness and is in good condition. The LCA is, therefore, assessed as having a medium landscape value.

Admaston Settled Farmland Plateau Slopes

11.3.9 This LCA occupies the land overlooking the Blithe Valley north of Stockwell Heath. This is a small-scale landscape characterised largely by 18th and 19th century historic field boundaries, overlaid upon a distinct, rolling topography. The ridgetop is defined by intermittent woodland blocks and the landform is cut by minor tributaries of the River Blithe. Settlement is defined by scattered farmsteads. The intactness of the landscape is medium to high, due to the distinctive nature of the valley landform and the small-scale field patterns. The LCA is, therefore, assessed as having a medium to high landscape value.

Admaston Riparian Alluvial Lowlands

11.3.10 To the north within the Blithe Valley is the Admaston Riparian Alluvial Lowlands LCA, an area of low lying/valley floor pasture farmland with a patchwork of small to medium scale and irregular shaped fields, largely determined by the meandering tree lined course of the River Blithe and its tributaries. The condition of the landscape is good due to a lack of modern development and intact field boundaries, which contribute to the distinctive nature of the valley floor landscape. The LCA is, therefore, assessed as having a medium-high landscape value.

Colton Riparian Alluvial Lowlands

11.3.11 This LCA lies to the west of the village of Colton. This is a mostly intact lowland landscape defined by small-scale 18th and 19th century historic field boundary enclosures. The landscape is cut by an intricate network of tree-lined tributary watercourses. Dispersed farmsteads linked by rural lanes create a lightly settled character, and the WCML and associated overhead line equipment is prominent on an embankment in the southernmost part of the LCA and overheard power lines form prominent features in the landscape. The condition and intactness of the landscape is medium due to evident historic field boundaries and the well-managed nature of the agricultural landscape. The LCA is, therefore, assessed as having an overall medium landscape value.

Visual baseline

11.3.12 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 locations maps (see LV-11 Map Series, Volume 2, CA1 Map Book). In each case, the middle number in the sequence (xxx.**xx**.xxx) identifies the type of receptor that is present in this area – 1: Protected Views (none within this area); 2: Residential; 3: Recreational[70]; 4: Transport; 5: Hotels/Healthcare Institutions (none within this area); and 6: Employment (none within this area).

11.3.13 Residential visual receptors within this area are located within large settlements, notably Fradley, Kings Bromley, Handsacre, Hill Ridware and Colton, and in smaller villages and hamlets, such as Admaston, Hamstall Ridware and Pipe Ridware, Blithbury and Stockwell Heath. Residential viewpoints are also located at numerous farmsteads and isolated properties.

11.3.14 A range of recreational visual receptors are located on the PRoWs associated with the Trent and Mersey Canal, Blithe Valley, Handsacre, the Ridwares and a more extensive path network at Colton and Stockwell Heath.

11.4 Effects arising during construction

11.4.1 As is commonplace with major infrastructure works, the scale of the construction activities means that works would be visible in many locations and would have the potential to give rise to significant temporary effects that cannot be mitigated

[70] Reference to specific civil parish numbers for PRoWs is provided where available; otherwise, the adjacent road name is used as a reference to the PRoW.

practicably. Such effects are temporary and 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 would take place, including the establishment of compounds, tunnelling, main earthworks and structure works.

11.4.2 The potential effects associated with the peak construction phase in this area are generally considered to be medium term, given the anticipated length of the construction programme. The majority of the main and satellite compounds are assumed to be in place for this phase.

11.4.3 The construction works that have been taken into account in determining the potential effects on landscape and visual receptors include, ordered from south to north:

- construction of the route of the Proposed Scheme and associated overhead line equipment;
- construction and use of the haul route alongside the route for construction traffic and plant;
- construction and operation of satellite compounds at: Pyford Brook viaduct, Common Lane, Bourne Brook viaduct, River Trent viaduct, Pipe Lane, Maintenance Loop satellite compound, Blithbury Road, Newlands Lane, B5013 and Moreton Brook;
- construction of transfer nodes;
- diversion of Common Lane, Shaw Lane, Pipe Lane, Hadley Gate Lane, Stonyford Lane and Moor Lane;
- realignment works for the A515 Lichfield Road, Newlands Lane (South), Newlands Lane (North), B5104 Uttoxeter Road, Blithbury Road and B5013 Uttoxeter Road;
- construction of culverts at Woodend, Ashby Stitch, Crawley Brook, Pipe Lane, Bourne Brook, Woodhouse, Blithbury and Blithbury West Inverted Siphon, Hurstwood Drop Inlet, Stockwell Heath, Sherracop, Hamley Stream and Hamley (north) Drop inlet;
- construction of balancing ponds and floodplain compensation areas;
- construction of viaducts over the Pyford Brook, the Bourne Brook, the River Trent and Moreton Brook;
- construction of Pyford South, Pyford North, Bourne, Pipe Ridware (and associated maintenance loops), Blithbury, Stockwell Heath and Moreton South embankments;
- the excavations of Blithbury South, Blithbury Central, Blithbury North and Stockwell Heath and Moreton South cuttings;
- construction of an underbridge at Newlands Lane (North);

- construction of overbridges such as Newlands Lane (South) overbridge, Mavesyn Ridware Footpath 38 / accommodation overbridge; B5013 Uttoxeter overbridge, Blithbury overbridge, Blithbury Road overbridge, and Colton Footpath 73 overbridge;
- PRoW diversions to Kings Bromley Footpaths 12, 0.390 and 1, Mavesyn Ridware Footpaths 32, 33, 38 and 8, Colton Footpaths 73, 34, 36, and Colton Footpath 52/ Staffordshire Way;
- utility diversions including National Grid high power gas diversion at Pipe Lane and National Grid overhead electrical diversion at Bourne Brook;
- demolition of three residential properties on Shaw Lane and three properties and outbuildings at Hadley Gate;
- construction of an auto-transformer feeder station at Newlands Lane and an auto transformer station at the River Trent viaduct; and
- lighting of construction works.

Avoidance and mitigation measures

11.4.4 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include the following:

- measures to reduce landscape and visual impacts associated with temporary site offices, vehicles, construction plant and compounds;
- avoidance of unnecessary tree and vegetation removal, and protection of existing trees in accordance with BS 5837: Trees in relation to design, demolition and construction[71];
- 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 and machinery;
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses; and
- replacement of any trees intended to be retained that may die as a consequence of nearby construction works.

11.4.5 Implementation of these measures has been taken into account in the assessment of the construction effects.

Assessment of impacts and effects

Introduction

11.4.6 The most apparent changes to landscape and visual receptors during construction would relate to the presence of construction plant, the excavation of cuttings, pile

[71] BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations, 2012, British Standard.

driving and erection of viaducts, construction of embankments, soils and material storage and stockpiling; and the removal of existing landscape elements, including trees and hedgerows, as well as the stopping up and diversion of existing roads, lanes and PRoW. Other key changes include the construction of over and under bridges, compounds and transfer nodes, plus property demolitions.

11.4.7 Effects in relation to landscape and visual receptors are summarised below.

Landscape assessment

11.4.8 The following section describes the likely significant effects on LCAs during construction.

11.4.9 Based on current data it is anticipated that potentially significant effects on landscape character would occur to the following LCAs:

- Curborough and Fradley Settled Heathlands LCA is a landscape of medium susceptibility and moderate overall sensitivity to change resulting from the Proposed Scheme. The Curborough and Fradley Settled Heathlands LCA would be directly impacted by construction works associated with the Pyford Brook viaduct, the Pyford North embankment and Pyford South embankment within the LCA. These works would result in the removal of trees and hedgerows, and the presence of earthworks and stockpiles that would introduce alterations to the existing flat landform. The presence of equipment and movement of construction vehicles would also introduce considerable change in a landscape with few existing infrastructure influences. Therefore, these changes would result in a medium magnitude of change and a moderate adverse (significant) effect on the character of the landscape within this LCA during construction;

- Kings Bromley Terrace Alluvial Lowlands LCA is a landscape of medium susceptibility and moderate high sensitivity to change resulting from the Proposed Scheme. The Kings Bromley Terrace Alluvial Lowlands LCA would be directly impacted by construction works associated with the Bourne Brook viaduct, the Pyford North embankment and the Bourne embankment and the southern end of the River Trent viaduct within the LCA. These works would result in the removal of trees and hedgerows, and the presence of earthworks and stockpiles that would introduce alterations to the existing flat landform. The presence of equipment and movement of construction vehicles would also introduce considerable change in a landscape with few existing infrastructure influences. Therefore, these changes would result in a high magnitude of change and a major adverse (significant) effect on the character of the landscape within this LCA during construction;

- Trent Riparian Alluvial Lowlands LCA is a landscape of medium to high susceptibility and moderate high sensitivity to change resulting from the Proposed Scheme. The Trent Riparian Alluvial Lowlands LCA would be directly impacted by the presence of construction works associated with the River Trent viaduct and the Pipe Ridware embankment. These works would result in the removal of trees and hedgerows and earthworks and stockpiles would introduce alterations to the existing flat landform. The presence of equipment

and movement of construction vehicles would also introduce considerable change in a landscape with few existing infrastructure influences. Therefore, these changes would result in a high magnitude of change and a major adverse (significant) effect on the character of the landscape within this LCA during construction; and

- Colton and Stockwell Heath Settled Farmlands LCA is a landscape of medium susceptibility and moderate sensitivity to change resulting from the Proposed Scheme. Colton and Stockwell Heath Settled Farmlands LCA would be directly impacted by the presence of construction works associated with the Pipe Ridware embankment and the maintenance loops, Blithbury cutting South, Central and North, the Stockwell Heath embankment and the Stockwell Heath cutting, associated road realignments, overbridges and underbridges. These works would result in the removal of trees and hedgerows. Earthworks and stockpiles would introduce alterations to the existing flat landform. The presence of equipment and movement of construction vehicles would also introduce considerable change in a landscape with few existing infrastructure influences. Therefore, these changes would result in a high magnitude of change and a major adverse (significant) effect on the character of the landscape within this LCA during construction.

Visual assessment

Introduction

11.4.10 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, would be in leaf. Where residential receptors experience significant effects at night time arising from additional lighting, these are also presented in this section.

11.4.11 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 would be lower than those reported.

11.4.12 In most cases, additional lighting is not considered to give rise to significant effects due to the anticipated nature of the construction programme, except in areas in which 24-hour working is anticipated to take place (see the 'Night time effects' section below for further detail of construction lighting effects.) Where there would be no direct foreground visibility of additional lighting, no further assessment has been undertaken.

Views north from the Trent and Mersey Canal tow path

11.4.13 From viewpoint 001-03-007 (Map LV-11-101 in Volume 2, CA1 Map Book) receptors would experience close to mid-range views of the construction of Pyford Brook viaduct and adjoining embankments. Connections to Phase One would be visible, glimpsed through canalside vegetation. These activities are anticipated to give rise to a high magnitude of visual change and potentially major adverse potential visual significant effects on these receptors.

Views west from individual residences to south of Kings Bromley

11.4.14 From viewpoints 002-02-002 and 002-03-001 (maps LV-11-101 and LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid-distance views of the construction of Pyford Brook and Bourne Brook viaducts and Pyford North embankment, partially obstructed by field boundary and waterside vegetation and woodland within the mid-ground. These activities are anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse visual significant effects upon these receptors.

Views east from residences and King Bromley Footpath 0.390 near to Rileyhill and Bromley Hayes

11.4.15 From viewpoints 002-03-010, 002-02-003, 002-02-005 and 002-02-04 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience close to mid-range views of the construction of the Bourne Brook viaduct and adjoining Pyford North and Bourne embankments. These activities are anticipated to give rise to a medium magnitude of visual change and potentially major adverse visual significant effects upon these receptors.

Views south from residences in Kings Bromley

11.4.16 From viewpoint 02-02-014 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid distance views of the construction of Bourne Brook viaduct and the adjoining Bourne embankment, partially obstructed by field boundary vegetation within the mid-ground. These activities are anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse visual significant effects upon these receptors.

Views east from Armitage and Handsacre Footpath 26 and residences east of Handsacre

11.4.17 From viewpoints 003-03-002, 003-02-009, 003-02-010 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close-range views of the construction of the River Trent viaduct and adjoining Bourne embankment and the River Trent satellite compound would be visible above intervening vegetation. These activities are anticipated to give rise to a medium to high magnitude of visual change and potentially moderate adverse visual significant effects on these receptors.

Views east from Kings Bromley Footpath 1

11.4.18 From viewpoint 003-03-001 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close-range views of the construction of the Bourne embankment and the River Trent viaduct that would form uncharacteristic and large new features in the lowland valley landscape, although these would be partially obstructed by vegetation within the mid-ground. These activities are anticipated to give rise to a high magnitude of visual change and potentially major adverse visual significant effects.

Views south from the Way for the Millennium long-distance promoted route and adjacent residences at Netherton

11.4.19 From viewpoints 003-03-012 and 003-02-013 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the construction of the River Trent viaduct. Due to the proximity of these receptors and the presence of the viaduct construction in the lowland valley landscape, these receptors would experience a high magnitude of visual change and potentially major adverse visual significant effects.

Views west from residences east of Hamstall Ridware

11.4.20 From viewpoints 004-03-003 and 003-03-017 (maps LV-11-103 and LV-11-104 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the construction of the River Trent Viaduct and the adjoining Pipe Ridware embankment, although these would be partially obscured by intervening vegetation. Receptors would, therefore, experience a medium magnitude of visual change and potentially moderate adverse visual significant effects.

Views south from the Way for the Millennium long-distance promoted route and adjacent residences at Pipe Ridware

11.4.21 From viewpoints 003-02-018, 003-02-019 and 003-03-024 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close-range views of the construction of the River Trent viaduct and the adjoining Pipe Ridware embankment, although these would be partially obscured by intervening vegetation. The construction activities are anticipated to give rise to a high magnitude of visual change and potentially major adverse visual significant effects on these visual receptors.

Views east from farmsteads and Mavesyn Ridware Footpath 38 to the east of Hill Ridware

11.4.22 From viewpoints 004-02-004, 004-03-005, 004- 02- 006, 004-02-006 and 004-03-014 (Map LV-11-104 in Volume 2, CA1 Map Book) receptors would experience close to mid-range views of the excavation of Blithbury South cutting, the construction of the maintenance loops (plus associated security and lighting), the realignment of Pipe Wood Lane, the construction of the Mavesyn Ridware Footpath 38 overbridge and views of the Maintenance Loop satellite compound. These activities are anticipated to give rise to a medium to high magnitude of visual change and potentially major adverse visual significant effects on these visual receptors.

Views east from residences to the east of Hill Ridware

11.4.23 From viewpoint 004-02-08 (Map LV-11-104 in Volume 2, CA1 Map Book) receptors would experience mid to long-range views of the excavation of Blithbury cutting, the construction of the maintenance loops (plus security and lighting) and the realignment of Pipe Wood Lane, the construction of the Mavesyn Ridware Footpath 38 overbridge and views of the Maintenance Loop satellite compound. The works would be filtered by field boundary vegetation within the mid-ground. These activities are anticipated to give rise to a medium-low magnitude of change and potentially a moderate adverse level of visual significant effect.

Views from Mavesyn Ridware Footpath 9 and residences to the south of Blithbury

11.4.24 From viewpoints 004-02-013, 004-03-015 and 004-02-017 (Map LV-11-104 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the excavation of Blithbury Central cutting and Blithbury South cutting and of the construction of Blithbury Road overbridge partially obstructed from view by roadside and field boundary vegetation within the mid-ground. These activities are anticipated to give rise to a medium magnitude of change and potentially a moderate adverse level of visual significant effect.

Views west from residences to the south of Stockwell Heath.

11.4.25 From viewpoints 005-03-015 and 005-03-005 (Map LV-11-105 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the excavation of Blithbury Central cutting and Blithbury North cutting in the mid-ground of the view, plus mid-range views of the associated construction of Blithbury Road and Newlands Lane overbridges. Views would be partially obstructed by landform and by intervening field boundary vegetation. These activities are anticipated to give rise to a medium magnitude of change and potentially a moderate adverse level of visual significant effect.

Views east from residences and Mavesyn Ridware Footpath 6 to the east of Stockwell Heath near Blithbury Road

11.4.26 From viewpoints 005-02-006, 005-03-007 and 005-02-009 (Map LV-11-105 in Volume 2, CA1 Map Book) receptors would experience mid-range range views of the excavation of Blithbury Central cutting and Blithbury North cutting, plus mid-range views of the associated construction of Blithbury Road and Newlands Lane overbridges. Views from these receptors would be partially filtered by intervening field boundary vegetation within the mid-ground. These activities are anticipated to give rise to a medium magnitude of change and potentially a moderate adverse level of visual significant effect.

Views west from residences and Colton Footpaths 52 and 76 on the western edge of Stockwell Heath

11.4.27 Receptors at viewpoints 006-02-010,006-02-013, 006-02-021 and 006-03-032 (Map LV-11-106 in Volume 2, CA1 Map Book) would experience close to mid-range views of construction works associated with the construction of the embankment for the Proposed Scheme, plus associated construction of the Newlands Lane (North) underbridge for the re-aligned road linking Stockwell Heath with Colton to the south. Views from these receptors would be open and the undulating nature of the landform would restrict long distance views; as such the works would become the primary feature within the view. These activities are anticipated to give rise to a high magnitude of change and potentially a major adverse significant visual effect.

Views west from residences and Colton Footpath 39 to the east of Stockwell Heath

11.4.28 Receptors at viewpoints 006-02-011 and 006-03-012 (Map LV-11-106 in Volume 2, CA1 Map Book) would experience mid-range views of works associated with the

construction of the Stockwell Heath embankment for the Proposed Scheme, plus associated construction of the Newlands Lane underbridge, albeit partially obstructed by intervening landform and vegetation. These activities are anticipated to give rise to a medium-high magnitude of change and, therefore, moderate adverse significant visual effects.

Views east from residences in Colton and Colton Footpaths 24 and 50

11.4.29 From viewpoints 006-02-015, 006-02-014, 006-03-017 and 006-03-018 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience horizon-line views of the construction of the Stockwell Heath embankment, visible above intervening vegetation and the realignment of Moor Lane and Newlands Lane. These activities are anticipated to give rise to a medium magnitude of visual change and potentially a moderate significant effect on these visual receptors.

Views east from Colton Bridleway 31 to south of Colton

11.4.30 From viewpoint 006-03-003 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience close-range views of the realignment of Newlands Lane and mid-range views of the construction of the embankment at Stockwell Heath. That would be a prominent new feature within the view that would be visible above intervening vegetation. These activities are anticipated to give rise to a high magnitude of visual change and potentially a major adverse significant effects on these visual receptors.

Views east from Hamley Heath

11.4.31 From viewpoints 006-02001 and 06-02-025 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience mid to upper levels of the construction of the B5013 Uttoxeter overbridge would be visible, as would realignment of the road to the north and potentially the excavation of the Stockwell Heath cutting and the construction of Stockwell Heath embankment, viewed above intervening field boundary vegetation. These elements are anticipated to give rise to a medium-high magnitude of change and potentially major adverse visual significant effects on these receptors.

Views west from residences south and west of Admaston

11.4.32 From viewpoints 006-02-02, 006-02-028, 006-03-029, 006-02-027 and 006-03-031 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the mid to upper levels of the excavation of the Stockwell Heath cutting and the construction of Stockwell Heath embankment, plus the associated realignment of the B5013 Uttoxeter Road and the construction of the overbridge, viewed above intervening field boundary vegetation. These activities are anticipated to give rise to a medium magnitude of change and potentially moderate adverse visual significant effects on these receptors.

Night time effects

11.4.33 Based on current design information it is not anticipated that there would be a requirement for continuous and/or overnight working in the area. Consideration of potential night time visual effects has therefore not been taken any further.

Other mitigation measures

11.4.34 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. This may include consideration of early planting in ecological mitigation sites, which would have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be practicably 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

11.4.35 These effects would be temporary and reversible in nature, lasting only for the duration of the construction works. Any temporary significant effects after mitigation would generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed from surrounding residential receptors, and users of PRoW and main roads within the study area.

11.4.36 It is anticipated that the following significant effects would remain after implementation of construction phase mitigation:

- major adverse effects in relation to Kings Bromley Terrace Alluvial Lowlands LCA, the Trent Riparian Alluvial Lowlands LCA and the Colton and Stockwell Heath Settled Farmlands LCA;
- moderate adverse effects in relation to the Curborough and Fradley Settled Heathlands LCA;
- major visual effects would be experienced by recreational receptors using the Trent and Mersey Canal near Fradley; residences and users of the Kings Bromley Footpath 0.390 near to Rileyhill and Bromley Hayes; users of the Armitage and Handsacre Footpath 26 and residences east of Handsacre; users of the Kings Bromley Footpath 1; users of the Way of the Millennium long distance promoted route and adjacent residences at Netherton and at Pipe Ridware; receptors in farmsteads and Mavesyn Ridware and users of Footpath 38 to the east of Hill Ridware; residences and users of Colton Footpaths 52 and 76 on the western edge of Stockwell Heath; residences and users of Colton Footpath 39 to the east of Stockwell Heath; receptors at Colton Bridleway 31; and receptors at Hamley Heath; and
- moderate adverse visual effects would be experienced by receptors to the south of Kings Bromley; residential receptors in Kings Bromley; users of Armitage and Handsacre Footpath 26 and residential receptors to the east of Handsacre; residences to the east of Hamstall Ridware; residences to the east of Hill Ridware; receptors using Mavesyn Ridware Footpath 9; residences to the south of Blithbury; residences to the south of Stockwell Heath; residences and users of Mavesyn Ridware Footpath 6 to the east of Stockwell Heath near Blithbury Road; residences in Colton and users of Colton Footpaths 24 and 50; and residences south and west of Admaston.

11.5 Effects arising from operation

11.5.1 The specific elements of the Proposed Scheme that have been taken into account in determining the effects on landscape and visual receptors in this area include:

- the permanent diversions of Kings Bromley Footpaths 12, 0.390 and 1, Mavesyn Ridware Footpaths 32, 33, 38, 7 and 8, Colton Footpaths 73, 34, 36, and Colton Footpath / Staffordshire Way;
- the permanent highway diversions at A515 Lichfield Road, Pipe Lane, Newlands Lane and B5013 Uttoxeter Road;
- the presence of overbridges at Newlands Lane South and for Mavesyn Ridware Footpath 38 / accommodation overbridge; B5014 Uttoxeter Road, Blithbury, Blithbury Road; Colton Footpath 73, Newlands Lane South and the B5013 Uttoxeter Road;
- the presence of an underbridge at Newlands Lane (North);
- the presence of viaducts over the Pyford Brook, the Bourne Brook, the River Trent and Moreton Brook;
- the presence of embankments including the Pyford South, Pyford North, Bourne, Pipe Ridware (and the associated maintenance loops), Blithbury, Stockwell Heath and Moreton South;
- the presence of Blithbury South, Blithbury Central, Blithbury North and Stockwell Heath and Moreton South cuttings;
- the presence of overhead line equipment, most prominently on the proposed viaducts and embankments;
- the presence of fencing and noise barriers;
- operation of the maintenance loops and associated lighting near Pipe Ridware; and
- presence of trains, track and supporting infrastructure, such as the auto-transformer feeder station at Newlands Lane and the River Trent viaduct.

Avoidance and mitigation measures

11.5.2 The operational assessment of impacts and effects is based on year 1 (2027) and year 15 (2042) of the Proposed Scheme. Operational impacts and effects for year 60 (2087) of the Proposed Scheme will be assessed and reported in the formal EIA Report. 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 would be incorporated into the design of the Proposed Scheme include:

- design of earthworks to tie the engineering earthworks for 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 also consider 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 and to provide enhanced landscape and green infrastructure connectivity, as well as connectivity of historic designed landscape features where reasonably practicable;
- hedgerow replacement and restoration in areas of loss to restore connectivity and landscape pattern where reasonably practicable and to tie Proposed Scheme mitigation into the wider landscape character; and
- compensation for loss of field ponds with new wetlands, water balancing and biodiversity wetland features.

Assessment of impacts and effects

Introduction

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. Additional potential effects would result from the permanent highway diversions of the A515, Pipe Lane, Newlands Lane and B5013 Uttoxeter Road. Other aspects include the presence of overhead line equipment, noise barriers and the presence of auto transformer stations.

Landscape assessment

11.5.4 The Curborough and Fradley Settled Heathlands LCA would be directly impacted by the presence of the Pyford Brook viaduct, Pyford North and Pyford South embankments and connections to Phase 1. Loss of vegetation and the presence of large-scale features would substantially alter the open rural character of the landscape. These changes would result in a medium magnitude of change and a moderate adverse effect on the character of the landscape within this LCA in both summer and winter of year 1 of operation.

11.5.5 The Kings Bromley Terrace Alluvial Lowlands LCA would be directly impacted by the presence of the Bourne Brook viaduct and adjoining Bourne embankment and the southern section of the River Trent viaduct and the realignment of Lichfield Road within the LCA. The loss of vegetation and the presence of large scale features would substantially change the open rural character of the landscape. These changes would result in a high magnitude of change and a major adverse effect on the character of the landscape within this LCA in both summer and winter of year 1 of operation.

11.5.6 The Trent Riparian Alluvial Lowlands LCA would be directly impacted by the presence of the River Trent viaduct within the LCA. The loss of vegetation and the presence of large scale features would substantially change the open rural character of this lowland valley landscape.

11.5.7 These changes would result in a high magnitude of change and a major adverse effect on the character of the landscape within this LCA in both summer and winter of year 1 of operation.

11.5.8 The Colton and Stockwell Heath Settled Farmlands LCA would be directly impacted by the presence of the Pipe Ridware embankment and the maintenance loops, Blithbury cutting South, Central and North, the Stockwell Heath embankment and the

Stockwell Heath cutting, associated road realignments, overbridges and underbridges. The loss of vegetation and the presence of large-scale features would substantially change the open rural lowland valley landscape character. These changes would result in a high magnitude of change and a major adverse effect on the character of the landscape within this LCA in both summer and winter of year 1 of operation.

11.5.9 By summer of year 15, due to the establishment of landscape mitigation planting, the above landscape effects would potentially be slightly reduced although they would remain significant (moderate adverse) due to the level of severance created by the Proposed Scheme.

Visual assessment

Introduction

11.5.10 The following section describes the likely significant effects on visual receptors during operation year 1 and year 15. 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, would be in leaf. Likely significant effects on residential receptors from additional lighting at night time are also identified.

11.5.11 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 may be lower than those reported.

11.5.12 In most cases, additional lighting is not considered to give rise to significant effects due to the operational nature of the Proposed Scheme (with the exception of the maintenance loops at Pipe Ridware). Where there would be no direct foreground visibility of additional lighting, no further assessment has been undertaken.

11.5.13 Visual receptor groups that experience significant construction phase effects and are not likely to experience significant effects at Operation Year 1 include residences at Blithbury and Admaston.

Views north from the Trent and Mersey Canal towpath

11.5.14 In winter and summer of year 1 from viewpoints 001-03-007 and 001-03-013 (Map LV-11-101 in Volume 2, CA1 Map Book) receptors would experience close to mid-range views of the Pyford Brook viaduct and adjoining embankments and connections to Phase One, glimpsed through canalside vegetation. These activities are anticipated to give rise to a high magnitude of visual change and potentially major adverse significant visual effects on these receptors.

11.5.15 It is likely that major effects in relation to views of the viaduct would remain at year 15, albeit partly integrated by scrub, woodland and hedgerow planting to tie the Pyford Brook viaduct abutments and Pyford South and Pyford North embankments into their context.

Views west from individual residences to South of Kings Bromley

11.5.16 In winter and summer of year 1 from viewpoints 002-02-002and 002-03-001 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid to long range views of the Bourne Brook viaduct and adjoining Pyford North and Bourne

embankments, partially filtered by woodland within the mid- and background. These activities are anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse visual significant effect upon these receptors.

11.5.17 It is likely that moderate visual effects in relation to views of the Proposed Scheme would remain at year 15, albeit partly integrated by scrub, woodland and hedgerow mitigation planting to tie the Bourne Brook viaduct abutments and adjoining embankments into the intervening vegetation within the view.

Views east from residences and King Bromley Footpath 0.390 near to Rileyhill and Bromley Hayes

11.5.18 In winter and summer of year 1, from viewpoints 002-03-010, 002-02-003, 002-02-005 and 002-02-04 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid to short-distance views of the Bourne Brook viaduct and adjoining Pyford North and Bourne embankments, lower elements would be partially obstructed by intervening field boundary vegetation; otherwise, open views would be afforded. The proposed viaduct, with associated overhead line equipment and noise barriers, is anticipated to give rise to a high magnitude of visual change and potentially major adverse visual significant effects on these visual receptors.

11.5.19 It is likely that major effects in relation to views of the viaduct would remain at year 15, albeit partly integrated by scrub, woodland and hedgerow mitigation planting to tie the Bourne Brook viaduct abutments and Pyford North and Bourne embankments into their context.

Views east from Trent and Mersey Canal towpath to the west of Rileyhill

11.5.20 In winter and summer of year 1, from viewpoints 002-03-021 and 002-03-011 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid to long-distance views of the Bourne Brook viaduct and adjoining Pyford North and Bourne embankments. The proposed viaduct, with associated overhead line equipment and noise barriers, is anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse significant visual effects on these visual receptors.

11.5.21 It is likely that effects would reduce to non-significant at year 15 due to the maturity of the mitigation planting and corresponding incremental growth of existing vegetation.

Views south from residences in Kings Bromley

11.5.22 In winter and summer of year 1, from viewpoint 002-02-014 (Map LV-11-102 in Volume 2, CA1 Map Book) receptors would experience mid-distance views of the Bourne Brook viaduct with associated overhead line equipment and noise barriers, partially obstructed by hedgerows boundaries within the middle ground. It is anticipated that this would result in a potentially medium magnitude of visual change. Potentially moderate adverse visual significant effects are, therefore, anticipated.

11.5.23 It is likely that moderate visual effects in relation to the viaduct would remain at year 15, albeit partly integrated by mitigation planting to tie the Bourne Brook viaduct abutments and adjoining embankments into their context

Views east from Armitage and Handsacre Footpath 26 and residences to east of Handsacre

11.5.24 In winter and summer of year 1 from viewpoints 003-02-009, 003-02-010, 003-03-002 and 003-03-001 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close- to mid-range views of the River Trent viaduct, which would form a large new feature in the lowland valley landscape, though vegetation within the foreground would often obstruct views. The Proposed Scheme is anticipated to give rise to a medium to high magnitude of visual change and potentially major adverse visual significant effects.

11.5.25 It is likely that significant effects in relation to the viaduct would remain at year 15.

Views east from Echills Farm and Kings Bromley Footpath 1

11.5.26 In winter and summer of year 1, from viewpoint 003-03-001 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close-range views of the Bourne embankment and the River Trent viaduct that would form a large new feature in the lowland valley landscape, though vegetation within the foreground would often obstruct views. The Proposed Scheme is anticipated to give rise to a high magnitude of visual change and potentially major adverse visual significant effects.

11.5.27 It is likely that major significant effects in relation to views of the River Trent viaduct and Bourne embankment would remain at year 15, albeit partly integrated by hedgerows and woodland mitigation planting to tie the abutments and embankments into their context.

View south from the Way for the Millennium long-distance promoted route and adjacent residences at Netherton

11.5.28 In winter and summer of year 1, from viewpoints 003-03-012 and 003-02-013 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the River Trent viaduct with associated overhead line equipment and noise barriers that would form a large new feature in the open lowland valley. The viaduct may also obstruct views to the wooded horizon of the Cannock Chase AONB. Visual receptors would, therefore, experience a high magnitude of visual change and potentially major adverse visual significant effects

11.5.29 It is likely that major adverse significant effects in relation to views of the viaduct would remain in year 15.

Views west from individual residences to the west of Hamstall Ridware

11.5.30 In winter and summer of year 1, from viewpoints 003-03-017 and 004-03-003 (maps LV-11-103 and LV-11-104 in Volume 2, CA1 Map Book) receptors would experience mid- to long-range views of the River Trent viaduct and the adjoining Pipe Ridware embankment with associated overhead line equipment and noise barriers, that would form a large new feature in the open lowland valley, though partially obstructed by vegetation within the view. Visual receptors would, therefore, experience a medium magnitude of visual change and potentially moderate adverse significant visual effects.

11.5.31 It is likely that effects would remain moderate adverse at year 15, though views of the River Trent viaduct would become partly integrated by mitigation planting and landscape earthworks, tying the abutments and embankments into their context.

Views south from the Way for the Millennium long-distance promoted route (to south-west of Proposed Scheme) and adjacent residences at Pipe Ridware

11.5.32 In winter and summer of year 1, viewpoints 003-02-018, 003-02-019 and 003-03-024 (Map LV-11-103 in Volume 2, CA1 Map Book) receptors would experience close-range views of the northern end of the River Trent viaduct and the adjoining embankment, topped by overhead line equipment and noise barriers, giving rise to a high magnitude of change and a potential major adverse significant visual effect.

11.5.33 It is likely that major adverse significant effects in relation to the viaduct would remain in year 15 due to the proximity of the Proposed Scheme, albeit partly integrated by woodland and hedgerow mitigation planting and landscape earthworks to tie the abutments and embankments into their context.

Views east from farmsteads and Mavesyn Ridware Footpath 38 to the east of Hill Ridware

11.5.34 In winter and summer of year 1 from viewpoints 004-03-005, 004-02-004, 004-02-006 and 004-03-014 (Map LV-11-104 in Volume 2, CA1 Map Book) receptors would experience close to mid-range views of Pipe Ridware embankment and Blithbury South cutting with associated overhead line equipment and noise barriers, Mavesyn Ridware Footpath 38 accommodation overbridge and the maintenance loops at Pipe Ridware (with associated lighting). These features would be likely to give rise to a high magnitude of visual change and an overall major adverse significant visual effect.

11.5.35 It is likely that major adverse significant effects in relation to views of these elements would remain in year 15 due to the proximity of the Proposed Scheme, albeit partly integrated by mitigation planting to tie the abutments and the Pipe Ridware embankment and Blithbury South cuttings into their context.

Views east from residences to the east of Hill Ridware

11.5.36 In winter and summer year 1 from viewpoint 004-02-008 (Map LV-11-104 in Volume 2, CA1 Map Book) receptors would experience mid to long range views of the Pipe Ridware embankment with associated overhead line equipment and noise barriers and the Pipe Ridware maintenance loops and associated lighting. These features would be partially obscured by field boundary vegetation and woodland within the mid- background of the view. The Proposed Scheme is likely to give rise to a medium magnitude of visual change and an overall moderate adverse significant visual effect.

11.5.37 It is likely that effects would decrease tonon- significant at Year 15, as the mitigation planting would screen overhead line equipment and the maintenance loops and would tie the Pipe Ridware embankment into its context within mid- long range views from these receptors.

Views west from residences to the south of Stockwell Heath

11.5.38 In winter and summer at year 1 from viewpoints 005-03-005 and 005-03-015 (Map LV-11-105 in Volume 2, CA1 Map Book) receptors would experience medium range views

of the Blithbury cutting and the overbridges at Newlands Lane and Blithbury Road. The upper elements of the overhead line equipment would be partially obstructed by the cutting and the Proposed Scheme would be intermittently visible due to vegetation within the view. These features would be likely to give rise to a medium magnitude of visual change and an overall moderate adverse significant visual effect.

11.5.39 It is likely that visual effects would become non-significant in relation to the cutting by summer year 15. It is anticipated that mitigation planting would screen overhead line equipment and would tie the overbridge embankments into their context.

Views east from residences and Mavesyn Ridware Footpath 6 to the south of Stockwell Heath near Blithbury Road

11.5.40 In winter and summer year 1 from viewpoints 005-02-006 and 005-02-009 (Map LV-11-105 in Volume 2, CA1 Map Book) receptors would experience mid- range views of the Blithbury Central cutting and Blithbury Road overbridge. The upper elements of the overhead line equipment would be partially obstructed by the cutting and the Proposed Scheme would be intermittently visible due to vegetation within the view. These features would be likely to give rise to a medium magnitude of visual change and an overall moderate adverse significant visual effect.

11.5.41 It is likely that effects in relation to the cutting would decrease to non-significant by summer year 15. It is anticipated that mitigation planting would screen the overhead line equipment and would tie the overbridge embankment into its context.

Views east from residences and Colton Footpaths 52, and 76 on the western edge of Stockwell Heath

11.5.42 In winter and summer of year 1 receptors at viewpoints 006-02-010, 006-02-013, 006-02-021 and 006-03-032 (Map LV-11-106 in Volume 2, CA1 Map Book) would experience close-range views of the Stockwell Heath embankment with associated overhead line equipment and noise barriers and the Newlands Lane underbridge. These features would be likely to give rise to a medium- high magnitude of visual change and an overall major adverse significant visual effect.

11.5.43 It is likely that visual effects would reduce to moderate at Year 15 due to views of the Stockwell Heath embankment becoming partly integrated by woodland and scrub mitigation planting and hedgerows to tie the embankment into its context.

Views east from residences and Colton Footpath 39 to the east of Stockwell Heath

11.5.44 In winter and summer of year 1 from viewpoints 006-02-011 and 006-03-012 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the Stockwell Heath embankment with associated overhead line equipment and noise barriers and the Newlands Lane underbridge, although these would be partially obstructed by intervening landform and vegetation within the mid-ground. These features would be likely to give rise to a high magnitude of visual change and an overall major adverse significant visual effect.

11.5.45 It is likely that major adverse significant effects in relation to views of the embankment would remain in year 15, albeit partly integrated by mitigation planting to tie the Stockwell Heath embankment into its context.

Views east from residences in Colton and Colton Footpaths 24 and 50

11.5.46 In winter and summer of year 1 from viewpoints 006-02-015, 006-02-014, 006-02-017 and 006-03-018 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the Stockwell Heath embankment with associated overhead line equipment and noise barriers, though partially filtered by field boundary within the mid-ground. These new features in the view are anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse significant effects on these visual receptors.

11.5.47 It is likely that visual effects would become non-significant in summer year 15, due to the integration by mitigation planting of the Stockwell Heath embankment into its context within mid-range views and the screening of overhead line equipment and noise barriers.

Views east from Colton Bridleway 31 to south of Colton

11.5.48 In winter and summer of year 1 from viewpoint 006-03-003 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience close-range views of the Stockwell Heath embankment with associated overhead line equipment and noise barriers, though partially filtered by field boundary within the mid-ground. These new features in the view are anticipated to give rise to a high magnitude of visual change and potentially major significant effects on these visual receptors.

11.5.49 It is likely that visual effects would remain major significant at summer of year 15, due to the integration by mitigation planting of the Stockwell Heath embankment and Blithbury cutting into their context within mid-range views and the screening of overhead line equipment and noise barriers.

Views east from Hamley Heath

11.5.50 In winter and summer of year 1 from viewpoints 006-02-021 and 006-02-025 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience close-range views of the Proposed Scheme within the Stockwell Heath cutting, the upper levels of the associated overhead line equipment and noise barriers and the B5013 Uttoxeter Road overbridge that passes over the cutting. Views of these features would be partially filtered by field boundary within the mid-ground. These new features in the view are anticipated to give rise to a high magnitude of visual change and potentially major adverse significant effects on these visual receptors.

11.5.51 It is likely that major visual effects would remain at summer year 15, albeit partly integrated by mitigation planting that would tie the Stockwell Heath cutting and embankments along B5013 Uttoxeter Road into their context within mid-range views.

Views west from residences south and west of Admaston

11.5.52 In winter and summer of year 1 from viewpoints 006-02-02, 006-02-028, 006-03-029, 006-02-027 and 006-03-031 (Map LV-11-106 in Volume 2, CA1 Map Book) receptors would experience mid-range views of the realigned B5013 Uttoxeter Road and

proposed overbridge and potentially views of the top of overhead line equipment due to the nature of the Proposed Scheme within a cutting in this location. These new features in the view are anticipated to give rise to a medium magnitude of visual change and potentially moderate adverse significant effects on these visual receptors.

11.5.53 It is likely that visual effects would become non-significant in summer year 15, due to the integration by mitigation planting of the Stockwell Heath cutting and the embankments along the B5013 Uttoxeter Road into their context within mid-range views and the screening of overhead line equipment and noise barriers.

Night time effects

11.5.54 Night time surveys will be undertaken for the formal EIA Report. Potential visual impacts arising from additional lighting at night in operation in this area may arise at Pipe Ridware maintenance loops. In some locations lighting of new road junctions and roundabouts will be required, however as these would generally sit in proximity to areas/roads which are already lit throughout the night these are not considered as part of the night time assessment.

11.5.55 The addition of lighting could give rise to significant effects in relation to a number of receptors. More detail will be provided in the formal EIA report on completion of the night time assessment.

Other mitigation measures

11.5.56 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described in this section. Effects in year 1 of operation may be further reduced by establishing planting early in the construction programme Additional planting will be considered as part of the ongoing development of the design. This would 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

11.5.57 In most cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following significant residual effects would remain following year 15 of operation.

- major adverse effects within Colton and Stockwell Heath Settled Farmlands due to the presence of large scale features which would substantially change the open rural lowland valley landscape. The presence of embankments and associated elevated overhead line equipment and noise barriers would create a locally large degree of change to the open rural landscape and settlements; though the maturing of mitigation planting would help to integrate the Proposed Scheme into the landscape;
- moderate adverse effects would remain within Curborough and Fradley Settled Heathlands LCA due to the presence of Pyford Brook viaduct, embankments and associated elevated overhead line equipment and noise

barriers continuing to create a locally large degree of change to the open rural landscape;

- major adverse effects are likely to remain in relation to the Trent Riparian Alluvial Lowland LCA and Kings Bromley Terrace Alluvial Lowlands LCA, due to the presence of viaducts, embankments and associated elevated overhead line equipment and noise barriers forming a locally large degree of change to the open rural landscape; though the maturing of mitigation planting would help to integrate the Proposed Scheme into the landscape;
- major adverse visual effects at year 15 would be experienced by receptors using the Trent and Mersey Canal near Fradley (001-03-007 and 001-03-013) due to a close to mid-range view of the Pyford Brook viaduct;
- moderate adverse visual effects at year 15 would be experienced by residences in Kings Bromley (02-02-014) due to mid-range views of the Bourne Brook viaduct;
- major adverse visual effects on PRoWs and residences to the east of Handsacre (003-02-009, 003-02-010 and 003-03-002) due to close to mid-range views of the mitigation planting for the Proposed Scheme which would partly integrate the Proposed Scheme into the landscape. Major adverse visual effects would remain for receptors at year 15 from residences and Kings Bromley Footpath 0.390 near to Rileyhill and Bromley Hayes (0002-03-010, 002-02-003, 002-02-005 and 002-02-04),Echills Farm and PRoWs (003-03-001), The Way for the Millennium close to Netherton (003-03-012 and 003-02-013) and The Way for the Millennium close to Pipe Ridware (003-02-018, 003-02-019 and 003-03-024). This is due to the proximity of the Proposed Scheme to these receptors, the level of effect would be unlikely to reduce over time;
- moderate adverse effects would remain for individual residences to the west of Hamstall Ridware (003-03-017 and 004-03-003) due to mid to long-range views of the River Trent Viaduct. Major adverse visual effects would remain for receptors to the east of Hill Ridware (004-03-005 and 004-02-004 and 004-02-006 and 004-03-014) and for receptors within and to the west of Stockwell Heath (006-02-011 and 006-03-012), due to the close range view of embankments, overhead line equipment and noise barriers;
- major adverse visual effects at year 15 would be experienced by receptors at Colton Bridleway 31 (006-03-003) and Hamley Heath (006-02-021 and 06-02-025) who would experience close- mid range views of railway cuttings. Due to the low-lying nature of the Proposed Scheme mitigation planting would further integrate the scheme into the landscape by and beyond Year 15; and
- moderate adverse visual effects would be experienced by receptors to the east of Stockwell Heath (006-02-011 and 006-03-012) due to the Stockwell Heath embankment becoming integrated into the mid-ground of the view.

12 Socio-economics

12.1 Introduction

12.1.1 This section provides a summary of the environmental baseline and likely economic and employment impacts and effects during construction and operation of the Proposed Scheme within the Fradley to Colton area.

12.1.2 The need for a socio-economic assessment results from the potential for the Proposed Scheme to affect:

- existing businesses and community organisations and thus the amount of local employment;
- local economies including employment; and
- planned growth and development.

12.1.3 The beneficial and adverse socio-economic effects of the Proposed Scheme are reported at two different levels: route-wide and by community area. Effects on levels of employment are reported at a route-wide level in Volume 3. Localised effects on businesses and observations on potential local economic effects are reported in this section.

12.1.4 Engagement with LDC has been undertaken. The purpose of this engagement has been to obtain relevant baseline information. Engagement with LDC will continue as part of the development of the Proposed Scheme.

12.1.5 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

Construction

12.1.6 The proposed construction works will have the following relevance in terms of socio-economics in relation to:

- premises demolished, with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme; and
- potential employment opportunities arising from construction in the local area (including in adjacent community areas).

Operation

12.1.7 The operation of the Proposed Scheme will have relevance in terms of socio-economics, in relation to the potential employment opportunities created by new business opportunities.

12.2 Scope, assumptions and limitations

12.2.1 The assessment scope, key assumptions and limitations for the socio-economics assessment are set out in the draft SMR and Volume 1.

12.3 Environmental baseline

Introduction

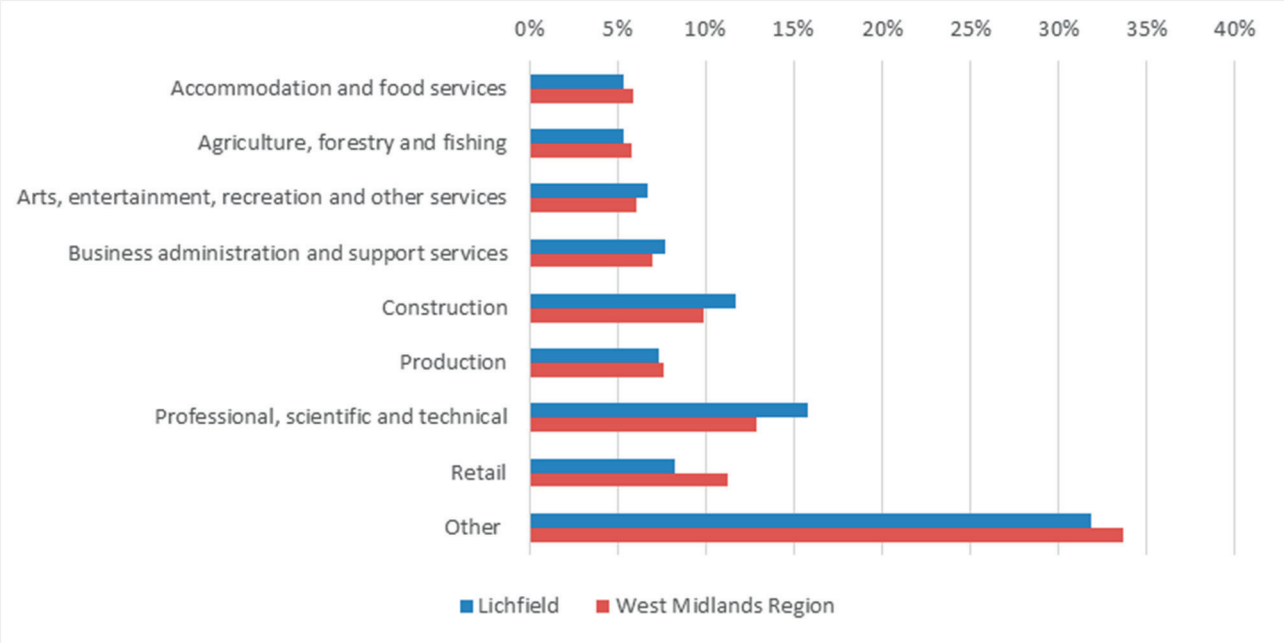
12.3.1 The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the Fradley to Colton area.

12.3.2 The Fradley to Colton area lies within the administrative area of Lichfield within the County of Staffordshire. The area also falls within the Stoke-on-Trent and Staffordshire Local Enterprise Partnership (LEP) area[72].

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 (16%), with construction the second largest (12%) followed by retail (8%). This is shown in Figure 6[73]. For comparison within the West Midlands region, the largest sectors were professional, scientific and technical (13%), followed by retail (11%) and construction (10%)[74].

Figure 6: Business sector composition in LDC area and the West Midlands



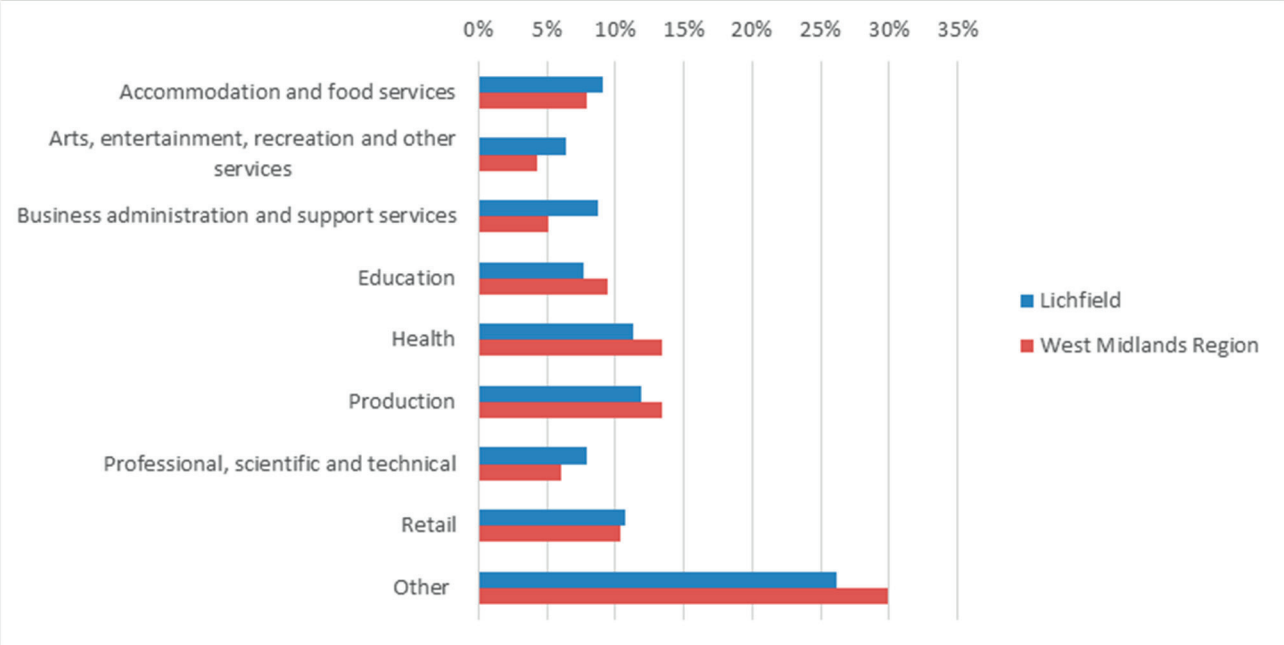
Source: Office for National Statistics; UK Business: Activity, Size and Location 2014; accessed: 11 January 2016.

12.3.4 In 2014[75], approximately 45,000 people worked in the LDC area. According to the Office for National Statistics (ONS) Business Register and Employment Survey 2014, the top five sectors in terms of share of employment in LDC are: production (12%); health (11%); retail (11%); accommodation and food services (9%); and business

[72] Stoke-on-Trent & Staffordshire LEP (undated), Stoke-on-Trent & Staffordshire Economic Growth Strategy 2012 - 2026, v2.1.
[73] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.
[74] Office for National Statistics UK Business: Activity, Size and Location 2014; Available online at: https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/ukbusinessactivitysizeandlocation ; Accessed: 11 January 2016. Please note 2014 data has been presented to provide an appropriate comparison with 2014 Census data.
[75] Office of National Statistics, (2014) Business Register and Employment Survey; Available online at: http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/businessregisterandemploymentsurveybresprovisionalresults/previousReleases . Accessed 11 January 2016.

administration and support services (9%). These compare with the top five sectors for the West Midlands region, which are: health (13%); production (13%); retail (10%); education (9%) and business administration and support services (8%). This is shown in Figure 7[76].

Figure 7: Employment by Industrial Sector in LDC area and the West Midlands



Source: Office of National Statistics, Census 2011; accessed: 11 January 2016.

12.3.5 According to the Annual Population Survey (2015)[77], the employment rate[78] within the LDC area was 80% (50,000 people), which is higher than that recorded for both the West Midlands (71%) and England (74%). In 2015, unemployment in the LDC area was 4%, which was lower than the West Midlands (6%) and England (5%).

12.3.6 According to the Annual Population Survey (2015)[79], 34% of LDC area's residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 31% in the West Midlands and 37% in England, while 10% of residents had no qualifications, which was lower than that recorded for West Midlands (13%) but higher than England (8%).

Property

12.3.7 A review of employment land in 2014 identified a need for 4.2ha per year to 2029 for general business land in the LDC area and that there has been an historic shortfall in the provision of employment land up until 2011[80]. A strategic employment site at Fradley has been identified as providing key opportunities for employment growth[81].

[76] Office of National Statistics, (2014) Business Register and Employment Survey; Accessed: 11 January 2016.
[77] Annual Population Survey, (2015), NOMIS, Accessed: 26 April 2016.
[78] The proportion of working age (16-64 year olds) residents that is in employment. Employment comprises the proportion of the total resident population who are 'in employment'.
[79] Annual Population Survey, (2015), NOMIS, Accessed: 26 April 2016.
[80] 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.
[81] Stoke-on-Trent & Staffordshire LEP (undated), Stoke-on-Trent & Staffordshire Economic Growth Strategy 2012 - 2026, v2.1.

12.3.8 The average vacancy rate for industrial and warehousing property in Lichfield in May 2016 has been assessed as 36% based on marketed space against known stock[82].

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 Businesses displaced by the Proposed Scheme would be compensated in accordance with the National Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to alternative premises and would, therefore, provide additional support over and above statutory requirements to facilitate this process.

12.4.2 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 fuels further economic growth across the UK.

Assessment of impacts and effects

12.4.3 Businesses directly affected (i.e. those that lie within land that would be used for the construction of the Proposed Scheme) are reported in groups where possible, 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/resources are clustered together.

12.4.4 One business, a medical supplies distributor, lies within the area, and would be directly affected by the Proposed Scheme. It is estimated that land required for the construction of the Proposed Scheme would result in the displacement or possible loss of approximately five jobs within this area[83]. Taking into account the availability of alternative premises and the total employed within the district (approximately 45,000), the displacement or possible loss of jobs is considered to be relatively modest compared to the scale of economic activity and opportunity in the area. Therefore, from an employment perspective, no significant direct effects on non-agricultural employment have been identified within the local area.

12.4.5 There are plans to locate 10 satellite construction compounds for the Proposed Scheme within the Fradley to Colton area.

12.4.6 These sites could result in the creation of up to 1,200 person years of construction employment[84] opportunities, equivalent to 120 full-time equivalent permanent jobs[85], which, depending on skill levels required and the skills of local people, are potentially

[82] 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).
[83] 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 2nd Edition (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.
[84] 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.
[85] Based on the convention that 10 employment years is equivalent to one full-time equivalent job.

accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been assessed as part of the route-wide assessment (Volume 3, Route-wide effects).

12.4.7 Direct construction employment created by the Proposed Scheme 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 assessed as part of the route wide assessment (Volume 3, Route-wide effects).

12.4.8 The combined effects of noise, vibration, visual, air quality or HGV congestion impacts and isolation on businesses will be reported in the formal EIA Report.

Other mitigation measures

12.4.9 No other mitigation measures have currently been identified.

Summary of likely residual significant effects

12.4.10 Any likely residual significant socio-economic effects will be reported in the formal EIA Report.

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 No mitigation measures during operation of the Proposed Scheme are proposed in relation to business resources.

Assessment of impacts and effects

12.5.2 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.

12.5.3 The Proposed Scheme would create direct and wider operation employment opportunities across the route. These are considered unlikely to be accessed by residents of this area.

12.5.4 Operational effects are assessed and reported at a route-wide level in Volume 3. The combined effects of noise, vibration, visual, air quality or large goods vehicles congestion impacts and isolation on businesses will be reported in the formal EIA Report.

Other mitigation measures

12.5.5 No mitigation measures during operation of the Proposed Scheme are proposed in relation to business resources.

Summary of likely residual significant effects

12.5.6 Any likely residual significant socio-economic effects will be reported in the formal EIA Report.

13 Sound, noise and vibration

13.1 Introduction

13.1.1 This section reports the initial assessment of the potential 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 areas[86]; 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'[87].

13.1.2 In this assessment, 'sound' is used to describe the acoustic conditions which 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.

13.1.3 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.

13.1.4 Consistent with Government noise policy[88] and the approach taken to the EIA of HS2 Phase One this working draft EIA Report reports how, in the context of Government sustainable development policy, the Proposed Scheme, through the effective management and control of noise would:

- avoid significant adverse impacts on health and quality of life from the Proposed Scheme;
- mitigate and minimise adverse impacts on health and quality of life from the Proposed Scheme; and
- where possible, contribute to the improvement of health and quality of life.

13.1.5 Engagement with LDC has been undertaken. The purpose of this engagement has been to obtain relevant information regarding residential and non-residential

[86] '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.
[87] Quiet areas are defined in the draft SMR as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity.
[88] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

resources and existing baseline information. Engagement with LDC will continue as part of the development of the Proposed Scheme.

13.1.6 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in Map Series CT-10 in the Volume 2, CA1 Map Book. Map Series SV-01 shows areas of impact and proposed noise mitigation in the Fradley to Colton area.

13.2 Scope, assumptions and limitations

13.2.1 The approach to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1. The scope and methodology are defined in the draft SMR.

13.2.2 The effects of construction sound, noise and vibration are assessed qualitatively, based on construction worksite locations, construction routes, initial construction estimates and professional judgement. No quantitative assessment has been undertaken at this stage.

13.2.3 The effects on operational sound, noise and vibration are assessed quantitatively. As, baseline information is limited at this stage, the quantitative assessment will be reported in the formal EIA Report.

13.3 Environmental baseline

13.3.1 This area is characterised as predominantly rural with a mix of 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: the A515 Lichfield Road that 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 It is likely that the majority of receptors adjacent to the Proposed Scheme are not currently subject to appreciable vibration. No baseline vibration monitoring has been undertaken as part of the assessment presented in this report. The effects of vibration at all receptors has been assessed using the absolute vibration criteria defined in the draft SMR.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP, which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), which would 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;
  - where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing would be offered in accordance with the draft CoCP's noise insulation and temporary re-housing policy;
- lead contractors would seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application would 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 would undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data would be provided regularly to and be reviewed by the nominated undertaker and will be made available to the local authorities; and
- contractors would 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.

13.4.2 Noise insulation would be offered for qualifying buildings as defined in the noise insulation and temporary re-housing policy in the draft CoCP. Noise insulation or ultimately temporary re-housing would avoid residents being significantly affected by levels of construction noise inside their dwellings. Further work is being undertaken to provide an estimate of the buildings that are likely to qualify for such measures, which will be reported in the formal EIA Report.

13.4.3 Qualification for noise insulation and temporary re-housing would be confirmed, as required in the draft CoCP, as part of seeking prior consent from the local authorities under Section 61 of the CoPA. Qualifying buildings would be identified, as required in the CoCP so that noise insulation could be installed, or any temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria. Noise insulation, where required, would be installed as early as possible to reduce internal sound levels from construction activities and also when the Proposed Scheme comes into operation.

Assessment of impacts and effects

13.4.4 Potential construction noise effects could occur due to the increase in noise levels around the communities closest to the Proposed Scheme in the following locations, as

a result of the construction works illustrated on the construction Map Series CT-05 (Volume 2, CA1 Map Book):

- Rileyhill, arising from construction activities such earthworks and track base installation;
- Kings Bromley, arising from construction activities such as earthworks, viaduct and track base installation;
- Pipe Ridware, arising from construction activities such as earthworks, viaduct and track base installation;
- Blithbury, arising from construction activities such as earthworks and track base installation;
- Blithbury Road/Hadley Gate Lane, arising from construction activities such as earthworks and track base installation;
- Stockwell Heath, arising from construction activities such as earthworks and track base installation;
- Colton, arising from construction activities such as earthworks and track base installation; and
- Hamley Heath, arising from construction activities such as earthworks and track base installation.

13.4.5 Construction traffic has the potential to cause adverse noise effects on occupants of residential properties through the additional traffic generated on local roads. The following routes have been identified on a precautionary basis as having the potential for an adverse noise effect on occupants of associated residential communities:

- Wood End Lane between the A38 Lichfield Road and the A515 Lichfield Road (north of Lichfield and south of Rileyhill);
- Rileyhill properties adjacent to the B5014 Uttoxeter Road; and
- Stockwell Heath and Colton properties adjacent to the B5013 Uttoxeter Road.

13.4.6 Track laying, power system and signalling installation works would be unlikely to result in significant construction noise effects, given the short duration close to any communities and the fact that the permanent noise barriers will have been constructed by this time.

Other mitigation measures

13.4.7 Further work is being undertaken to confirm the likely significant effects and identify any site-specific mitigation, or amendment to construction routes considered necessary in addition to the general measures set out in the draft CoCP. Any site-specific mitigation will be presented in the formal EIA Report and will include an estimate of the number of properties that may qualify for noise insulation or temporary re-housing under provisions set out in the draft CoCP.

Summary of likely residual significant effects

13.4.8 Further work is being undertaken to confirm significant construction noise and vibration effects, including any temporary effects from construction traffic. Non-residential receptors identified at this stage as potentially subject to construction noise or vibration effects will be further considered, where necessary, on a receptor-by-receptor basis. Any further assessment would be reported in the formal EIA Report.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 The development of the Proposed Scheme has sought to keep the route as low as reasonably practicable and away from main communities. These avoidance measures would protect many communities from likely significant noise or vibration effects.

Airborne noise

13.5.2 HS2 trains are assumed to be quieter than the relevant current European Union specifications, as assumed for the HS2 Phase One Environment Statement. Assuming quieter trains than the Technical Specification for Interoperability (TSI) Noise is consistent with Phase One and will be detailed in a technical appendix to the formal EIA Report. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on proven technology in use in East Asia. The track would be specified to reduce noise, as would the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track.

13.5.3 The Proposed Scheme would incorporate noise barriers in the form of landscape earthworks and/or noise fence barriers to avoid or reduce significant airborne noise effects. The assessment has been based on the assumption of noise fence barriers that are acoustically absorbent on the railway side and are located 5m to the side of the outer rail. The envisaged noise barrier locations based upon the currently available information are shown on the SV-01 Map Series (Volume 2, CA1 Map Book).

13.5.4 In practice, barriers may differ from this description while maintaining the required acoustic performance. For example, where noise barriers are in the form of landscape earthworks, they would need to be higher above rail level to achieve similar noise attenuation to the noise fence barrier because the crest of the earthwork would be further than 5m from the outer rail.

13.5.5 Noise effects are 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).

13.5.6 Significant noise effects from the operational static sources, such as line-side equipment, would be avoided through their design and the specification of noise emission requirements.

13.5.7 Noise insulation measures would be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996 (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 would be formally identified and noise insulation offered, should the Proposed Scheme become operational. Where noise insulation is required, as well as improvements to noise insulation of windows facing the railway, ventilation would be provided so that windows can be kept closed to protect internal sound levels.

13.5.8 Noise insulation would 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.

13.5.9 Following Government's National Planning Practice Guidance[89], where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the World Health Organization's (WHO) Night Noise Guidelines for Europe[90], residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed[91]. The Interim Target is a lower level of noise exposure than the Regulations trigger threshold for night noise. In these particular circumstances, where night time noise levels for the use of new or additional railways authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB[92], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion[91], noise insulation would be offered for these additional buildings.

Ground-borne noise and vibration

13.5.10 Significant ground-borne noise or vibration effects would be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

13.5.11 Map Series SV-01 (Volume 2, CA1 Map Book) indicate the likely long-term daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or LpAeq,day) from HS2 operations alone. The contours are shown in 5dB steps from 50dB to 70dB. With the train flows described in Volume 1, the night time sound level (defined as the equivalent continuous sound level from 23:00 to 07:00 or LpAeq, night) from the Proposed Scheme would be approximately 10dB lower than the daytime sound level. The 50dB contour, therefore, indicates the distance from the Proposed Scheme at which the night time sound level would be 40dB. This contour represents where the lowest observed community noise effects would be expected to occur during the day (with respect to annoyance) and night (with respect to sleep disturbance). It is generally unlikely that there would be any adverse noise effects outside of the area within this contour. With regard to sleep disturbance the assessment has also taken account of the maximum sound levels generated by each train pass by.

[89] National Planning Practice Guidance – Noise; Available online at: http://planningguidance.planningportal.gov.uk.
[90] World Health Organization (2010), *Night time Noise Guidelines for Europe*.
[91] 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).
[92] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

13.5.12 Residential receptors within the daytime 65dB contour, and therefore, the night time 55dB contour, have been identified as being likely to experience a significant adverse effect from Proposed Scheme noise alone. This is in line with the daytime threshold for in the Noise Insulation Regulations and the Interim Target defined in the World Health Organization's Night Noise Guidelines.

13.5.13 The potential for significant noise effects on communities in areas between the 50dB and 65dB daytime sound contours, or 40dB and 55dB night time contours, would be dependent on the baseline in that area and the change in sound level brought about by the Proposed Scheme.

13.5.14 The criteria used for the working draft EIA Report to assess whether an effect is potentially significant include factors such as the number and magnitude of impacts in a community as well as the existing sound environment. The further significance criteria set out in the draft SMR would be taken into account in the formal EIA Report. These include the character of the existing sound environment, any unique features of the Proposed Scheme's sound or impacts, and the potential combined impacts of sound and vibration.

13.5.15 In the case of 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 would be intermittent and its level would vary as the PRoW moves closer to and further from the Proposed Scheme. Noise effects would generally be reduced by the landscape earthworks envisaged to reduce visual impact of the Proposed Scheme and envisaged noise mitigation to protect other receptors. No significant noise effects have, therefore, been identified on PRoW within the Fradley to Colton area.

13.5.16 A number of potential minor ground-borne noise and vibration impacts have been forecast at a small number of properties very close to the route. Taking account of the number and minor magnitude of the impacts, and the experience of HS1, no significant effects have been identified. Further assessment would be undertaken for the formal EIA Report to confirm whether the impacts currently forecast are likely to occur. Vibration from the operation of the Proposed Scheme would present no risk of any building damage.

13.5.17 It is currently anticipated that there would be no potentially significant noise or vibration effects arising from changes to existing roads. This will be confirmed in the formal EIA Report.

Other mitigation measures

13.5.18 Further work is being undertaken to confirm the extent of the noise mitigation included within the Proposed Scheme, which will be confirmed within the formal EIA Report.

Summary of likely residual significant effects

13.5.19 The envisaged mitigation, including landscape earthworks and noise barriers, described in this chapter and presented in Map Series SV-01 (Volume 2, CA1 Map Book), would substantially reduce the potential airborne sound impacts and noise effects that would otherwise arise from the Proposed Scheme. Nonetheless, this

initial assessment has identified potential significant adverse airborne noise effects due to increased noise levels around the following communities:

- Rileyhill: occupants of residential properties on Rileyhill and Shaw Lane, located closest to the Proposed Scheme, identified by OSV01-C01 on Map SV-01-102;
- Pipe Ridware: occupants of residential properties on Pipe Ridware, located closest to the Proposed Scheme, identified by OSV01-C02 on Map SV-01-103;
- Blithbury Road / Hadley Gate Lane: occupants of residential properties on Blithbury Road, located closest to the Proposed Scheme, identified by OSV01-C03 on Map SV-01-104;
- Stockwell Heath: occupants of residential properties on Moor Lane, located closest to the Proposed Scheme, identified by OSV01-C04 on Map SV-01-105;
- Colton: occupants of residential properties on Heathway and High Street, located closest to the Proposed Scheme, identified by OSV01-C05 on Map SV-01-105; and
- Hamley Heath: occupants of residential properties on Hamley Heath, located closest to the Proposed Scheme, identified by OSV01-C06 on Map SV-01-106a.

13.5.20 The initial assessment indicates that, on a precautionary basis, the forecast noise from long-term railway operation may exceed the daytime threshold set by the Noise Insulation Regulations, the night time Interim Target identified in the WHO Night Noise Guidelines for Europe 2009 or the maximum noise levels criteria set out in the WHO (1999) Guidelines for Community Noise, at individual residential properties closest to the Proposed Scheme in the vicinity of Rileyhill, Blithbury Road near Blithbury, Rugeley Road near Kings Bromley, Pipe Wood Lane near Pipe Ridware, Hamley Heath, Colton and Stockwell Heath. These properties are identified on Map Series SV-01 (Volume 2, CA1 Map Book).

13.5.21 This initial assessment has identified a potential airborne noise effect on the Ridware Theatre, Pipe Ridware, identified in Map Series SV-01 (Volume 2, CA1 Map Book). This initial assessment is in the absence of detailed baseline sound levels, and specific information regarding these resources including their construction, layout, day-to-day requirements and uses.

13.5.22 Further assessment work is being undertaken to confirm operational sound and vibration significant effects, especially those at non-residential receptors and quiet areas (as necessary, on a receptor-by-receptor basis). This will be reported in the formal EIA Report, which will present baseline levels, forecasts for the Proposed Scheme and the change in sound levels brought about by the Proposed Scheme both as impact plans and tables. There would be no risk of any building damage due to vibration from the operation of the Proposed Scheme.

13.5.23 Map Series SV-01 (Volume 2, CA1 Map Book) shows the draft list of non-residential locations to be considered in the sound, noise and vibration assessment as part of the formal EIA Report. This list will be developed further incorporating consultation feedback and ongoing stakeholder engagement.

14 Traffic and transport

14.1 Introduction

14.1.1 This section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the Proposed Scheme through the Fradley to Colton area.

14.1.2 The main issues associated with traffic and transport are expected to be increased traffic as a result of the construction of the Proposed Scheme, road diversions and realignments, temporary and permanent road closures, and temporary alternative routes and permanent realignments of PRoW.

14.1.3 Engagement with SCC and Highways England has been undertaken. An important focus of this engagement has been to obtain relevant baseline information. Engagement with these and other relevant stakeholders will continue as part of the design development of the Proposed Scheme.

14.1.4 Maps showing the location of the key environmental features and the key construction and operation features of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

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 and the draft SMR.

14.2.2 The study area for traffic and transport includes all roads affected by the Proposed Scheme including: the A38 Lichfield Road, 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.

14.2.3 The effects on traffic and transport are assessed qualitatively, based on proposed construction routes, initial estimates of construction traffic and professional judgement.

14.2.4 No quantitative assessment has been undertaken at this stage. A quantitative assessment will be presented in the formal EIA report.

14.3 Environmental baseline

14.3.1 Existing conditions in the study area have been determined through site visits, traffic and transport surveys and liaison with SCC (including the provision of information on public transport, PRoW and accident data) and desktop analysis.

14.3.2 Traffic surveys of roads crossing the route or potentially affected by the Proposed Scheme were undertaken in November 2015 and February and March 2016, comprising of automatic traffic counts, junction turning counts and queue surveys. This data has been supplemented by existing traffic data from other sources where available, including from 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 and July 2016 to establish their nature and usage by non-motorised users (pedestrians, cyclists and equestrians). The surveys included all PRoW and roads that 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.

14.3.4 The Proposed Scheme would intersect 12 PRoW although others in the area could also be affected. The Proposed Scheme would also cross eight roads and roadside footways including: Common Lane, A515 Lichfield Road, Shaw Lane, A513 Rugeley Road, Pipe Lane, B5014 Uttoxeter Road, Blithbury Road, Hadley Gate Lane, Newlands Lane (North), Newlands Lane (South), Moor Lane and the B5013 Uttoxeter Road.

14.3.5 There are no strategic routes in the area, although the A38 Lichfield Road, which is part of the strategic road network passes in proximity to the Proposed Scheme and is included in the assessment, as traffic impacts and effects will be assessed up to the strategic road network. The A38 Lichfield Road runs in a north-south direction and has connections to Lichfield, Alrewas and Fradley. This is the main route into Birmingham in the south and Burton on Trent and Derby in the north. There are two primary 'A' roads: 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 would 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, Abbotts Bromley, Handsacre and 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; and the A5192 Eastern Avenue which connects the A38 Lichfield Road with the A51 Stafford Road; and Wood End Lane, which connects the A38 Lichfield Road with the A515 Lichfield Road. The local road network 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 latest three year period (2012 to 2015) has been assessed and any identified clusters have been examined. No substantial accident clusters were identified within the area.

14.3.8 Bus services travel through the area on their way to the central hub of Lichfield. There are five bus corridors that would cross the Proposed Scheme and these follow the A38 Lichfield Road via Lichfield, the A515 Rugeley Road via Kings Bromley, the A513 Rugeley Road and B5014 Uttoxeter Road via Handsacre and Armitage and the A51 Stafford Road via Rugeley. The A38 Lichfield Road corridor via Lichfield is served by five services providing connections to Lichfield, Burton upon Trent, Barton-under-Needwood, Alrewas and Tamworth. The A515 Rugeley Road corridor via Kings Bromley is served by three bus services providing connections to Lichfield, Barton-under-Needwood, Burton upon Trent, Fradley and Alrewas. The A513 Rugeley Road and B5014 Uttoxeter Road corridor via Handsacre and Armitage is served by four bus

services providing connections to Lichfield, Rugeley, Elmhurst, Stafford, Hill Ridware and Christ Church. The A51 Stafford Road corridor via Rugeley is served by eight bus services providing connections to Lichfield, Longdon, Stafford and Rugeley.

14.3.9 National and local rail services are accessible via Lichfield Trent Valley and local rail services are accessible via Rugeley Trent Valley. Lichfield Trent Valley 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.

14.3.10 There are pedestrian footways in the built-up areas of Kings Bromley, Handsacre and Armitage, Colton and Stockwell Heath. In Kings Bromley there is a network of advisory cycle routes including the A513 Alrewas Road, the A515 Yoxall Road and the A515 Lichfield Road. In Handsacre and Armitage the canal towpath to the north of the settlement provides an off-road cycle route and there are a number of advisory cycle routes, including the B5014 Lichfield Road between Handsacre and Blithbury. In the Colton and Stockwell Heath area there is a network of advisory cycle routes, including the High Street between Colton and Stockwell Heath.

14.3.11 There are two navigable waterways situated within this area, the Trent and Mersey Canal and the Coventry Canal, which meet at Fradley junction. In close proximity is a canal boat marina located at Bromley Hayes, known as Kings Bromley Marina, which has capacity for 275 narrow boats.

14.4 Effects arising during construction

Avoidance and mitigation measures

14.4.1 The following measures have been included as part of the design of the Proposed Scheme and would avoid or reduce effects on transport users:

- creation of a haul route adjacent to the route of the Proposed Scheme;
- construction materials and equipment would be transported along the haul route where reasonably practicable, to reduce HGV movements on the public highway;
- new highways to be constructed and operational prior to the permanent closure of any existing highways, where reasonably practicable;
- the majority of roads crossing the Proposed Scheme would be maintained or locally diverted during construction to limit the need for diversions of traffic onto alternative routes;
- restricting road closures to overnights and weekends where reasonably practicable;
- HGV routeing, as far as reasonably practicable, along the strategic and/or primary road network;
- temporary alternative routes for PRoW during construction; and
- provision of on-site welfare facilities to reduce daily travel by site workers.

14.4.2 The draft CoCP includes measures that seek to reduce the impacts and effects of deliveries of construction materials and equipment, including where appropriate reducing construction HGV trips during peak background traffic periods. The draft CoCP includes HGV management and control measures.

14.4.3 Where reasonably practicable, the number of private car trips to and from the site (both workforce and visitors) would be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This would be supported by an overarching framework travel plan that would require construction workforce travel plans to be produced along with 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 clear 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, generic and site specific traffic management measures would 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 Specific measures would include:

- core site operating hours of 08:00 to 18:00 on weekdays and 08:00 to 13:00 on Saturdays and site staff and workers would, therefore, generally arrive before the morning peak hour and depart after the evening peak hour; and
- excavated material being reused where reasonably practicable along the route of the Proposed Scheme.

14.4.6 There are no potential effects on Network Rail assets in this area.

Assessment of impacts and effects

14.4.7 The following section considers the impacts on traffic and transport and the likely consequential effects resulting from construction of the Proposed Scheme.

14.4.8 The temporary traffic and transport impacts within this area would include:

- construction vehicle movements to and from the various worksites;
- road closures and associated diversions; and
- alternative routes for PRoW.

14.4.9 The construction assessment has also considered any impacts in this area that arise from construction of the Proposed Scheme in the adjoining community area.

14.4.10 Construction vehicle movements required to construct the Proposed Scheme would include the delivery of plant and materials, movement of excavated materials and site worker trips. Works would include utilities diversions, earthworks, underpass, viaduct, bridge and highway construction.

14.4.11 There are ten construction compounds, which are all satellite compounds and would be managed from the A51 main compound located in the Colwich to Yarlet area.

14.4.12 Details of construction compounds are provided in Section 2.3 of this report.

14.4.13 It is expected that the A51 Stafford Road, the A515 Lichfield Road, the A513 Rugeley Road and the B5014 Uttoxeter Road, which broadly run parallel to the Proposed Scheme, would provide the primary access routes for construction vehicles, from which HGVs would access construction compounds via Blithbury Road and the B5013 Uttoxeter Road. Where reasonably practicable, HGVs would use the haul road alongside the proposed route to reduce the impact on the local road network.

14.4.14 Construction of the Proposed Scheme is expected to result in increases in traffic flows on parts of the following roads as a result of construction traffic, temporary closures and diversions or realignments:

- A38 Lichfield Road;
- A51 Stafford Road;
- A515 Lichfield Road;
- A513 Rugeley Road;
- A5192 Eastern Avenue;
- Wood End Lane;
- B5014 Uttoxeter Road; and
- B5013 Uttoxeter Road.

14.4.15 The expected increases in traffic have the potential to result in increased congestion and delays and, on some roads, increased traffic severance for non-motorised users. The assessment of these will be reported in the formal EIA Report.

14.4.16 The construction of the Proposed Scheme would be likely to require temporary traffic management measures in the vicinity of the works. Any lane restrictions would be scheduled to reduce as far as reasonably practicable the impacts on traffic in the peak periods, with advance notice provided to travellers.

14.4.17 The Proposed Scheme would require the permanent stopping up of parts of Common Lane and Shaw Lane where they cross the route of the permanent railway structures. The direct impacts of these roads being stopped up are reported under operational impacts.

14.4.18 There would be temporary alternative routes for a number of PRoW in the vicinity of the Proposed Scheme. The following PRoW would be temporarily diverted:

- Kings Bromley Footpath 12;
- Kings Bromley Footpath 0.390;
- Kings Bromley Footpath 1;
- Mavesyn Ridware Footpath 30;
- Mavesyn Ridware Footpath 32;
- Mavesyn Ridware Footpath 33;
- Mavesyn Ridware Footpath 38;

- Mavesyn Ridware Footpath 8;
- Colton Footpath 73;
- Colton Footpath 34;
- Colton Footpath 36; and
- Colton Footpath 52.

14.4.19 Non-motorised users would also be re-routed around construction compounds. The changes to PRoWs are likely to result in some increases in travel distances with the potential for adverse significant effects. These will be reported in the formal EIA Report.

Other mitigation measures

14.4.20 The implementation of the draft CoCP in combination with the construction workforce travel plan would, to some degree, mitigate the transport-related effects during construction of the Proposed Scheme. In order to provide a robust assessment, the reductions in effects arising from the travel plan measures have not been included in the assessment, which would mean any adverse effects may be overstated.

14.4.21 Any further traffic and transport mitigation measures required during the construction of the Proposed Scheme would be considered as necessary based on the outcomes of the assessment. These will be reported in the formal EIA Report.

Summary of likely residual significant effects

14.4.22 Construction of the Proposed Scheme has the potential to lead to additional congestion and delays for road users on a number of routes including the A38 Lichfield Road, A51 Stafford Road, A515 Lichfield Road, A513 Rugeley Road, A5192 Eastern Avenue, Wood End Lane, B5014 Uttoxeter Road and B5013 Uttoxeter Road. Increases in traffic could also result in increased traffic severance for non-motorised users of the routes. These will be reported in the formal EIA Report.

14.4.23 Twelve PRoW would be affected and users would be temporarily diverted at different times during the construction period. This could result in significant adverse effects on users. These will be reported in the formal EIA Report.

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 would avoid or reduce impacts on transport users:

- reinstatement of most 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 consequential effects resulting from the operational phase of the Proposed Scheme.

14.5.3 The operation of the Proposed Scheme would be unlikely to have any substantial impacts within this area due to increased traffic, as there are no stations or depots proposed within the Fradley to Colton area. The maintenance of the Proposed Scheme would generate limited vehicular trips and the effects would not be significant.

14.5.4 The operational impacts are therefore related to permanent diversion, realignment and stopping up of roads and the diversion of PRoW.

14.5.5 Common Lane crosses the Proposed Scheme and it is proposed that part of Common Lane is permanently stopped-up either side of the route. Common Lane is an unclassified road that provides access to a number of farm buildings in the vicinity of Bromley Hayes. Accessing and egressing properties on Common Lane north of the Proposed Scheme would still be possible, however the closure would lead to an increase in journey length for traffic. It is likely to lead to a small increase in traffic, including agricultural transport, routeing through the outer suburbs of Kings Bromley. The change in journey distance is unlikely to be significant for vehicular traffic. The additional travel distance arising from the closure may result in a significant effect for non-motorised users of the route. These will be reported in the formal EIA Report.

14.5.6 Shaw Lane crosses the Proposed Scheme and it is proposed that part of Shaw Lane is permanently stopped-up. Shaw Lane is an unclassified road that provides access to a number of buildings at its southern end in the vicinity of Bromley Hayes. Closure of Shaw Lane would lead to an increase in journey length for traffic accessing and egressing properties on Shaw Lane. However, this change in journey distance is unlikely to be significant for vehicular traffic. The additional travel distance arising from the closure may result in a significant effect for non-motorised users of the route. These will be reported in the formal EIA Report.

14.5.7 It is proposed to permanently realign or divert the A515 Lichfield Road, Pipe Lane, Hadley Gate Lane, the B5014 Uttoxeter Road, Blithbury Road, Stonyford Lane, Newlands Lane (North), Newlands Lane (South), Moor Lane and the B5013 Uttoxeter Road. These realignments and diversions are not expected to substantially change journey times or result in any significant effects for vehicles, but may have an effect on non-motorised users of these routes, including for Hadley Gate Lane, the users of Colton BOAT 16 and Colton Footpath 17. These will be reported in the formal EIA Report.

14.5.8 A number of PRoW would be either permanently realigned or diverted including:

- Kings Bromley Footpath 12 would be extended to meet the realigned A515 Lichfield Road;
- Kings Bromley Footpath 0.390 would be realigned to meet the realigned A515 Lichfield Road;
- Kings Bromley Footpath 1 would be diverted along the Kings Bromley Footpath 1 diversion and the proposed River Trent Viaduct and A513 Rugeley Road;
- Mavesyn Ridware Footpaths 32 and 33 would be diverted via the Mavesyn Ridware Footpath 32 diversion and the Mavesyn Ridware Footpath 33

diversion respectively and locally combined as a result of embankment works for the approach to the River Trent viaduct;

- Mavesyn Ridware Footpath 38 would be locally realigned to cross the Proposed Scheme over the Mavesyn Ridware Footpath 38 accommodation overbridge;
- Mavesyn Ridware Footpath 8 would be diverted along the Mavesyn Ridware Footpath 8 diversion and locally combined Mavesyn Ridware Footpath 38 to cross the Proposed Scheme over the Mavesyn Ridware Footpath 38 accommodation overbridge, before rejoining the existing alignment of Mavesyn Ridware Footpath 8;
- Colton Footpath 73 would be locally realigned to cross the Proposed Scheme on the Colton Footpath 73 overbridge;
- Colton Footpath 34 would be diverted along the Colton Footpath 34 diversion to the realigned Newlands Road (South);
- Colton Footpath 36 would be diverted along the Colton Footpath 36 diversion and cross the Proposed Scheme on the Newlands Lane (North) underbridge; and
- Colton Footpath 52 would be diverted along the Colton Footpath 52 diversion and the realigned Moor Lane and Newlands Lane (North) before rejoining its existing alignment on Moor Lane.

14.5.9 For Kings Bromley Footpath 1, users travelling to and from the north-east would have an increase in travel distance of over 500m, while users travelling to and from the north-west would have a similar reduction in travel distance. For Mavesyn Ridware Footpath 8, users travelling to and from the north-west would have an increase in travel distance of over 500m, while users travelling to and from the north-east would have a similar reduction in travel distance.

14.5.10 The realignment of some of the PRoW would increase journey distance and time for non-motorised users and may result in significant effects. These will be reported in the formal EIA Report.

Other mitigation measures

14.5.11 Any further traffic and transport mitigation measures required during the operation of the Proposed Scheme would be considered as necessary based on the outcomes of the assessment. These will be reported in the formal EIA Report.

Summary of likely residual significant effects

14.5.12 The Proposed Scheme would require the permanent stopping up of Common Lane and Shaw Lane and this will result in increased journey times for users and may impact significantly on non-motorised users of these routes. These will be reported in the formal EIA Report.

14.5.13 A number of other roads would be permanently diverted or realigned although this is not expected to change journey times substantially.

14.5.14 Eleven PRoW would be permanently realigned or diverted. There could be an increase of over 500m in distance for some users on two of these routes. However, other users of these routes could see a reduction of over 500m. Any significant effects will be reported in the formal EIA Report.

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 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, SCC, (which is the Lead Local Flood Authority (LLFA)), SBC, the Canal & River Trust and Severn Trent Water Limited (which is the local water and sewerage undertaker). The purpose of this engagement has been to obtain relevant baseline information and discuss the Proposed Scheme and potential effects. Engagement with these stakeholders will continue as part of the development of the Proposed Scheme.

15.1.3 Maps showing the location of environmental features and the construction and operational components of the Proposed Scheme can be found in the Volume 2, CA1 Map Book.

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 the draft SMR and Volume 1 of this draft EIA Report.

15.2.2 Unless indicated otherwise, the spatial scope of the assessment is based upon the identification of surface water and groundwater features between Fradley and Colton that are within 1km of the centre line of the proposed route. This the definition of the study area.

15.2.3 The assessment of surface waters focuses on the River Trent and its tributaries: Pyford Brook, Bourne Brook, Bentley Brook and Moreton Brook.

15.2.4 The groundwater assessment focuses on the Sherwood Sandstone Group, a Principal aquifer, which outcrops over a small area near Blithbury, and the Mercia Mudstone Group, the predominant bedrock, which is a Secondary B aquifer. Superficial deposits are also present within the study area. Some of these have been designated Secondary A aquifers and consequently they have also been included in the assessment.

15.2.5 Impacts on biological receptors such as aquatic flora and fauna are assessed in Section 8, Ecology and biodiversity.

15.2.6 The assessment is primarily based on desk study information due to land access limitations. However, surveys of accessible water features within the study area are currently in progress. Hydraulic modelling of rivers and watercourses is also currently being undertaken. The assessment will be updated, as required, in the formal EIA to reflect the findings of these surveys and modelling studies.

15.3 Environmental baseline

15.3.1 The Proposed Scheme would include a 730m long viaduct over the Bourne Brook floodplain and a 1.9km long viaduct over the main channel of the River Trent near Kings Bromley. As the route proceeds north and eastwards, it would comprise alternating sections of cutting and embankment, interspersed with short sections that are at existing ground level. The Fradley to Colton area would not include any tunnelled sections. There are ten proposed satellite construction compounds located within the study area.

Water resources and Water Framework Directive (WFD) baseline

15.3.2 All water bodies in the study area fall within the Staffordshire Trent Valley catchment of the Humber River Basin District (RBD).

15.3.3 The River Basin Management Plan (RBMP)[93] identifies the chemical[94] and ecological[95] condition of all surface water bodies, and the quantitative[96] and chemical[97] status of all groundwater bodies within this RBD.

15.3.4 The statutory objective of the RBMP 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. Pending the results of detailed site surveys, all surface water bodies, other than minor ponds and ditches, have been identified within this draft assessment as being of either high or very high value, sensitive to impacts that could affect any one of the individual elements that are used to define their WFD status in the long term.

15.3.5 A summary of the crossing locations, current overall WFD status and future overall status objectives associated with the key surface water bodies within the Fradley to Colton area is provided in Table 12.

Table 12: Key surface water bodies and their WFD status

Water body name and identification number	Crossing location description	Current WFD Status	WFD status objective
Pyford Brook Catchment (tributary of the Trent) GB104028047250	Pyford Brook viaduct	Bad	Good by 2027
Bourne – Bilson Brook Catchment (tributary of the Trent)	Bourne Brook viaduct Tributary watercourse crossings:	Moderate	Good by 2027

[93] Environment Agency (2015), Water for life and livelihoods Part 1: Humber river basin district: River basin management plan.
[94] The **chemical status** of surface waters reflects concentrations of priority and hazardous substances present.
[95] 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.
[96] 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.
[97] 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.

Water body name and identification number	Crossing location description	Current WFD Status	WFD status objective
GB104028047270	Ashby Stitch culvert		
River Trent (Trent from Moreton Brook to the River Tame) GB104028047290	Tributary watercourse crossings - Crawley Brook realignment under River Trent viaduct; - Luth Burn realignment under River Trent viaduct; - Tributaries of Bentley Brook crossings (Blithbury inverted siphon and Blithbury West inverted siphon).	Poor	Good by 2027
Moreton Brook from Source to River Trent GB104028047380	Tributary watercourse crossings: - Finners culvert; - Stockwell Heath culvert; - Sherracop culvert; - Hamley (south) culvert; - Hamley (north) drop inlet culvert.	Moderate	Good by 2021

15.3.6 There are seven licensed surface water abstractions in the study area. Six of these are from the River Trent and its associated tributary watercourses in the vicinity of Kings Bromley. One abstraction is from Moreton Brook downstream of the Proposed Scheme.

15.3.7 Records of private unlicensed water abstractions, which comprise those for quantities less than 20m^3 per day, have been obtained from the local authorities. However, as there is no obligation to register private water supplies, there remains the possibility that other, unregistered private water supplies exist.

15.3.8 The geology of the area is described in detail in Section 10, Land quality and summarised below.

15.3.9 The main bedrock geology consists of the Mercia Mudstone Group, which is classified as a Secondary B aquifer. This is predominantly impermeable with minor and localised permeable beds, such as skerries. Skerries can yield limited quantities of groundwater suitable for domestic or small-scale agricultural use.

15.3.10 The Sherwood Sandstone Group (sandstones from the Helsby Sandstone Formation and the Chester Formations) outcrop in parts of this area near Blithbury. This formation has been classified as a Principal aquifer by the Environment Agency and is therefore a receptor of high value.

15.3.11 Superficial deposits, where present, consist of alluvium, river terrace gravels and glaciofluvial sheet deposits, all classified as Secondary A aquifers, which may be capable of supporting water supplies at a local rather than strategic scale and can form an important source of baseflow to rivers.

15.3.12 Glacial till deposits that would be crossed by the route are classified as Secondary undifferentiated aquifers, which may supply baseflow or store and yield limited

amounts of groundwater. A summary of the groundwater body locations, current overall WFD status and future overall status objectives associated with the designated groundwater bodies within the Fradley and Colton area is provided in Table 13.

Table 13: Groundwater bodies and their WFD status

Water body name and identification number	Location	Current WFD status	WFD status objective
Staffordshire Trent Valley - PT Sandstone Staffordshire GB40401G300500	In the vicinity of Blithbury	Poor	Good by 2027
Staffordshire Trent Valley - Mercia Mudstone West GB40402G300400	Across the Fradley to Colton area	Good	Good

15.3.13 There are four licensed groundwater abstractions in the study area, with an additional two outside the corridor, but within 250m of the boundary of land required for construction. All of these are private water abstractions for commercial and agricultural uses.

15.3.14 The information on private unlicensed water abstractions obtained from the local authorities indicates that there are no unlicensed groundwater abstractions located within the study area. However, there remains the possibility that other, unregistered private water supplies exist.

15.3.15 There are 11 features within the study area, identified from Ordnance Survey maps that have potential to be springs, all of which are likely to contribute flows to surface water bodies. In the absence of site surveys, all of these features will be assumed to comprise springs, which are high-value receptors.

15.3.16 There are no designated groundwater dependent terrestrial ecosystems (GWDTEs) in the study area.

Flood risk and land drainage baseline

15.3.17 The Environment Agency's Flood Maps are the principal data set that has been used to define the baseline for river, surface water and infrastructure failure flood risks. River and surface water flood risk zones are shown in WR-01 Map Series in Volume 2, CA1 Map Book.

15.3.18 The LLFA for the Fradley to Colton area is SCC. The following reports were used to help determine the baseline flood risk within the study area:

- Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011)[98];
- South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014)[99]

[98] Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011) Staffordshire County Council
[99] South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014) Capita

  - this report identifies the areas of floodplain associated with the River Trent and Bourne Brook at Kings Bromley. Other floodplains crossed by the Proposed Scheme in the study area include those associated with Pyford Brook and Moreton Brook;

- Shropshire and Staffordshire Local Flood Risk Management Strategy (2015)[100]; and

  - this report identifies the key communities in urban and rural locations at risk of flooding from surface water and smaller watercourses within Staffordshire. None of these are in the study area.

15.3.19 Blithfield Reservoir is located approximately 1.7km from the proposed route. Although the Proposed Scheme would lie within the area that could be flooded if this reservoir were to fail and release the water it holds, this is considered extremely unlikely to happen as reservoirs of this kind are inspected and maintained to the highest safety standards under reservoir safety legislation.

15.3.20 The Trent and Mersey Canal also passes through this area, but at some distance from the route as indicated on the CT-10 Map Series in Volume 2, CA1 Map Book.

15.3.21 Existing topography, soils and land drainage systems within the 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.

15.4 Effects arising during construction

Avoidance and mitigation measures

15.4.1 The draft CoCP[101] includes a range of mitigation measures that are suitable to reduce impacts to as low a level as is reasonably practicable. The measures that are of particular relevance to water resources and flood risk during construction are described below.

Water resources and WFD

15.4.2 The principal strategy adopted to limit the temporary and permanent effects of the Proposed Scheme on water bodies and their associated water resources, is to avoid sensitive receptors wherever reasonably practicable, recognising the wider constraints on route selection. This strategy has reduced the risks associated with the Proposed Scheme not complying with the requirements of the WFD. Examples of this avoidance strategy include:

- avoidance of floodplain areas: the route would avoid passing along river or stream valleys, such as that of the River Trent and Moreton Brook, and their associated floodplains. Instead it would pass over the larger watercourses

[100] Shropshire and Staffordshire Local Flood Risk Management Strategy (LFRMS) (2015) Staffordshire County Council
[101] Volume 1, Appendix: Draft code of construction practice

(rivers and streams) on viaducts spanning the floodplain. The only permanent structures within river floodplain areas would be where the viaducts require intermediate piers, and these would be placed so as to avoid the river channel;

- avoidance, where reasonably practicable, of GWDTEs, 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 and groundwater.

15.4.3 Where permanent watercourse diversions and/or realignments are proposed, the aim will be to design these with equivalent hydraulic capacity to the existing channels. The design of 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 will aim to incorporate appropriate features to retain, and where reasonably practicable enhance, their hydromorphological status. For watercourses that are not in their natural condition, the design will aim, where reasonably practicable, to incorporate measures to improve their hydromorphological status, provided this is compatible with the watercourses' flood risk and land drainage functions.

15.4.4 To protect water bodies and their associated water resources from the potential impacts of polluting materials within construction site runoff, the practices detailed in the relevant pollution prevention guidelines and Construction Industry Research and Information Association (CIRIA) publications would be adhered to, as far as is reasonably practicable. The draft CoCP also requires contractors to comply, as far as reasonably practicable, with BS 6031 code of practice for earthworks[102] regarding the general control of site drainage including, for example, all washings, dewatering, abstractions and surface water runoff, unless otherwise agreed with the Environment Agency. Specific measures referred to in the draft CoCP to protect the water environment include, as 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 regulators as part of the approvals process. These method statements would cover, where applicable:
  - the avoidance of discharges of site runoff to ditches, watercourses, drains, sewers or soakaways without the prior agreement of the appropriate authority;
  - measures to prevent silt-laden runoff and other pollutants entering the water environment; and

[102] BS 6031:2009 Code of practice for earthworks. British Standards Institute.

- restrictions or controls on excavation within watercourses to limit effects on water quality, sedimentation, fisheries and aquatic ecology.

15.4.5 Where watercourses would be permanently culverted under the route or beneath proposed highway realignments or diversions, or to allow maintenance access to features such as balancing ponds, temporary channel realignments may be required to allow new culverts to be constructed in dry conditions. Where such realignments are required these would be established in advance of stopping up the existing channel. The relevant watercourse crossings include:

- Ashby Stitch culvert;
- crossings by the Proposed Scheme of the tributaries of Bentley Brook and the B5014 highway diversion near Blithbury (Blithbury and Blithbury West inverted siphons); and
- crossings by the Proposed Scheme of the tributaries of the Moreton Brook at Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert.

15.4.6 Existing groundwater abstraction boreholes or abstraction points would be protected from physical damage, in so far as reasonably practicable. If boreholes are to be decommissioned and replaced with alternatives, contractors would adopt the latest good practices, as far as reasonably practicable. This would 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 re-located.

15.4.7 Measures would be introduced 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-off 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 abstracted 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.

15.4.8 In accordance with the draft CoCP, monitoring would be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed construction impact mitigation measures.

Flood risk and land drainage

15.4.9 The contractors would, as far as reasonably practicable, ensure that flood risk is managed throughout the construction period and would consider flooding issues when planning sites and storing materials. If necessary, temporary provision would be made to manage impacts on existing land drainage systems during construction. Some of the specific measures referred to in the draft CoCP include, as appropriate:

- preparation of flood risk assessments and method statements for temporary works, including main compound and satellite compound drainage, watercourse crossings and realignments and realignments in consultation with the Environment Agency, and if appropriate, 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 significant increases in flood risk.

15.4.10 In accordance with the draft CoCP, monitoring would 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 permits and that impacts on existing land drainage systems are limited as far as is reasonably practicable.

15.4.11 The design of the Proposed Scheme will aim to mitigate permanent significant impacts on flood risk and land drainage as follows:

- the floodplain avoidance strategy outlined above would 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; the design has made precautionary allowances for replacement floodplain storage areas to mitigate for the impact of intermediate piers situated in floodplain areas. This is in case detailed hydraulic modelling indicates that the effects of these losses of floodplain would be significant in terms of the magnitude of any increase in peak flow downstream or increase in water level upstream, and the sensitivity of any receptors potentially affected;
- on watercourses where new culverts are to be installed beneath the route, the culvert length would be reduced as far as is reasonably practicable, and would be designed with invert levels below the firm bed of the watercourse to mitigate impact on flows and sediment transfer. Culverts would be designed in general accordance with CIRIA and Environment Agency guidance, and in consultation with the Environment Agency. The mitigation specifically

proposed for the ecology of the watercourses is considered in Section 8, Ecology and biodiversity;

- provision has been made to pass surface water runoff and land drainage flows beneath sections of raised embankment that cross dry valleys. This would 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 would cross watercourses, the design aim would be for structures to accommodate flood flows up to and including the 1 in 100 (1%) annual probability storm with an allowance for climate change based on latest guidance issued by the Environment Agency[103];
- runoff from the footprint of the new infrastructure may occur more rapidly post-construction due to steeper slope angles and the permeability of the newly created surfaces. The design of drainage systems would aim to ensure that there are no significant increases in flood risk downstream, during storms up to and including the 1 in 100 (1%) annual probability design event, with an allowance for climate change based on the latest guidance issued by the Environment Agency;
- balancing ponds for 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 reasonably practicable, drainage would be designed to encourage water to soak back into the ground, for example where cuttings intercept groundwater flows;
- at cutting locations, drainage measures would 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 would also be drained to the catchments to which this water would naturally drain, avoiding transfers of water from one water body to another, which could increase flood risk or impact on land drainage systems; and
- measures would 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.

Assessment of impacts and effects

15.4.12 The majority of the potential temporary effects on the water environment during construction would be mitigated by the working methods outlined in the draft CoCP. Permanent effects would be mitigated by a range of measures incorporated into the design that have been informed by the environmental assessment process.

[103] Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities

Water resources and WFD

15.4.13 Potential impacts on surface water quality, due to site runoff and increased pollution risk, are a key concern during construction and have potential to affect abstractions and the water environment more generally. However, the practices outlined in the draft CoCP are considered to mitigate any associated effects on water quality, such that no significant effects are anticipated.

15.4.14 The proposed cuttings in the study area would 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 would mean that any effects on the overall status of these aquifers are unlikely to be significant. The implications of localised impacts on these aquifers for features such as springs and abstractions are assessed below.

15.4.15 The route would not impact on any of the 13 licensed (seven surface and six groundwater) abstractions identified in the study area.

15.4.16 The construction work would result in loss of two features which may be springs, the first at Quintons Orchard and the second at Blithbury West. This potentially constitutes a major impact (loss of an attribute). These features are currently assessed as high value receptors, pending the results of a site survey, and the assessment, therefore, identifies these as significant (major adverse) effects.

15.4.17 The temporary impact on water resources associated with construction of viaducts (Pyford Brook, Bourne Brook, River Trent including Luth Burn and Moreton Brook), culverts (Ashby Stitch culvert, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert, Hamley (north) drop inlet culvert) and inverted siphon crossings (Blithbury and Blithbury West), including any associated temporary channel realignments required, would be mitigated by the measures outlined in the draft CoCP. These measures would also likely ensure that there would be no permanent significant effects on WFD physico-chemical quality elements.

15.4.18 Ashby Stitch culvert, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert and the inverted siphons at Blithbury and Blithbury West are required to maintain the flow in permanent watercourses beneath the Proposed Scheme. These watercourses have been attributed a high value, pending the results of site survey. The culverts would have a minor impact on their hydromorphological status. These crossing locations are therefore assessed as having potential to result in significant (moderate adverse) effects at this stage on the hydromorphology of these watercourses.

15.4.19 Woodend culvert, Woodhouse culvert and Hurstwood drop inlet culvert are required to maintain connectivity of existing overland flow routes and land drainage systems. There are no existing channel features at these locations, so these structures have no implications for hydromorphology and would not result in significant effects.

15.4.20 The design of the permanent watercourse realignments associated with the watercourse crossings at Ashby Stitch culvert, Crawley Brook, Blithbury West inverted siphon, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert will aim to incorporate natural

hydromorphological features, within the constraints imposed by the need to accommodate flood defence and land drainage functions. These permanent realignments are, therefore, unlikely to result in significant adverse effects on the relevant watercourse's WFD hydromorphology element status.

Flood risk and land drainage

15.4.21 Construction of viaducts over the River Trent, Pyford Brook, Bourne Brook, Luth Burn, Moreton Brook, and their associated floodplains would require temporary working within flood zones. This would also apply to construction works associated with the proposed culverts (Ashby Stitch culvert, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert, Hamley (north) drop inlet culvert) and inverted siphon crossings (Blithbury and Blithbury West), including associated temporary or permanent channel realignments. Construction sequencing and temporary works design would need to be carefully considered and assessed in terms of impacts on flood risk. Construction work required to the existing pylons located in the vicinity of the Bourne Brook also has potential implications for flood risk and could impact on any field subsurface drainage systems present. Measures defined in the draft CoCP would result in the flood risk and land drainage effects of construction being reduced as far as is reasonably practicable. These activities would be implemented in consultation with the Environment Agency, and where applicable, the LLFA. It is not anticipated that these activities would result in significant temporary adverse effects on flood risk and land drainage.

15.4.22 The permanent watercourse crossing points at Pyford Brook, Bourne Brook, the River Trent and Moreton Brook would be on viaducts that span the floodplain. The design incorporates areas where provision can be made to compensate for the loss of floodplain storage associated with the footprint of any intermediate piers. Piers would be placed to avoid the channel and allow access for channel inspection and maintenance, where necessary. As a result, it is unlikely that the proposed viaducts would result in significant permanent adverse effects related to flood risks at these sites.

15.4.23 The design aim for all permanent culverts (Ashby Stitch culvert, Woodend culvert, Woodhouse culvert, Hurstwood drop inlet culvert, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert would be to accommodate the peak 1 in 100 (1%) annual probability flow in the relevant watercourse, with an explicit allowance for future increases caused by climate change in accordance with current Environment Agency guidance. This equally applies to the inverted siphons proposed on the minor watercourses at Blithbury and Blithbury West. These structures are, therefore, unlikely to have a significant effect on flood risk.

15.4.24 The design aim for the permanent watercourse realignments associated with the crossings at Ashby Stitch culvert, Crawley Brook, Blithbury West inverted siphon, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert would have equivalent capacity to the existing channels downstream. The aim would be design these such that any existing field subsurface drainage systems can be connected-in. These realignments are, therefore, unlikely to have a significant adverse effect on flood risk and land drainage.

15.4.25 The design aim for the nine permanent balancing ponds would be to ensure that the peak rate of runoff from the Proposed Scheme is attenuated to present greenfield runoff rates, including an explicit allowance for the projected impacts of future climate change on peak rainfall intensities, in accordance with current Environment Agency guidance. None of the potential effects associated with these features and their associated receptors have been assessed as being significantly adverse.

Other mitigation measures

15.4.26 Additional mitigation measures may be required to further reduce the temporary and permanent impacts of construction stage activities, particularly with regard to demonstrating that:

- all reasonably practicable measures have been taken to mitigate the impacts of the proposed culverts on the WFD element status of the relevant watercourses; and
- the proposals would not result in significant increases in flood risks from any source for a range of events up to and including the 1 in 100 annual probability, including allowance for climate change.

15.4.27 The precise form of these will be site specific and based on the outcome of site survey, hydraulic modelling work and ongoing consultation with the Environment Agency and LLFA, as appropriate, and reported in the Formal EIA Report.

15.4.28 These surveys will include inspection of watercourses affected by culvert crossings so that the relative value of these watercourses can be confirmed and an approach to mitigating the impacts of these culverts on the natural hydromorphology of these watercourses can be developed. This will be reported in the formal EIA Report.

15.4.29 The potential spring features at Quinton's Orchard and Blithbury West, and any associated wetland habitat, will be inspected so that an outline approach to mitigating the construction effects and replacing these springs nearby can be developed.

Summary of likely residual significant effects

15.4.30 Without the additional mitigation summarised above the anticipated residual significant effects related to construction would be as follows:

- the permanent impacts on watercourse hydromorphology resulting from construction of Ashby Stitch culvert, Finners culvert, Stockwell Heath culvert, Sherracop culvert, Hamley (south) culvert and Hamley (north) drop inlet culvert and the inverted siphons at Blithbury and Blithbury West. These effects are assessed as having potential to be of moderate adverse significance; and
- the temporary impacts on the potential spring features at Quintons Orchard and Blithbury West. These effects are assessed as having potential to be of major adverse significance.

15.4.31 It is currently anticipated that it should be possible to develop the means of mitigating these impacts, to ensure that there are no residual effects of significance.

15.5 Effects arising from operation

Avoidance and mitigation measures

15.5.1 Generic examples of design measures that would reduce potentially significant adverse effects on the quality and flow characteristics of surface water and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1. A draft operation and maintenance plan for water resources and flood risk will be prepared and included in the formal EIA Report.

Assessment of impacts and effects

15.5.2 The principal issue of concern during operation is the potential for accidental spillages to occur that result in the release of contaminants into the water environment. This issue is considered in the route-wide assessments outlined in Volume 3. No adverse effects of significance related to water quality are anticipated from operation of the scheme at this stage of the assessment.

15.5.3 Adherence to the policies in the National Planning Policy Framework (NPPF) with regard to flood risk will ensure that the Proposed Scheme is safe from flooding without increasing flood risk elsewhere. Evidence of application of the Sequential Test and Exception Tests in NPPF will be provided on a route-wide basis in the route-wide assessment in Volume 3. No adverse effects of significance related to flood risk are anticipated from operation of the scheme at this stage of the assessment.

15.5.4 Sustainable drainage systems would be used where reasonably practicable. These will also help to remove any suspended material within runoff from the Proposed Scheme through filtration, vegetative adsorption or settlement. The drainage systems proposed would ensure that the scheme would have no adverse effects of significance on the quantity and quality of water draining from the Proposed Scheme during its operational phase.

15.5.5 The operational impacts of the Proposed Scheme on surface and groundwater bodies are unlikely to be significant, once the construction stage mitigation measures outlined above have been implemented. A route-wide WFD compliance assessment will be conducted and reported in Volume 3 of the formal EIA Report.

Other mitigation measures

15.5.6 It is considered unlikely that further measures will be required to mitigate operational effects on surface water resources, groundwater resources or flood risk.

Summary of likely residual significant effects

15.5.7 It is not anticipated that there would be any significant residual effects on water resources and flood risk resulting from operation of the Proposed Scheme.

16 References

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