High Speed Two Phase 2a: West Midlands to Crewe

Working Draft Environmental Impact Assessment Report

Volume 2: Community Area report

CA4: Whitmore Heath to Madeley

September 2016

CS590_C12

High Speed Two Phase 2a: West Midlands to Crewe

Working Draft Environmental Impact Assessment Report

Volume 2: Community Area report

CA4: Whitmore Heath to Madeley

September 2016

Department for Transport

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

High Speed Two (HS2) Limited,
One Canada Square,
Canary Wharf,
London E14 5AB

Telephone: 020 7944 4908

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.gov.uk/hs2

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

ARUP ERM

High Speed Two (HS2) Limited has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the HS2 website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard please contact High Speed Two (HS2) Limited.

recycle

Printed in Great Britain on paper containing at least 75% recycled fibre.

Contents

List of figures

List of tables

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 Whitmore Heath to Madeley area are provided in a separate corresponding document entitled Volume 2, CA4 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 currently 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'.

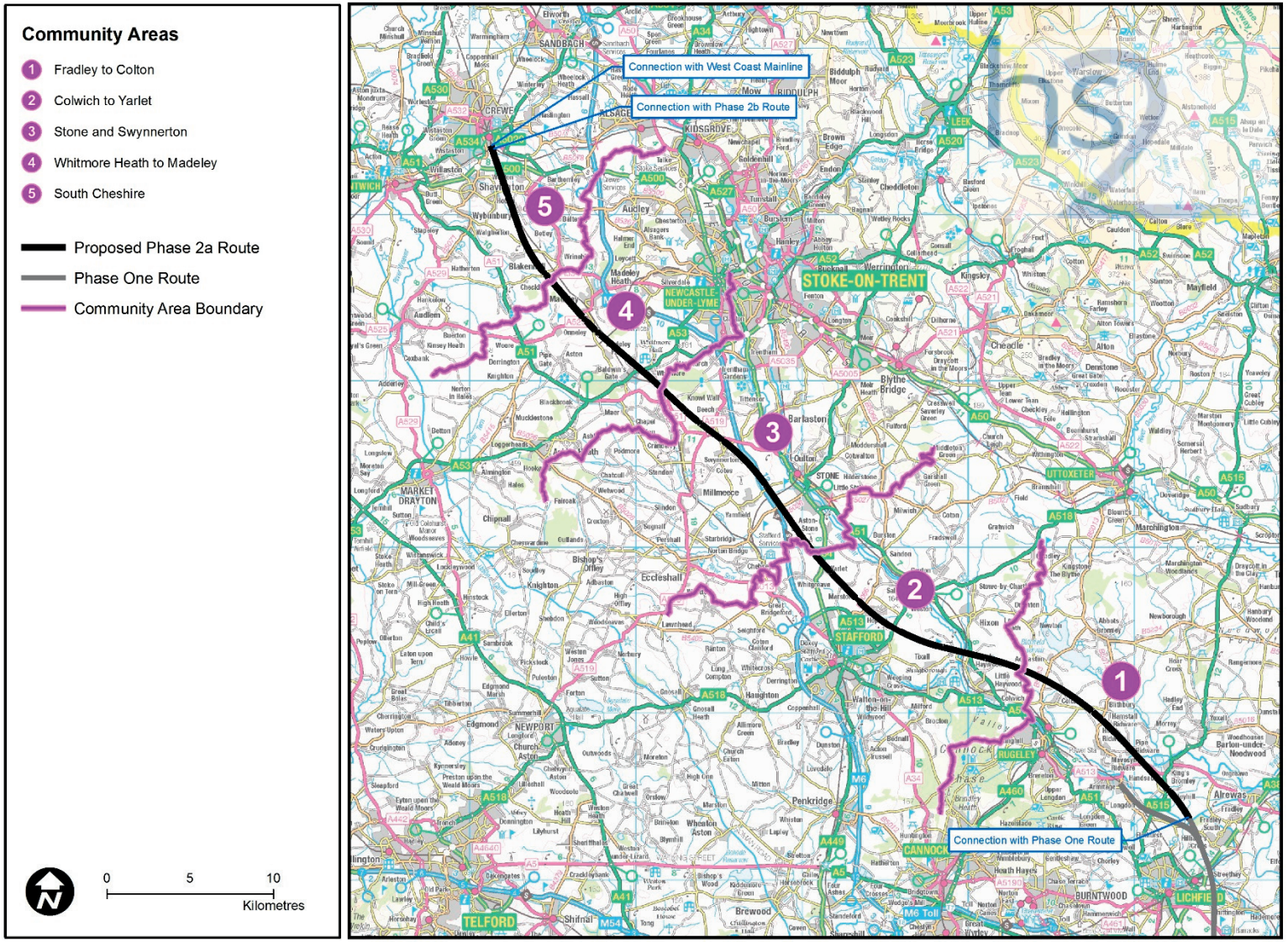
1.1.4 Phase 2a (the Proposed Scheme), the subject of this working draft Environmental Impact Assessment (EIA) Report[1], comprises the first section of the western leg of Phase Two from the West Midlands to Crewe (approximately 60km (37 miles) in length). It would connect with Phase One near Fradley, 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 Whitmore Heath to Madeley 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 out 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 in consideration comments received. The revised SMR is published alongside this working draft EIA Report, which will be used to develop the formal EIA Report.

1.3.5 The maps relevant to the Whitmore Heath to Madeley area are provided in a separate corresponding document entitled Volume 2, CA4 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 Whitmore Heath to Madeley area covers an approximately 9km section of the Proposed Scheme passing through the parishes of Whitmore, and Madeley, within the Newcastle-under-Lyme Borough Council (NBC) and Staffordshire County Council (SCC) areas. The boundary between Swynnerton parish and Whitmore parish forms the southern boundary of this section. The boundary between Madeley parish and Checkley cum Wrinehill parish forms the northern boundary of this section.

2.1.2 As shown in Figure 2, the Stone and Swynnerton community area (CA3) lies to the south and South Cheshire community area (CA5) lies to the north.

Settlement, land use and topography

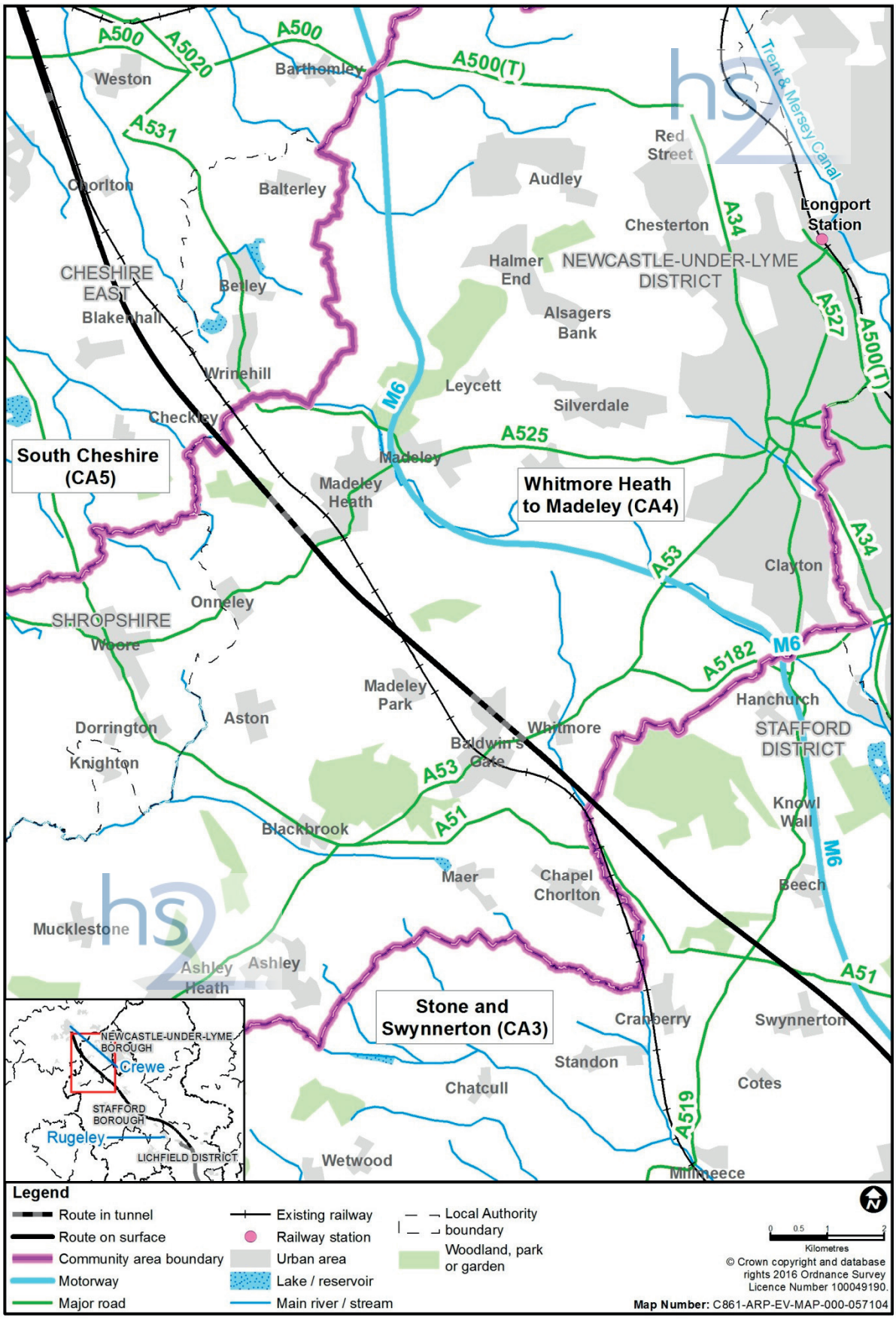
2.1.3 The area is predominantly rural in character, with agriculture being the main land use, interspersed with ancient woodland, small villages and a scattering of isolated dwellings and farmsteads. Much of the area encompasses gently undulating lowland and settled river valley landscapes, with occasional lowland bog and flood-plain pasture at lower levels.

2.1.4 At the southern end of this section, the route would pass within 1km of the villages Baldwin's Gate and Madeley Park, which lie to the west of the Proposed Scheme, and Whitmore, which lies to the east. The route would run under Whitmore Heath in tunnel and through Whitmore Wood Ancient Woodland. The route would then enter the valley of the River Lea, where there are several historical features including the Grade II listed building Hey House and the Old Madeley Manor scheduled monument.

2.1.5 The route would continue towards the village of Madeley, passing the sandstone outcrops at Bar Hill , the Lea Head moated site scheduled monument, and several listed buildings including the farmstead of Aston Cliff and Lea Head Manor.

2.1.6 To the east and north of Whitmore village there are several detached rural properties along the A53 Newcastle Road. To the east of Madeley village there are several large isolated farmsteads set back from the road, including Moor Hall Farm, Bowerend Farm, Beechfields and Bar Hill House Farm.

Figure 2: Area context map



Key transport infrastructure

2.1.7 The M6 runs in a north-west/south-east alignment along the eastern boundary of the area. Junction 15 of the M6 is located on the south-east boundary of the area, and connects Newcastle-under-Lyme and Stoke-on-Trent to the strategic road network. The A53 Newcastle Road runs east to west across the area and would cross the route to the south of Whitmore Heath. The A525 Bar Hill Road runs north-east to south-west and would cross the route at Bar Hill. The main local roads that would cross the Proposed Scheme are Bent Lane, which connects the settlements of Whitmore and Stableford; Heath Road, Snape Hall Road and Manor Road, which all serve the village of Baldwin's Gate; and Bower End Lane, which connects a number of rural properties to the settlement of Madeley.

2.1.8 The WCML traverses the area in a broadly north-west/south-east alignment and is crossed by the Proposed Scheme where it runs over the River Lea. The Proposed Scheme also crosses the out of use Silverdale Line of the Stoke to Market Drayton railway on viaduct at the same location. There are no stations within the Whitmore Heath to Madeley area, but WCML services stop at Stoke-on-Trent with onward connections to major national destinations, including London, Birmingham and Manchester. Rail users can interchange at both Stoke-on-Trent and Newcastle-under-Lyme for regional and local destinations.

2.1.9 Within the area there are a number of public rights of way (PRoW) and local access roads which provide important links between scattered rural dwellings and villages throughout the area.

Socio-economic profile

2.1.10 The area is generally sparsely populated, reflecting its rural character. The area's labour market outperforms England as a whole; unemployment at 2% is significantly lower than the national level of 5%, while 76% of the population aged 16-64 is employed, compared to the national figure of 74%[5]. In 2015, unemployment in the NBC area was 2%, which was lower than England as a whole (5%).

2.1.11 Within the NBC area there is a wide spread of business types reflecting a diverse range of commercial activities. Retail accounts for the largest proportion of businesses (13%) followed by construction (11%) and professional, scientific and technical (11%).

2.1.12 According to the Annual Population Survey (2015)[6], 28% of NBC's residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, while 9% of residents had no qualifications.

Notable community facilities

2.1.13 The area from Bent Lane to Hey Sprink is predominantly agricultural land with three main villages: Baldwin's Gate, Whitmore and Madeley. These small settlements have limited community facilities, and in general, the majority of community facilities lie within the village centres. These facilities include the Madeley Practice and Baldwin's

[5] Data comes from the 2014 business register and employment survey.
[6] Office of National Statistics (2015) Annual Population Survey claimants as a percentage of economically active persons aged 16 – 64 (includes employees, self-employed and actively seeking work)

Gate Surgery, the Saint Mary and All Saints Church, Baldwin's Gate CE (VC) Primary School, Madeley High School, Sir John Offley CE (VC) Primary School, and Meadows Primary School, and community meeting places, such as Whitmore Village Hall.

Recreation, leisure and open space

2.1.14 The Whitmore Heath to Madeley area comprises gently undulating lowland and land cover with a combination of dairy pasture, arable and horse grazing. Areas of heath occur on higher ground in combination with mixed species woodland and ancient woodland.

2.1.15 The Proposed Scheme would cross several PRoW including the Newcastle Way, Two Saints Way and the South Cheshire Way. Whitmore Hall and Cudmore Fisheries are local and regional visitor attractions.

Policy and planning context

Planning framework

2.1.16 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.

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

- Adopted Newcastle-under-Lyme and Stoke-on-Trent Core Spatial Strategy 2006-2026 (2009)[7];
- Adopted Newcastle-under-Lyme Local Plan 2011 (saved policies) (2003)[8];
- Adopted Shropshire Local Development Framework: Core Strategy (2011)[9];
- Adopted Shropshire Council Site Allocations and Management of Development (SAMDev) Plan (2015)[10];
- Adopted Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006 (saved policies) (1999)[11]; and
- Adopted Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026, (2013)[12].

[7] https://www.newcastle-staffs.gov.uk/sites/default/files/IMCE/Planning/Planning_Policy/SpatialStrategy/Core%20Strategy%20Final%20Version%20-%2028th%20October.pdf
[8] https://www.newcastle-staffs.gov.uk/sites/default/files/IMCE/Planning/Planning_Policy/Saved%20Policies%20of%20the%20Newcastle-under-Lyme%20Local%20Plan%20154KB.pdf
[9] http://shropshire.gov.uk/media/830904/shropshire-core-strategy-2011-reduced.pdf
[10] http://shropshire.gov.uk/media/1900363/SAMDev-Adopted-Plan.pdf
[11] https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/MineralsLocalPlanadoptedsavedpolicieswebversion1.pdf
[12] 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

2.1.18 Emerging policies are not generally included 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[13], which was submitted to the Secretary of State on 8 January 2016.

2.1.19 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

2.1.20 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 taken into account 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 Whitmore Heath to Madeley 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 field surveys, and as part of ongoing consultation and stakeholder engagement. Any further changes resulting from this would be reported in the formal EIA Report. The main areas of design development to be considered include:

- refinement of tunnel options including lengths, design and construction methods and alternative engineering options;
- reviewing the proposed lengths and heights of viaducts and other river crossing structures and associated replacement floodplain storage areas, following hydraulic modelling[14];
- temporary and permanent utility diversions;

[13] https://consultation.staffordshire.gov.uk/environment/staffordshire-minerals-local-plan/user_uploads/0100-the-new__---june-2015.pdf
[14] 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 final design and formal EIA Report.

- 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 and access to tunnel portals and headhouses;
- additional environmental features required to mitigate likely significant adverse environmental effects;
- accommodation works and crossings of the route for private means of access;
- refinement of construction compound locations and haul roads; and
- refinement of auto-transformer station locations.

Overview

2.2.5 The Proposed Scheme would run through the Whitmore Heath to Madeley area and extend from Meece Brook Valley in the south to the west of Madeley passing through Barhill Ancient Woodland, for approximately 9km.

2.2.6 This section of route is illustrated on Maps CT-06-229 to CT-06-234 in the Volume 2, CA4 Map Book.

Shelton under Harley to Whitmore tunnel north portal

2.2.7 The route would enter the Whitmore Heath to Madeley area, north-west of Shelton under Harley Farm and continue on Stableford North embankment for approximately 600m into the Meece Brook valley. The Proposed Scheme would pass onto the Meece Brook viaduct then onto Meece embankment. It would then continue into the Whitmore South cutting before entering the porous portal and tunnel under the A53 Newcastle Road and Whitmore Heath for approximately 1.3km.

2.2.8 This section of route is illustrated on Maps CT-06-229 and CT-06-230.

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

- Stableford North embankment at the start of the Whitmore Heath to Madeley area continuing for approximately 600m at varying heights up to approximately 12m;
- permanent diversion of Swynnerton Footpath 10 (diverted from the Stone and Swynnerton area into the Whitmore Heath to Madeley area) which would cross the Proposed Scheme via the Swynnerton Footpath 10 underbridge and incorporate a culvert;
- permanent closure of a section of Bent Lane (South) along the southern side of the route;
- permanent diversion of Bent Lane (North) continuing for approximately 600m from the Stone and Swynnerton area, along the north side of the route;

- diversion of an unnamed watercourse under the diverted Bent Lane (North) via the culvert at Swynnerton 10 Footpath diversion;
- Meece Brook viaduct, approximately 270m in length and at a height of approximately 12m over Meece Brook;
- a replacement floodplain storage compensation area to the east of the Proposed Scheme;
- areas of wetland and grassland habitat creation under Meece Brook viaduct;
- Meece embankment, approximately 215m in length and up to 10m in height;
- Whitmore South cutting, approximately 540m in length, approximately 85m in width, with a depth of up to approximately 13m;
- two balancing ponds for railway drainage: one located to the west of the Proposed Scheme with access from the A53 Newcastle Road, and the other located to the west of the Proposed Scheme, approximately 50m north of Snape Hall Road with access from Snape Hall Road;
- four ecological mitigation ponds; two to the north and two to the south of the Proposed Scheme;
- permanent realignment of the A53 Newcastle Road over the Whitmore Heath tunnel southern portal;
- a tunnel headhouse and emergency assembly area at the southern end of the Whitmore Heath tunnel, to the west of the route with access from the A53 Newcastle Road to the south;
- a porous portal approximately 150m in length at the southern end of Whitmore Heath tunnel;
- Whitmore Heath tunnel, which would include Whitmore Heath cut and cover tunnel for approximately 250m in length, continuing into Whitmore Heath twin bored tunnel for approximately 750m in length under Whitmore Heath at a depth of approximately 50m;
- a porous portal approximately 150m in length at the northern end of Whitmore Heath tunnel;
- permanent closure of an approximately 330m section of Snape Hall Road where it crosses the route;
- Snape Hall inverted siphon[15] for the realignment of Snape Hall Road Stream under the route and with access from Snape Hall Road to the north;

[15] 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.

- a tunnel headhouse and emergency assembly area at the northern end of Whitmore Heath tunnel, approximately 100m north of Snape Hall Road to the east of and adjacent to the route with access from Snape Hall Road;
- a noise fence barrier approximately 3m in height and 2km in length, from the Whitmore Heath porous portal approximately 50m west of the existing Snape Hall Road and continuing over the River Lea viaduct; and
- a surface water pump station to the west of the route approximately 100m north of Snape Hall Road with an access road heading south to Snape Hall Road.

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

2.2.11 Construction of this section would be managed from the Meece Brook viaduct satellite compound, Whitmore Heath tunnel satellite compound and Snape Hall Road satellite compound, which are described in Section 2.4, and as shown on Maps CT-05-229 and CT-05-230.

Whitmore tunnel north portal to Manor Road overbridge

2.2.12 The route would continue through a section of Whitmore Wood Ancient Woodland in Whitmore North cutting with a retaining wall on the north-east side for approximately 500m. The route would then enter the valley of the River Lea on Lea South embankment and continue onto River Lea viaduct, passing over the River Lea and the WCML. The route would then continue on Lea North embankment until passing under Manor Road overbridge.

2.2.13 This section of route is illustrated on Maps CT-06-230 to CT-06-232.

2.2.14 Key features of this approximately 2.9km section would include:

- Whitmore North cutting, approximately 500m in length, 11m in depth and 75m in width; with Whitmore Wood retaining wall starting north of Snape Hall Road and continuing north for approximately 500m;
- Dab Green drop inlet culvert[16] under the route approximately 350m north of Snape Hall Road as the route passes through Whitmore Wood. Access to the culvert would be via Whitmore Wood overbridge and along the north side of the route;
- Whitmore Wood overbridge, for accommodation access, approximately 550m north of Snape Hall Road in Whitmore Wood;
- Whitmore Wood culvert, approximately 700m north of Snape Hall Road;
- Madeley Park culvert for diversion of an unnamed watercourse to the approximately 1.1km north of Snape Hall Road;

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

- two balancing ponds for railway drainage: one located to the south of the route, approximately 150m north of Madeley Park culvert with an access road from Snape Hall Road, and one located to the north of the route with access from Manor Road;
- Lea South embankment, approximately 910m in length and a height of approximately 21m;
- two ecological mitigation ponds: one located immediately to the north of the route approximately 200m north of Madeley Park culvert, and one located south of the route, approximately 650m north of the River Lea viaduct;
- permanent diversion of Madeley Footpath 14 for approximately 500m along the south of the route and under the River Lea viaduct adjacent to the River Lea;
- areas of wetland and grassland habitat creation under the River Lea viaduct, to the south of the WCML;
- realignment of a tributary of the River Lea to the south of the route from the WCML to the out of use Silverdale line of the Stoke to Market Drayton railway;
- River Lea viaduct, approximately 490m in length and 20m in height, over the River Lea, the WCML, Madeley Chord and the Stoke to Market Drayton railway;
- a noise fence barrier of up to approximately 3m in height immediately south of the route from Whitmore Heath northern portal to the Stoke to Market Drayton railway;
- Lea North embankment, approximately 1km in length from the River Lea viaduct to the realigned Manor Road, at a height of approximately 18m;
- Bitterns Lane auto-transformer station to the west of the route with access from Manor Road; and
- permanent realignment of Manor Road on an embankment approximately 11m in height and crossing the Proposed Scheme on Manor Road overbridge approximately 100m to the north of the existing alignment.

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

2.2.16 Construction of this section would be managed from the Snape Hall Road satellite compound, River Lea viaduct satellite compound and Bitterns Lane ATS satellite compound, which are described in Section 2.3, and as shown on Maps CT-05-230, CT-05-231 and CT232.

Manor Road overbridge to Checkley Brook

2.2.17 The route would continue in Madeley cutting, continuing under A525 Bar Hill overbridge before entering a porous portal and Madeley tunnel, to the west of Madeley close to Barhill Ancient Woodland. Madeley tunnel would emerge into a

porous portal and into a cutting before transferring to Checkley South embankment for 1.3km up to the boundary with the South Cheshire area (CA5).

2.2.18 This section of route is illustrated on Maps CT-06-232 to CT-06-234.

2.2.19 Key features of this approximately 3.4km section would include:

- Madeley cutting, approximately 1.1km in length and 80m in width, with a depth of approximately 12m;
- a noise fence barrier north of the route along Madeley South cutting, approximately 550m in length and 3m in height;
- permanent diversion of Red Lane/Madeley Bridleway 1 for approximately 500m along the south of the route, crossing the route on the A525 Bar Hill overbridge to join the realigned A525 Bar Hill Road;
- Drummer Stile inverted siphon which would run under the Proposed Scheme for approximately 100m, 175m south of the A525 Bar Hill Road realignment;
- permanent realignment of the A525 Bar Hill Road, crossing the Proposed Scheme at A525 Bar Hill overbridge, approximately 50m to the south of the existing road. The realigned A525 Bar Hill Road would be raised onto embankments of approximately 7m height;
- three ecological mitigation ponds; one located north-east of the Proposed Scheme at Bar Hill Road; and one located north of the Proposed Scheme 150m south of Madeley Bridleway 5, which would be permanently closed;
- Bar Hill aqueduct;
- a tunnel headhouse at the southern end of Madeley tunnel, a surface water pump station and emergency assembly area with access from A525 Bar Hill Road;
- a porous portal extending 150m to the south of Madeley Tunnel;
- Madeley tunnel, a twin bored tunnel extending under Bar Hill for approximately 670m in length at a depth of up to approximately 38m;
- a porous portal extending 150m to the north of Madeley Tunnel;
- a balancing pond for railway drainage with access from the A525 Bar Hill Road;
- a tunnel headhouse and emergency assembly area at the northern end of Madeley tunnel with an access road approximately 1.7km in length from the A525 Bar Hill Road;
- Checkley South embankment extending for approximately 1.2km in length; at a height of up to approximately 14m;
- Wrinehill South culvert for diversion of an unnamed watercourse for 100m, along the existing alignment of the Madeley Bridleway 5, which would be permanently closed;

- permanent closure of Madeley Bridleway 5, diverted along the route of Madeley Footpath 28, which would be upgraded to a bridleway; and
- Madeley Bridleway 2 accommodation underbridge for the realignment of Madeley Bridleway 2 and incorporating a culvert for diversion of an unnamed watercourse.

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

2.2.21 Construction of this section would be managed from Bar Hill satellite compound, Madeley tunnel east satellite compound, Madeley tunnel west satellite compound and Checkley Brook viaduct satellite compound, which are described in Section 2.3, and as shown on Maps CT-05-233 and CT-05-234.

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 Whitmore Heath to Madeley 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 Map Series CT-05 (Volume 2, CA4 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 owner 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, Sections 5 and 6 provide details of 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 assumed.

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 would comprise the following general stages:

- advance works, including: site surveys further to those already undertaken; preliminary mitigation works; preliminary enabling works;
- civil engineering works, including: establishment of construction compounds; 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; associated utility diversions;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and removal of construction compounds; and
- site finalisation works; and
- system 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 railway systems, including 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. The installation of track in tunnels would comprise slab tracks.

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 Eight civil engineering satellite compounds, four of which would continue to be used for railway installation satellite compounds, and one additional railway installation satellite compound would be located in the Whitmore Heath to Madeley area.

2.3.15 All satellite compounds for civil engineering works would be managed from the A519 Newcastle Road main compound and all railway systems satellite compounds would be managed from the Stone railhead main compound (see Stone and Swynnerton (CA3)).

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

General overview of construction compounds

2.3.17 Main compounds 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 will 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 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 6.3 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, whether to carry materials, plant, other equipment and workforce, or moving empty, would take place within the construction compounds, on public roads and between the compounds and working areas. Construction traffic 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 Whitmore Heath to Madeley area are described in the 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 of the Proposed Scheme 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 CT05-229 to CT05-234a in the Volume 2, CA4 Map Book.

Figure 3: Construction compounds showing indicative key civil engineering works within the Whitmore Heath to Madeley area

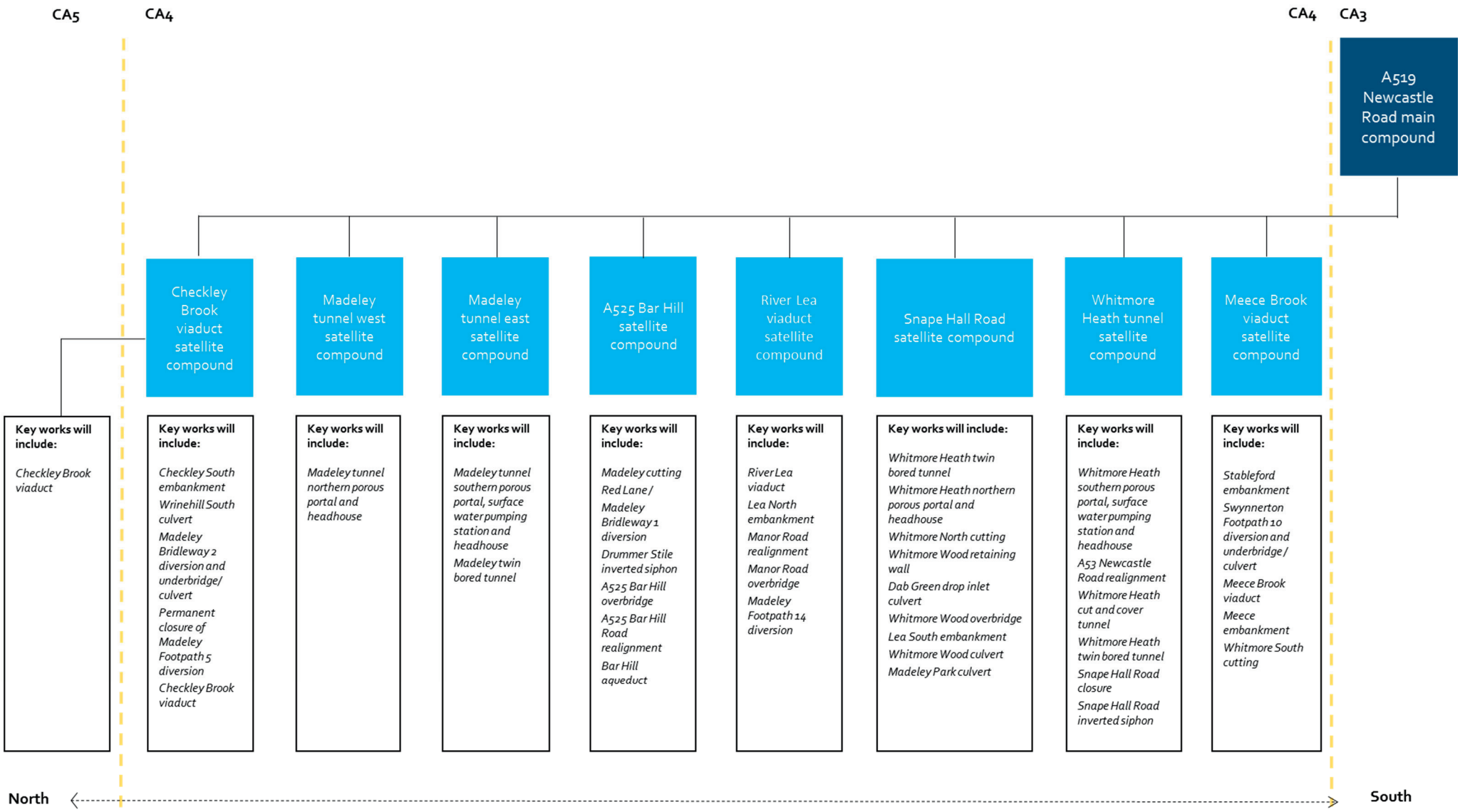
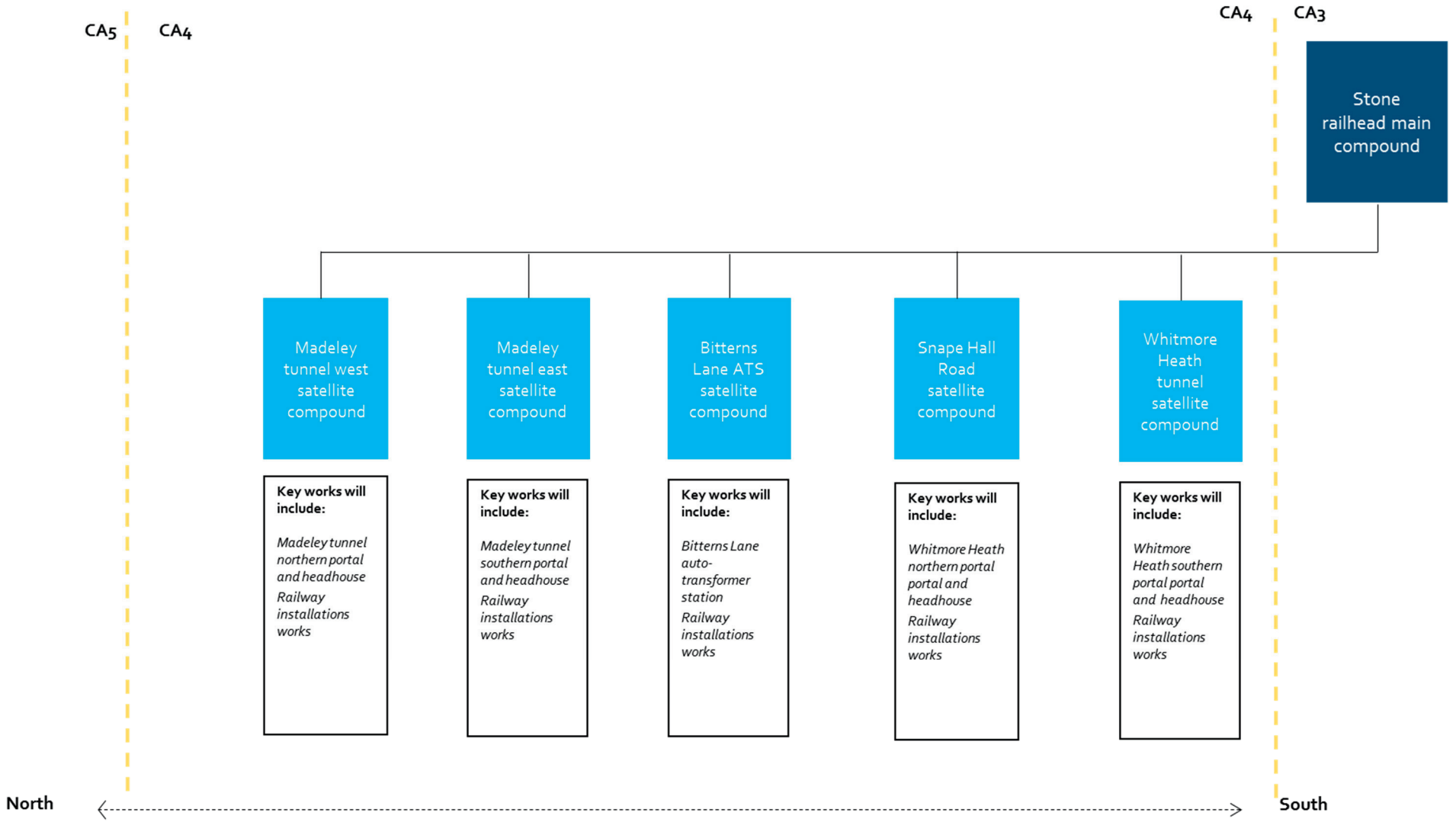


Figure 4: Construction compounds showing indicative key railway installation works within the Whitmore Heath to Madeley area



Meece Brook viaduct satellite compound

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

- be operational for approximately four years and three months, commencing during 2020;
- support approximately 35 civil engineering workers per day (approximately 50 workers at peak times) throughout much of the works period;
- be accessed via Bent Lane from the south; and
- be managed from A519 Newcastle Road main compound.

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

- Stableford North embankment;
- Swynnerton Footpath 10 diversion;
- Swynnerton Footpath 10 underbridge and culvert;
- Meece Brook viaduct;
- Meece embankment;
- Whitmore South cutting; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.26 It is currently anticipated that demolition of an isolated steel frame outbuilding accessed from Bent Lane would be required as a result of the works to be managed from this compound.

2.3.27 Swynnerton Footpath 10 would be permanently diverted from its existing alignment in the adjoining Stone and Swynnerton (CA3) area, crossing the route of the Proposed Scheme via the Swynnerton Footpath 10 before rejoining its existing alignment to the north.

2.3.28 Diversion of an unnamed watercourse would be required to enable the construction of the Stableford embankment. The unnamed watercourse would be permanently diverted beneath the Proposed Scheme via the culvert at Sywnnerton 10 Footpath underbridge and permanently diverted to the south of the route.

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

Whitmore Heath tunnel satellite compound and tunnelling and logistics areas

2.3.30 This compound would provide for civil engineering works and rail systems works and would:

- be operational for approximately six years and nine months, commencing during 2020;

- support approximately 95 civil engineering workers per day (approximately 140 workers at peak times) throughout much of the works period;
- support approximately 25 railway systems workers per day (approximately 40 workers at peak times) throughout much of the works period;
- be accessed via the A53 Newcastle Road from the east;
- be managed from A519 Newcastle Road main compound for civil engineering works; and
- be managed from Stone railhead main compound for railway systems works.

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

- Whitmore Heath tunnel southern portal and headhouse;
- A53 Newcastle Road permanent realignment;
- Whitmore Heath cut and cover tunnel;
- Whitmore Heath twin bored tunnel;
- permanent closure of Snape Hall Road;
- Snape Hall Road inverted siphon;
- railway installations works; and
- finalisation works including site reinstatement, landscaping and planting.

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

2.3.33 A 330m section of Snape Hall Road would be permanently closed where it would cross the route. A temporary diversion of the A53 Newcastle Road would be required during the construction period. Temporary and intermittent lane restrictions on the A53 Newcastle Road may be required over a three-month period for access of construction vehicles for construction works.

2.3.34 A temporary alternative route for Madeley Footpath 4 would be required, diverting it to outside the area required for construction, for a distance of approximately 650m over approximately three years. Following completion of the construction in this area, Madeley Footpath 4 would be reinstated along its existing alignment.

2.3.35 Snape Hall Stream would be permanently diverted beneath the Whitmore Heath tunnel northern portal via Snape Hall Road inverted siphon and permanently realigned to the north of Snape Hall Farm.

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

Snape Hall Road satellite compound

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

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 35 civil engineering workers per day (approximately 50 workers at peak times) throughout much of the works period;
- support approximately 10 railway systems workers per day throughout much of the works period;
- be accessed via Snape Hall Road from the north-east;
- be managed from A519 Newcastle Road main compound for civil engineering works; and
- be managed from Stone railhead main compound for railway systems works.

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

- Whitmore Heath twin bored tunnel;
- Whitmore Heath tunnel northern portal, surface water pumping station and headhouse;
- Whitmore North cutting;
- Whitmore Wood retaining wall;
- Dab Green drop inlet culvert;
- Whitmore Wood overbridge;
- Lea South embankment;
- Whitmore Wood culvert;
- Madeley Park culvert;
- railway installations works; and
- finalisation works including site reinstatement, landscaping and planting.

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

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

2.3.41 Diversion of the following watercourses would be required as a result of the works to be managed from this compound:

- an unnamed watercourse would be permanently diverted via Dab Green drop inlet culvert for approximately 150m over Whitmore North cutting;
- Whitmore Wood Stream would be permanently diverted via Whitmore Wood culvert for approximately 75m over Whitmore North cutting; and

- an unnamed watercourse would be permanently diverted via Madeley Park culvert for approximately 75m under the Lea South embankment.

River Lea viaduct satellite compound

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

- be operational for approximately four years and three months, commencing during 2020;
- support approximately 50 civil engineering workers per day (approximately 75 workers at peak times) throughout much of the works period;
- be accessed via Manor Road and then via the site haul road to the south of the Proposed Scheme alignment; and
- be managed from A519 Newcastle Road main compound.

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

- River Lea viaduct;
- Lea North embankment;
- Manor Road realignment;
- Manor Road overbridge;
- Madeley Footpath 14 diversion; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.44 It is currently anticipated that demolition of the following buildings and structures would be required as a result of the works to be managed from this compound:

- Hey House Lodge, a residential farmhouse accessed off Manor Road, adjacent to Hey House grade II listed building; and
- an abandoned railway bridge on the Stoke to Market Drayton railway to the west of the route.

2.3.45 Manor Road would be permanently realigned over the Manor Road overbridge. The Manor Road overbridge would be built off line, with local traffic management measures in place during the construction works, after which the Manor Road overbridge would rejoin the existing Manor Road alignment.

2.3.46 Madeley Footpath 14 would be permanently diverted by approximately 100m from its existing alignment and cross the Proposed Scheme under the River Lea viaduct.

2.3.47 Permanent realignment of a tributary of the River Lea would be required as a result of the works to be managed from this compound.

2.3.48 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.

Bitterns Lane ATS satellite compound

2.3.49 This compound would provide for the construction of Bitterns Lane auto-transformer station and would:

- be operational for approximately three years, commencing during 2024;
- support approximately 30 railway systems workers per day (approximately 40 workers at peak times) throughout much of the works period;
- be accessed via Manor Road from the north; and
- be managed from Stone railhead main compound.

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

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

A525 Bar Hill satellite compound

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

- be operational for approximately four years and three months, commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 25 workers peak times) throughout much of the works period;
- be accessed via A525 Bar Hill Road from the west; and
- be managed from A519 Newcastle Road main compound.

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

- Madeley cutting;
- Red Lane/Madeley Bridleway 1 diversion;
- Drummer Stile inverted siphon;
- A525 Bar Hill Road overbridge;
- A525 Bar Hill Road realignment;
- Bar Hill aqueduct; and
- finalisation works including site reinstatement, landscaping and planting.

2.3.54 It is currently anticipated that demolition of the following buildings and structures would be required as a result of the works to be managed from this compound:

- two residential properties on Bower End Lane, accessed from A525 Bar Hill Road; and
- one outbuilding on Bower End Lane accessed from A525 Bar Hill Road.

2.3.55 The A525 Bar Hill Road would be realigned over the A525 Bar Hill Road overbridge. The A525 Bar Hill Road overbridge would be built off line. Following construction, local traffic management measures would be in place during the works to rejoin the A525 Bar Hill overbridge with the current A525 Bar Hill alignment.

2.3.56 Temporary diversion of Madeley bridleway 1 would be required, diverting users adjacent to permanent route tie-ins and around the construction compound perimeter approximately 300m to the north via Red Lane and following the realigned A525 Bar Hill Road.

2.3.57 Two watercourse diversions would be required as a result of the works to be managed from this compound. An unnamed watercourse would be permanently diverted via the Drummer Stile inverted siphon for approximately 100m under Madeley cutting. A second unnamed watercourse would be permanently diverted via the Bar Hill aqueduct for approximately 150m over Madeley cutting.

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

Madeley tunnel east satellite compound and tunnelling and logistics areas

2.3.59 This compound would provide for civil engineering works and rail systems works and would:

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 100 civil engineering workers per day (approximately 145 workers at peak times) throughout much of the works period;
- support approximately 25 railway systems workers per day (approximately 40 workers at peak times);
- be accessed via the A525 Bar Hill Road from the east and via a haul road along the north of the route;
- be managed from A519 Newcastle Road main compound for civil engineering works; and
- be managed from Stone railhead main compound for railway systems works.

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

- Madeley tunnel southern portal and headhouse;
- Madeley twin bored tunnel;
- railway installations works; and
- finalisation works including site reinstatement, landscaping and planting.

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

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

Madeley tunnel west satellite compound

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

- be operational for approximately six years and nine months, commencing during 2020;
- support approximately 20 civil engineering workers per day (approximately 25 workers at peak times) throughout much of the works period;
- support approximately 10 railway systems workers per day (approximately 10 workers at peak times) throughout much of the works period;
- be accessed via the A525 Bar Hill Road from the east and via a haul road along the north of the route;
- be managed from A519 Newcastle Road main compound for civil engineering works; and
- be managed from Stone railhead main compound for railway systems works.

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

- Madeley tunnel northern portal, surface water pumping station and headhouse;
- railway installations works; and
- finalisation works including site reinstatement, landscaping and planting.

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

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

Checkley Brook viaduct satellite compound

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

- be operational for approximately four years and three months, commencing during 2020;
- support approximately 30 civil engineering workers per day (approximately 45 workers at peak times) throughout much of the works period;
- be accessed via Checkley Lane from the west; and
- be managed from A519 Newcastle Road main compound.

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

- Checkley South embankment;
- Wrinehill South culvert;
- Madeley Bridleway 2 realignment;
- Madeley Bridleway 2 accommodation underbridge, incorporating a culvert;
- Madeley Footpath 5 diversion;
- permanent closure of Madeley Bridleway 5;
- Checkley Brook viaduct; and
- finalisation works including site reinstatement, landscaping and planting.

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

2.3.70 Madeley Bridleway 5 would be permanently closed between Madeley Footpath 28 and Madeley Bridleway 2. A temporary alternative route for Madeley Bridleway 5 would be required, diverting the bridleway 50m north of its existing alignment. Following completion of construction, Madeley Bridleway 5 would be diverted via the existing Madeley Footpath 28, which would be upgraded to a bridleway.

2.3.71 Madeley Bridleway 2 would be permanently realigned via the Madeley Bridleway 2 accommodation underbridge. Madeley Bridleway 2 would be temporarily realigned 50m north of its existing alignment during the construction period over a period of approximately one year and six months.

2.3.72 Diversion of two unnamed watercourses would be required to enable the construction of the Checkley South embankment. One watercourse would be permanently diverted via Wrinehill South culvert for approximately 100m. A second watercourse would be permanently diverted for approximately 300m via a culvert at Madeley Bridleway 2 accommodation underbridge.

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

Construction waste and material resources

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

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

Commissioning of the railway

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

Construction programme

2.3.77 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																																
Bored Tunnels and 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 describes the envisaged operational characteristics of the Proposed Scheme and how they change when the remainder of 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 Whitmore Heath to Madeley 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 Sunday.

2.4.3 In this area, trains would run at speeds of 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 describes the anticipated maintenance regime for the Proposed Scheme.

2.4.5 It is intended 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 and milling 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 in Pipe Ridware, in the Fradley to Colton area (CA1) 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 during the day when maintenance activities are being undertaken over a number of nights without returning to the HS2 Crewe IMD. Further information on the maintenance loops can be found in Volume 2, CA1 Fradley to Colton. Further information on the HS2 Crewe IMD can be found in Volume 2, CA5 South Cheshire.

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

2.5.1 The strategic, route-wide and route corridor alternatives to the Proposed Scheme and local alternatives considered prior to November 2015 are presented in Volume 1 and in the Alternatives report as an appendix to the Volume 1. The local alternatives

considered for the Proposed Scheme within the Whitmore Heath to Madeley area since the route announcement in November 2015 are described in this section.

2.5.2 In this area, the route of the Proposed Scheme would be in tunnel in two locations, one passing to the west of Whitmore and one passing to the south-west of Madeley.

2.5.3 As part of the design development process since November 2015, consideration has been given to the impact of the Proposed Scheme on residents of Whitmore Heath to Madeley, environmental receptors including Whitmore Wood and Barhill ancient woodlands and the impact on roads, including the A53 Newcastle Road.

2.5.4 Further consideration will be given to the construction and engineering options in this area, including the length of tunnels, design and construction methods, and alternative engineering options. Further detailed engineering studies are ongoing and will be reported in the formal EIA Report.

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 Whitmore Heath to Madeley 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 HS2 website[17]. 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 scheme 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;
- Staffordshire Wildlife Trust;
- Department for 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.

[17] 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 community, for example The Staffordshire Wildlife Trust, 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 to 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 exist in the Whitmore Heath to Madeley 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 Whitmore Heath to Madeley area is represented by the following county, borough, district and parish councils:

- Staffordshire County Council;
- Newcastle-Under-Lyme Borough Council;
- Whitmore Parish Council; and
- Madeley 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 resources and flood risk, amongst others topics.

3.4.4 Some key discussion and inputs gained from engagement with Staffordshire County Council, Newcastle-Under-Lyme Borough Council and Whitmore Parish Council include:

- inputs to the Proposed Scheme from Whitmore Parish Council during a site visit of the Whitmore Heath area;
- discussions regarding 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 to the landscape and visual assessment;
- identifying 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 the 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 Whitmore Heath Action Group.

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 to 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 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 Fourteen 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. The purpose of the consultation 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"[18] and the Government response issued in the "Decision Document HS2 Phase Two: West Midlands to Crewe Property Consultation 2015"[19].

3.6.7 A programme of property consultation events has been undertaken route-wide, in parallel to the working draft EIA process. Within the local area, a property consultation event was held for landowners and individuals at Whitmore and District Village Hall on the 23 January 2016 and The Madeley Centre on the 29 January 2016. The purpose of the property consultations were 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 Whitmore Heath to Madeley 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.

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

[19] 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

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 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 Whitmore Heath to Madeley area since the route announcement in November 2015, and which are informing the Proposed Scheme are:

- retention or realignment of PRoW;
- potential impact of noise during construction and operation of the Proposed Scheme, particularly at Whitmore Wood and the surrounding area;
- potential impacts on landscape character and visual receptors, with a key consideration being the impact of the Proposed Scheme at Whitmore Wood;
- the suitability of the geology and ground conditions below Whitmore Heath for the construction of the tunnel;
- mitigation measures for increased pressure on local roads as a result of road closures or construction traffic particularly on the A53 Newcastle Road;
- provision of access to severed agricultural land, including access under viaducts and the provision of farm access tracks; and
- refining the location of balancing ponds and environmental mitigation to minimise the loss of agricultural land.

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 is 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 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 Whitmore Heath to Madeley 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 of the likely impacts and significant effects of the construction and operation of the Proposed Scheme in the Whitmore Heath to Madeley 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)[20] 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 function or service provided is 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[21] 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, CA4 Map Book.

[20] 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.
[21] 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 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 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. This is 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 Whitmore Heath to Madeley 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 underlying geology mapped by the BGS[22] in the south of the area at Whitmore and Whitmore Heath is sandstone of the Wildmoor Sandstone Member of the Wilmslow Sandstone Formation. Whitmore Heath is underlain by sandstone and conglomerate of the Chester Formation. The Salop Formation borders the sandstones to the north. This mostly comprises red-brown mudstone, although it also includes narrow bands of sandstone, pebbly sandstone and conglomerate, extending to the west of Hey Sprink. A full description of the geological characteristics of this area is provided in Section 10, Land Quality.

4.3.3 Sandstone of the Halesowen Formation is found west of Hey Sprink and northwards to the west of Madeley. There is an outcrop of the Chester Pebble Beds Formation to the west of Madeley, which then borders Sidmouth Mudstone further west and north. The pebble beds include pebbly sandstone, whilst the Sidmouth Mudstone is contrasting and includes structureless mudstone and siltstone, which continues northwards to Wrinehill.

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

4.3.4 There are no superficial deposits mapped over substantial parts of the southern part of this area over the sandstone formations. Alluvial deposits are found in a relatively shallow, narrow valley system, which is cut into the Wildmoor Sandstone Member north and south of Whitmore. Alluvium is also found in the main channel of the River Lea and in association with the Checkley Brook further north. These deposits mostly comprise consolidated silty clay, but also contain silt, sand, peat and gravel. A very small pocket of River Terrace sand and gravel deposits is also mapped on the eastern valley side to the south of Whitmore.

4.3.5 Peat deposits are shown in the Lea Valley west of Whitmore Heath and Whitmore Wood. Superficial till deposits are also mapped on the eastern valley side on the shallow, lower slopes, extending north-west of Whitmore Heath. These comprise unsorted material ranging in size from clay to boulders (hence also commonly referred to as Boulder Clay), deposited by glaciers.

4.3.6 In the northern part of the area, glaciofluvial deposits interspersed with till deposits overlie the bedrock. The glaciofluvial deposits comprise sand and gravel and are typically found on the shallower, lower slopes. The glacial till is typically found on moderate, mid-slopes.

Topography and drainage

4.3.7 The main topographic feature in this area is an elongated plateau in the south with a steep scarp slope facing west into the Lea Valley. The plateau is around 165m to 170m above Ordnance Datum (AOD) and is aligned roughly north to south. The steep scarp slope is eroded with gullies and small valleys and the ground falls to the lower slopes of the Lea Valley at 105m to 120m AOD, where the gradients are generally shallow.

4.3.8 The Lea Valley continues northwards to Madeley at approximately 115m AOD. The topography becomes more complex to the north-west of Madeley, with altitudes reaching 140m to 170m AOD to the east and west of the Lea Valley respectively.

4.3.9 Land at risk of flooding by rivers is widespread throughout the area, particularly between Whitmore and Madeley, and in the northern reaches, to the south-east of Checkley. In the south, at Whitmore, the flood risk is associated with the Meece Brook, whilst to the west of Whitmore Heath and Whitmore Wood and as far north as Madeley, the flood risk is associated with the River Lea, and further north, also with the Checkley Brook. This land is classed as predominantly Flood Zone 3, in which there is a 1 in 100 or greater annual probability of flooding. Further details are provided in Section 15, Water resources and flood risk.

Description and distribution of soil types

4.3.10 The characteristics of the soils are described by the Soil Survey of England and Wales[23],[24] and shown on the National Soil Map[25].

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

4.3.11 There are three groups of soil associations in this area. The first comprises coarse-textured topsoils of loamy sand, sandy loam or organic sand, overlying sandy loam, sand or sandstone. The associations included in this group are Bridgnorth, Goldstone and Wick. Soil profiles are well drained, of Wetness Class[26] (WC) I. Goldstone soils are characteristically very acidic, and are mostly under woodland or heath.

4.3.12 The second group comprises clay loam, silty clay loam or sandy clay loam topsoils over clay or clay loam subsoils of the Brockhurst 1, Whimple 3, Hodnet and Clifton associations. These soils are typically imperfectly (WC III) or poorly (WC IV) drained.

4.3.13 The third group comprises peat of the Altcar 1 association. Where drained, these soils are typically of WC I; where undrained, they are susceptible to waterlogging and are poorly to very poorly drained (WC IV to VI).

Soil and land use interactions

Agricultural land quality

4.3.14 The principal soil/land use interaction in the Whitmore Heath to Madeley area 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 site.

4.3.15 The main soil properties that affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility.

4.3.16 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[27] limitations of the land.

4.3.17 The local agro-climatic data for the area have been interpolated from the Meteorological Office's standard 5km grid point dataset[28] for three points within the area. The data show climate in the area to be cool and moist. The number of Field Capacity Days (FCDs), when the soil moisture deficit is zero, ranges from 187 to 192 days per year. This is higher than average for lowland England (150 days) and generally constrains agricultural cultivations and soil handling for relatively long periods over winter. Crop moisture deficits are moderate to moderately small.

4.3.18 Site factors include gradient and micro-relief, which are likely to be limiting to agricultural land quality throughout the area, particularly around Whitmore Heath and west of Madeley. Flood risk is also likely to be limiting to agricultural land quality within the River Lea valley and potentially south-east of Checkley. Further details are provided in Section 15, Water resources and flood risk.

4.3.19 On the floodplains of the River Lea and the Checkley Brook the flood risk limits land quality to Subgrade 3b.

[26] 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 WC VI which is very poorly drained.
[27] 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.
[28] Meteorological Office (1989), *Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations*.

4.3.20 The main physical limitations that result from interactions between soil, climate and site are soil wetness, droughtiness and a localised susceptibility to erosion. Each soil is allocated a WC based on soil structure, evidence of waterlogging and the number of FCDs. The topsoil texture then determines its ALC grade.

4.3.21 The first group of soil associations, comprising well drained, coarse-textured soil profiles in the Bridgnorth, Goldstone and Wick associations, is most likely to be affected by soil droughtiness. The severity of limitation will be determined by factors such as topsoil texture, stone content and depth to the sandstone bedrock. As crop moisture deficits are moderate to moderately small, droughtiness limitations are likely to be mostly slight, potentially to Grade 2. The Goldstone association is likely to have a more severe droughtiness limitation to Grade 4 or 5, as reflected in the typical land use of heath and woodland.

4.3.22 The second group comprising imperfectly drained (WC III) profiles with medium loamy topsoils (Brockhurst 1, Whimple 3, Hodnet and Clifton associations) will be limited by soil wetness and workability to Subgrade 3a, and those with heavier loamy topsoils will be limited to Subgrade 3b. Poorly drained (WC IV) profiles with medium loamy topsoils will be of Subgrade 3b, whilst those with heavier loamy topsoils will be of Grade 4.

4.3.23 The third group (peat soils of the Altcar 1 association) may be of WC I or IV, depending on whether underdrainage has been installed. Peaty profiles are likely to have sufficient water holding capacity to prevent any drought stress to crops, and, if well drained, they may have only slight or no physical limitation to agricultural land quality. However, these soils are susceptible to compaction when wet and wind erosion when dry. Peaty profiles of WC IV would be limited to Subgrade 3a by wetness and workability. If more severely or even permanently waterlogged, of WC V or VI, as is likely to be the case in the Lea Valley where the area is classified as Flood Zone 3, the profile would be classified as Grade 4 or 5.

4.3.24 Defra mapping[29] 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

4.3.25 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[30] and The Natural Choice: securing the value of nature[31], 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;

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

- protection of cultural heritage;
- providing raw materials; and
- providing a platform for human activities, such as construction and recreation.

4.3.26 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.

4.3.27 The floodplains of the River Lea and the Checkley Brook occupy land where water has to flow or be stored in times of flood, as set out in Section 15, Water resources and flood risk. Environment Agency mapping shows substantial areas to be at risk from flooding, with the soils functioning as water stores for flood attenuation, as well as providing ecological habitat.

Land use

Land use description

4.3.28 Agricultural land use in this area is mostly pasture, used to support dairy enterprises, with a number of beef and sheep enterprises also present. The fields are regular in shape and medium to large in scale, reflecting the size of the farm holdings. The area also includes equestrian enterprises north of Madeley.

4.3.29 Woodland is found predominantly around Whitmore Heath, although there are some smaller blocks near Madeley. The larger blocks include Whitmore Wood, Hey Sprink, Barhill Wood and Wrinehill Wood.

4.3.30 A number of environmental designations potentially influence land use within the Whitmore Heath to Madeley 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 that seek to retain and enhance the landscape and biodiversity qualities and features of farmland. These are associated with the Environmental Stewardship Scheme (the Entry Level Scheme (ELS) or Higher Level Scheme (HLS)), or the Countryside Stewardship Scheme, which has replaced Environment Stewardship. Holdings with land entered into an agri-environment scheme are identified in Table 2.

Number, type and size of holdings

4.3.31 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 farm owners and occupiers. Other farm holdings may be identified as survey work continues and the design develops.

4.3.32 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
Whitmore Hall	Dairy	365	Tele-communications mast; shoot; commercial fishery; livery.	ELS and HLS	High
Moat Farm	Beef cattle	89	None	None	Medium
Snape Hall Farm	Dairy and arable	105	3ha of commercial forestry	None	High
Madeley Park Farm	Beef, sheep and pigs	91	Farm abattoir and shop (butchers)	ELS	Medium
Manor Farm	Dairy	152ha self-contained dairy unit within 660ha overall holding	Woodland let for paintball; ponds let for fishing; barn conversions let; shoot	ELS	High
Land at Wood Croft	Equestrian (semi-commercial)	6.2	None	None	Low
Bar Hill House Farm	Sheep, pigs and cattle	36	Farm butchery and shop; pond let for fishing	None (formerly ELS)	Medium
Netherset Hey Farm	Dairy; free range poultry	324	Shoot	None	High
Bar Hill Farm	Beef and arable	576	Shoot and agricultural contracting	None	Medium
Bower End Farm	Beef and sheep	25	None	None	Medium
Beechwood Farm	Beef and sheep	105	Shoot	Countryside Stewardship	Medium
Wrinehill Hall Farm	Dairy	230	None	None	High
Wrinehill Mill Farm	Equestrian	22	Buildings let to Wrinehill Hall Farm; building let	None	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
			for children's swimming lessons		

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 would be 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 identified 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 or other open 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 would be resumed, provided good practice techniques are used to handle, store and reinstate soils. Some poorly or very poorly drained land or land with heavier textured soils, particularly the Altcar 1, Brockhurst 1 and Clifton 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 or 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 design of the Proposed Scheme 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 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 floodplain storage area replacement, 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 would be likely to require approximately 220ha of agricultural land within the Whitmore Heath to Madeley area during the construction phase, of which approximately 50ha (23%) 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 Whitmore Heath to Madeley area.

4.4.7 BMV land in this local area is a receptor of low sensitivity and the potential effect of the Proposed Scheme in the Whitmore Heath to Madeley area, 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. Based on the current design, overall for the Proposed Scheme, it is estimated that there would not be any significant surplus of topsoil or subsoil material arising. Some permanently displaced soils may be used to restore land to agriculture or other uses with slightly deeper topsoil and subsoil layers, where appropriate. This could improve the quality of agricultural land locally, for example where droughty soils are limited by soil depth, subject to the soil resource plans 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[32]. These principles would be followed throughout the construction period.

4.4.11 Peaty, clayey and seasonally waterlogged soils (including Altcar 1, Brockhurst 1 and Clifton 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. Compliance with the draft CoCP would ensure the magnitude of impact on soil would be low and the significance of the effect would be negligible and not significant.

4.4.12 The disturbance of peat soils has implications for carbon emissions and biodiversity. In view of this the disturbance of deep peat soils would be reduced where possible during the design of the Proposed Scheme. 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.

Impacts on holdings

4.4.13 Land may be required from holdings both permanently and temporarily (i.e. the latter only required 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 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 currently unknown but will be reported in the formal EIA Report.

Impacts on holdings

4.4.17 The potential permanent effects from the construction of the Proposed Scheme on individual agricultural and related interests are summarised for those holdings that

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

have been surveyed in Table 3. 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
Whitmore Hall	Low	Low	Negligible	Moderate adverse
Moat Farm	Negligible	Negligible	Negligible	Negligible
Snape Hall Farm	Medium	Medium	Low	Major/moderate adverse
Madeley Park Farm	Negligible	Negligible	Negligible	Negligible
Manor Farm	Medium	Medium	Medium	Major/moderate adverse
Land at Wood Croft	Medium	Medium	Low	Minor adverse
Bar Hill House Farm	Medium	Medium	Low	Moderate adverse
Netherset Hey Farm	Negligible	Negligible	Negligible	Minor adverse
Bar Hill Farm	Negligible	Medium	Negligible	Moderate adverse
Bower End Farm	Medium	Negligible	Negligible	Moderate adverse
Beechwood Farm	Negligible	Medium	Low	Moderate adverse
Wrinehill Hall Farm	Low	Low	Low	Moderate adverse
Wrinehill Mill Farm	Negligible	Negligible	Negligible	Negligible

4.4.18 Overall, the construction of the Proposed Scheme would potentially affect 13 holdings in this area. On the basis of information currently available, eight could experience moderate or major/moderate adverse permanent effects from construction, which would be significant. No holdings are anticipated to experience major adverse effects.

4.4.19 Five dairy units, which are generally more susceptible to the effects of severance than other farm holdings, would be affected by the Proposed Scheme: Whitmore Hall, Snape Hall Farm, Manor Farm, Netherset Hey Farm and Wrinehill Hall Farm. Of these, the greatest permanent adverse effects are likely to occur at Snape Hall Farm and

Manor Farm, both of which are expected to incur major/moderate adverse effects from a combination of the proportion of land required and the impacts of severance.

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 at this time, current indications are that the effect on BMV agricultural land during construction would be minor adverse in this area, which is not significant.

4.4.23 On the basis of information currently available, eight of the 13 farm holdings within this area would experience moderate or major/moderate adverse permanent effects from construction, which would be significant. No farms are anticipated to experience a major adverse effect. Two farms are anticipated to experience major/moderate adverse effects, principally from the impacts of the proportion of land required and severance. Six farms are anticipated to experience moderate adverse effects from a combination of impact of severance and the proportion of land required.

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 is 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. There are no farm buildings close to the Proposed Scheme, although further work is required to identify if any significant effects on the use of the closest buildings at Snape Hall Farm, Bower End Farm and Wrinehill Hall Farm would occur.

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 construction and operation of the Proposed Scheme within the Whitmore Heath to Madeley area.

5.1.2 Nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), fine particulate matter (PM10, PM2.5) and dust 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 NBC has been undertaken. The purpose of this engagement has been to obtain relevant baseline information. Engagement with NBC 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, CA4 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 within the Whitmore Heath to Madeley area are emissions from road vehicles and agricultural activities. The main roads within the area are the M6, the A53 Newcastle Road (which continues as the A53 Whitmore Road), the A525 Bar Hill Road, the A51 London Road and the A5182 Trentham Road. There are industrial emission sources in the region, however, none of these are considered to have an effect on local air quality in the area.

5.3.2 Estimates of background air quality have been obtained from the Defra for the baseline year of 2015. The data are estimated for 1km grid squares for NO_x, NO_2, 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 is currently one diffusion tube site located within the Whitmore Heath to Madeley area for monitoring NO2 concentrations. Measured concentrations in 2015 at 'Collingwood', 3 Newcastle Road, Madeley, were within the air quality standard.

Air quality management areas

5.3.4 There are no air quality management areas within the Whitmore Heath to Madeley area.

Receptors

5.3.5 Several locations have been identified in the study area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust-generating activities or traffic routes during construction and operation of the Proposed Scheme. Most of the receptors located close to the route are residential.

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 as being suitable to reduce impacts to as low a level as 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 will 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;
- 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 NO_2, PM10 and PM2.5 concentrations.

5.4.5 Construction activities, such as demolition, earthworks, construction and trackout[33], have been assessed for their risk to have an effect on dust soiling and human health[34]. There are residential receptors located within 350m of these activities in this area.

5.4.6 In the absence of mitigation, there is a negligible risk of dust soiling and human health effects arising from demolition activities at receptors in the Whitmore Heath to Madeley area. For earthworks, there is a medium risk of dust soiling but low risk of human health effects at receptors close to the works along the route. There is a high risk of dust soiling at receptors on the A525 Bar Hill Road as a result of construction of Madeley tunnel. There is a medium risk of dust soiling at other receptors as a result of construction of the rest of the Proposed Scheme. There is, however, a low risk of human health effects from construction activities at all locations. For trackout, there is a high risk for dust soiling at receptors around Madeley tunnel, and a medium risk of dust soiling at other receptors along the rest of the works for the Proposed Scheme. There is a low risk for human health effects at all receptors along the construction 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 M6, the A51 London Road, the A53 Newcastle Road, the A525 Bar Hill Road and the A5182 Trentham 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 expected on the M6, the A51 London Road, the A53 Newcastle Road, the A5182 Trentham Road, the A525 Bar Hill/Newcastle Road and Manor Road. A detailed assessment of air quality impacts from traffic emissions in the area will be undertaken and reported in the formal EIA Report.

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 all receptors within 200m of construction routes. 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.

[33] 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.

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

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 are proposed at this stage in relation to air quality during construction of the Proposed Scheme 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 and construction traffic emissions and, therefore, no significant residual effects are considered likely.

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 the 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 Whitmore Heath to Madeley 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, CA4 Map Book.

6.2 Scope, assumptions and limitations

6.2.1 The scope, key assumptions and limitations for the community assessment are set out in Volume 1 and the draft SMR.

6.2.2 The assessment of in-combination effects will draw upon the findings of other technical disciplines (for example air quality, sound, noise and vibration, landscape and visual assessment, 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 areas 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 Whitmore Heath to Madeley area covers approximately 9km of the Proposed Scheme in Staffordshire. It extends from Chorlton Mill in the south to Wrinehill Mill in the north, passing near to Baldwin's Gate, Whitmore, Whitmore Heath to Madeley.

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 Baldwin's Gate, Whitmore and Madeley. The area is characterised by small clusters of dwellings and individual dwellings within rural areas close to the Proposed Scheme.

6.3.3 There is one promoted PRoW in the Whitmore Heath to Madeley area, the Newcastle Way.

6.4 Effects arising during construction

Avoidance and mitigation measures

6.4.1 During the construction phase, PRoW routes would be maintained and would remain operational wherever reasonably practicable. Where PRoW would cross the Proposed Scheme and require diversion, generally the alternative PRoW crossing of the Proposed Scheme would be constructed prior to any closure of existing routes. Where PRoW cross the Proposed Scheme in proximity to the existing alignment, a temporary alternative alignment may be required before the new crossing is completed.

Assessment of impacts and effects

Temporary effects

Residential properties

6.4.2 The area required for the construction of Madeley cutting, Madeley tunnel southern portal and the realignment of the A525 Bar Hill Road would be located adjacent to a group of six properties located to the west of Madeley (comprising two rural farms and four detached properties on the A525 Bar Hill Road). The A525 Bar Hill satellite compound, the Madeley tunnel east satellite compound and the Madeley tunnel west satellite compound would also be located in proximity to the properties. Access to the properties would be maintained via the A525 Bar Hill Road, however this route would be used as a construction traffic route, possibly leading to delays. The possible reduction in accessibility and the presence of construction activities is likely to result in temporary isolation for this group of properties. A major adverse effect has been identified for the residents, which would be significant.

6.4.3 The construction of the Madeley tunnel including associated compounds would require part of the land associated with three properties accessed from the A525 Bar Hill Road. The temporary loss of this land is not considered to be significant at a community level.

Community facilities

6.4.4 It is currently anticipated that there will be no temporary effects on community facilities as a result of the Proposed Scheme.

Recreational facilities

6.4.5 It is currently anticipated that there will be no temporary effects on recreational facilities as a result of the Proposed Scheme.

Open space and PRoW

6.4.6 Land required for the construction and operation of the Proposed Scheme would result in severance of one promoted PRoW, the Newcastle Way, which is 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

6.4.7 The construction of the Lea North embankment would require the demolition of one residential property on Manor Road known as Hey House Lodge. This residential property would be permanently lost.

6.4.8 The construction of Madeley cutting would require the demolition of two residential properties accessed from the A525 Bar Hill Road, located to the east of Barhill Wood. These residential properties would be permanently lost.

6.4.9 The construction of a road to access the proposed Madeley tunnel southern and northern headhouses and a balancing pond for railway drainage would permanently require a small area of land from three properties accessed from the A525 Bar Hill Road. Although the impact on the individuals may be significant, due to the loss of garden, it would not result in a significant effect at a community level.

Community facilities

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

Recreational facilities

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

Open space and PRoW

6.4.12 Land required for the Proposed Scheme would result in severance of one promoted PRoW, the Newcastle Way, which is considered to provide a recreational resource. The Proposed Scheme would include permanent and, as required, temporary realignment for each PRoW. The effect on these PRoW would not be significant.

Other mitigation measures

6.4.13 No other mitigation measures have currently been identified.

Summary of likely residual significant effects

6.4.14 There would be a major adverse temporary isolation effect on six properties to the west of Madeley (comprising two rural farms and four detached properties on the A525 Bar Hill Road).

6.5 Effects arising from operation

Avoidance and mitigation measures

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

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 Specific mitigation measures, where required, will be described in the formal EIA Report. These could include improvement or provision of community resources, as appropriate.

Summary of likely residual significant effects

6.5.4 A summary of any 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 Whitmore Heath to Madeley 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 focusses on the extent to which the Proposed Scheme would affect designated and non-designated heritage assets. Impacts on assets as a result of the Proposed Scheme would occur largely through the physical removal and alteration of heritage assets and changes to their setting.

7.1.3 Maps showing the location of the key environmental features can be found in Volume 2, CA4 Map Book. Only designated heritage assets within the Whitmore Heath to Madeley area are shown on maps CT-10-115b to CT-10-118a. 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 with regard to the nature of the cultural heritage assets within the area. 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 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 the effects on the historic landscape will be considered in the formal EIA Report.

7.2.3 A detailed assessment of all known designated and non-designated heritage assets 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[35] data examined covers the majority of the study area although there were some areas for which data was unavailable; and

[35] 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 surveys. 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 and local archives, has been used to provide information relating to the potential archaeological 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;
- historical 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 from the Proposed Scheme.

7.3.4 The following designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

- The Milepost, Grade II, on Bar Hill Road; and

- Hey House, Madeley, Grade II.

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):

- Whitmore Conservation Area. An exceptionally well-preserved historic town which combines siting, design and materials of buildings, including St Mary and All Saints Church, Whitmore Hall Lodge and their landscape setting;
- Madeley Conservation Area. An area characterised by the Pool which lies at its centre, views across it to historic buildings, trees within the village and historic hedgerows, the Church of All Saints, Madeley Mill and a variety of other historic buildings constructed with local materials;
- Chorlton Mill, Grade II;
- Former Cock Inn, Stone Road, Stableford, Grade II;
- Station House, Baldwins Gate, Grade II;
- Church of St Mary and All Saints, Whitmore, Grade II*;
- the following designated memorials lie within the curtilage of St Mary and All Saints Church, Whitmore:
  - Rhodes Memorial approximately 13m south of the Church of St Mary and All Saints, Grade II; Chest tomb; probably late 18th century; sandstone ashlar; in plan;
  - Williams Memorial approximately 25m south-west of Church of St Mary and All Saints, Grade II; tomb; circa 1835; sandstone ashlar; rectangular plan;
  - Fitch Memorial, Grade II; tomb; mid-19th century; sandstone ashlar; rectangular plan;
  - Malkin Memorial approximately 14m north-west of Church of St Mary and All Saints, Grade II; Chest tomb; early 19th century; sandstone ashlar; rectangular plan.
- Whitmore Hall Lodge, Grade II including Gate Piers to Whitmore Hall, immediately to the west of Whitmore Hall Lodge, Grade II;
- cottages dated 1877, Whitmore, Grade II;
- house, approximately 130m west north-west of the Church of St Mary and All Saints, Whitmore;
- milepost, at NGR SJ 7980 4054 , Grade II;
- Lake House, Whitmore, Grade II;
- Snape Hall Farmhouse, Grade II;
- Manor Farmhouse, Madeley, Grade II;

- Offley Well Head, Madeley, Grade II;
- scheduled monument: Site of Old Madeley Manor: a moated site with late 16th century house, gardens and a watermill;
- Town House, Madeley, Grade II;
- Offley Almshouses and front boundary wall, Grade II;
- Bridge Cottage (Part) Ye Olde House, Madeley, Grade II;
- School House, Madeley, Grade II;
- Sir John Offley Primary School, Madeley, Grade II;
- K6 telephone kiosk outside school, Madeley, Grade II;
- Church of All Saints, Madeley, Grade II; Parish church; tower: probably circa 1400, with stepped buttresses and rectangular stair turret at south-west corner;
- the following designated memorials lie within the graveyard of All Saints, Madeley:
    - Rowley Memorial, approximately 4m south of south porch of Church of All Saints, Grade II;
    - Buckley Memorial, approximately 6m south of south transept of Church of All Saints within 2km of the Proposed Scheme, Grade II;
    - Timmis Memorial, approximately 8m west of west tower of Church of All Saints, Grade II;
    - Brice Storr Memorial, approximately 2m south-east of chancel of Church of All Saints, Grade II;
    - Rowley Memorial, approximately 15m south east of south-east corner of south transept of Church of All Saints, Grade II;
    - Broade/Halmarach Memorial, approximately 1m north of north chancel chapel of Church of All Saints, Grade II;
    - Wilkinson Memorial, approximately 3.5m north of the north-east corner of north transept of Church of All Saints, Grade II;
    - Timmis Memorial, approximately 4m north of the north-west corner of north transept of Church of All Saints, Grade II;
    - unidentified chest tomb, approximately 6m west of south porch of Church of All Saints, Grade II;
    - Cope Memorial, approximately 6m west of the south-west corner of south porch of Church of All Saints, Grade II;
    - Timmis Memorial, approximately 5m south of chancel of Church of All Saints, Grade II.

- Birches Farmhouse, Madeley, Grade II;
- The Old Hall, Madeley, Grade II*; and
- The White House, Madeley, Grade II.

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):

- one scheduled monument: Multivallate Hillfort at Berth Hill;
- Maer Hall Registered Park and Garden, Grade II;
- Milepost at NGR SJ 78525 39678, Grade II;
- Cowhouse attached to right angles to east end of Number 181, Grade II;
- Aston Cliffe Farmhouse, Grade II;
- Whitmore Hall, Grade I;
- Old Stable Block, Whitmore, Grade II*;
- Bridge, Whitmore Hall Park, approximately 15 metres south east of Old Stable Block, Grade II;
- Mile post at NGR SJ 81306 41119, Grade II;
- Netherset Hey Farmhouse, Grade II;
- Lower Stoney Low House, Grade II;
- Farmhouse buildings to north of Lower Syoney Low House, Grade II;
- The White House, Betley, Grade II;
- Boat House approximately 250m east of Madeley Manor, Grade II;
- Madeley Manor and attached Conservatory, Grade II;
- Higher Thornhill Farmhouse, Grade II;
- Heighley Castle, Grade II and Scheduled Monument;
- The Cottage, Grade II;
- Milepost at NGR SJ 76340 46483;
- Wrinehill Bridge, Grade II; and
- Betley Conservation Area.

Non-designated assets

7.3.7 No non-designated heritage assets have yet been identified partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

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 (from south to north);

- Madeley Great Park, Deer Park, listed in the Staffordshire Historic Environment Record;
- North Staffordshire Railway – Stoke, Silverdale and Market Drayton, listed in the Staffordshire Historic Environment Record;
- a medieval moated site at Moor Hall, Madeley, listed in the Staffordshire Historic Environment Record;
- an extensive medieval and post medieval agricultural landscape with fields, boundaries and holloways[36], surviving in part as earthworks visible in LiDAR data and in part as cropmarks visible on aerial photographs, east of Beechfields;
- Wrinehill Wood including earthworks and wood bank, identified in LiDAR;
- incised country lanes crossing the landscape east to west, Madeley to A525 Bar Hill, Bar Hill Road, and Manor Road), identified from site visits and historic maps;
- linear features of unknown purpose and date seen as cropmarks on aerial photographs to the north of the Madeley Chord and the disused Silverdale line;
- linear features of unknown purpose and date seen as cropmarks on aerial photographs to the south of Bar Hill Road and Red Lane;
- a brick kiln, near Wrinehill Hall, Madeley listed in the Staffordshire Historic Environment Record; and
- Wrinehill Hall Garden, listed in the Staffordshire Historic Environment Record.

7.3.9 The following non-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):

- Mainwaring Arms public house, A53 Newcastle Road, Whitmore, a locally listed building, listed in the Staffordshire Historic Environment Record;
- a former Post Office, Three Mile Lane, Whitmore, listed in the Staffordshire Historic Environment Record;
- Whitmore shrunken village, earthworks associated with Whitmore Village, west of present park, listed in the Staffordshire Historic Environment Record;

[36] A historic routeway, sunken in relation to surrounding ground-level as the result of use over long periods of time.

- a possible barrow, Whitmore Heath, located approximately 140m east of the Proposed Scheme, which is recorded in the Staffordshire Historic Environment Record;
- a reservoir at Whitmore, associated with construction of the railway, recorded in the Staffordshire Historic Environment Record;
- Madeley Great Park, a medieval deer park, with earthworks extant in the landscape, recorded in the Staffordshire Historic Environment Record;
- North Staffordshire Railway – Stoke, Silverdale and Market Drayton, constructed in 1860s and taken out of service in 1998, recorded in the Staffordshire Historic Environment Record;
- a possible barrow, near Madeley Old Manor, recorded in the Staffordshire Historic Environment Record;
- features associated with Old Madeley Manor, including the garden and Old Madeley Hall Quarry, recorded in the Staffordshire Historic Environment Record;
- Nethersethey Deer Park, a medieval period deer park, recorded in the Staffordshire Historic Environment Record;
- Hey House Farm, Manor Road, Madeley adjacent to Grade II listed Hey House, recorded in the Staffordshire Historic Environment Record;
- a signal box associated with the London and North Western Railway, Madeley, recorded in the Staffordshire Historic Environment Record;
- the Leycett to Madeley Mineral Railway, a private railway connecting the Colliery to the WCML, recorded in the Staffordshire Historic Environment Record;
- The Old Vicarage, a locally listed building on Vicarage Lane, Madeley, recorded in the Staffordshire Historic Environment Record;
- Townhouse Farm, a locally listed building in Madeley, recorded in the Staffordshire Historic Environment Record;
- Wesleyan Methodist Chapel, a locally listed building, Madeley, recorded in the Staffordshire Historic Environment Record;
- Madeley Pool and The Old Hall, Poolside, Madeley, recorded in the Staffordshire Historic Environment Record;
- a reservoir near theGrand Junction Railway, Madeley, recorded in the Staffordshire Historic Environment Record;
- earthwork mounds, interpreted as possible barrows near A525 Bar Hill Road, Madeley, recorded in the Staffordshire Historic Environment Record;
- flint finds, field south of Bar Hill House Farm, recorded in the Staffordshire Historic Environment Record;

- Moss House Farm, Madeley a non-designated farmhouse, recorded in the Staffordshire Historic Environment Record;
- Wrinehill Wood, containing earthworks and possible assarting dating to the medieval period, recorded in the Staffordshire Historic Environment Record;
- a pond bay, Madeley, recorded in the Staffordshire Historic Environment Record;
- A brick kiln, near Wrinehill Hall, Madeley part of the brick making industry using the local geology, recorded in the Staffordshire Historic Environment Record; and
- Wrinehill Hall Garden and Wrinehill Mill and mill pond, recorded in the Staffordshire Historic Environment Record.

Cultural heritage overview

7.3.10 At the end of the last glaciation, the ice sheet covering the landscape began to retreat, dumping unsorted boulder clays and sands and gravels in the glacial outwash and creating the kettleholes in which developed the meres and mosses that are characteristic of the Staffordshire-Shropshire border. Research into the geoarchaeological potential of the area, based on geological and topographical evidence indicates the survival of Pleistocene deposits, particularly around the Madeley region, where a palaeolake is recorded. There is some debate about the extent of the Devensian ice sheet in this area, with several areas containing potential for deposits of till and organic sediments, including at Baldwin's Gate. The earliest prehistory for the area dates from the Mesolithic period, where a number of flint tools including a late Mesolithic tool were found in Madeley Parish, near Bar Hill. The landscape to the west of the Proposed Scheme at Maer suggests a Late Prehistoric landscape, with the scheduled multivalliate hillfort monument at Maer. This western study area adjacent to the Proposed Scheme contains a low ridge running through to Madeley and Bar Hill, along which a number of earth mounds, interpreted as Bronze Age Barrows, are located.

7.3.11 The two major towns in this area, Whitmore and Madeley, are mentioned in the Domesday Book. Whitmore is recorded as consisting of five houses, including that of Ulfac.

7.3.12 The estate at Madeley forms the subject of a charter of 975, recording a grant made by King Edgar to Æthelwold, bishop of Winchester. The town of Madeley is recorded in the Domesday Books as a manor given to the Staffords in 1066, supporting four deer parks and a mill. Old Madeley Manor is recorded as early as 1348, when a licence to crenellate the Manor was granted to Ralph, Lord Stafford. In 1540 the manor was sold to Thomas Offley, who became Lord Mayor of London in 1556. After the union of the Offley and Crewe families in 1679 the manor house was abandoned. A Market Charter was granted to the town in 1341. The church, manor, and associated village at Madeley grew up around a crossroads.

7.3.13 Other smaller settlements surrounding these include Baldwin's Gate to the south-west of the Proposed Scheme, Acton to the east and Onneley to the west. The study area contains a number of earthworks that indicate the presence of former hamlets.

These include the shrunken village at Whitmore, the likely deserted medieval village of Radwood, near Radwood Fall Farm and the possible deserted medieval village of Wood Farm, Wrinehill. There does not appear to be a consistent pattern for siting of extant villages in the area. Some are on high ground, for instance Whitmore. Others are sited in valleys, such as Madeley, which developed for agricultural reasons. The village at Whitmore may have developed through association with the iron and forge industry. Enclosure of the fields in the area also affected the landscape during the post-medieval period and the role of local farmsteads.

7.3.14 By the late medieval period much of the character area comprised open fields, probably farmed by inhabitants of these scattered settlements. Around Madeley at Castle Lane former field plots occur as small re-planned enclosure, implying earlier field systems had been in place.

7.3.15 A notable addition to the historic landscape of Madeley is provided by the Grand Junction Railway, which was opened in 1837. A reservoir in the east of the study area, on the west side of the Grand Junction Railway, was built to supply locomotive watering troughs.

7.3.16 The geology surrounding Madeley contains good clay deposits, limestone and accessible coal seams. The extraction industry which developed around this geology led to rapid development of the Madeley Heath to the west of town in the 19th century. Growth of the area was assisted by the addition of the Silverdale line, the Madeley Chord and the Leycett to Madeley mineral railway. Older properties at Madeley evidence this use of local geology in texture variations and pebble inclusions resulting from local hand-fired kilns. Such kilns occur to the north near Lowermill House and at Wrinehill Hall. At this point, the route would enter a bored tunnel west of Madeley near Barhill ancient woodland and continue onto Checkley South embankment to the end of the Whitmore Heath to Madeley area. Whitmore Heath, where the Proposed Scheme would run underneath in a bored tunnel, was developed in the 1950s for residential properties.

7.4 Effects arising during construction

Avoidance and mitigation measures

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

- management measures that would be implemented for heritage 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 seeks to reduce impacts on heritage assets within the Whitmore Heath to Madeley area by the following measures:

- avoidance of the loss of or physical impacts on any scheduled monuments, registered parks or gardens, registered battlefields or listed buildings; and
- avoidance of Whitmore Conservation Area and Madeley Conservation Area, seeking to avoid settings impacts on the high-value built heritage assets it contains.

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, the setting of 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 The setting of Grade II listed Hey House, an 18th century country house, has already been altered as a result of the construction of the WCML 100m to the east and its current use as commercial kennels and cattery. However on its western and northern sides its historic relationships with the surrounding garden and landscape survive largely unaltered. Noise and movement of vehicles and plant associated with the construction of the Lea North embankment and Manor Road overbridge would affect these aspects of its significance and thereby its setting. This would constitute a medium adverse impact and moderate adverse effect.

7.4.7 The presence of the Snape Hall Road construction satellite compound, the excavation of the Madeley tunnel and the construction of the Checkley South embankment less than 200m to the north would all affect the setting of Grade II listed Snape Hall Farm. The historical and functional relationship of the farmhouse with the hill-slopes above it are an important element of its significance, and would be altered by noise and movements of vehicles and plant during the construction of these nearby elements of the Proposed Scheme. This would constitute a medium adverse impact and a moderate adverse effect.

7.4.8 Roadworks associated with the realignment of A525 Bar Hill Road and overbridge would affect the setting of Grade II listed Bridge Cottage (Part) Ye Olde House. The Cottage faces the road, and although the overbridge rises to obscure the A525 Bar Hill Road itself, noise and movement from the increased traffic and construction works associated with construction of the A525 Bar Hill overbridge would have a medium adverse impact and moderate adverse effect on the amenity of the cottage.

Permanent effects

7.4.9 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.

7.4.10 The Grade II listed milepost located on Bar Road, east of the route of the Proposed Scheme, will be impacted by road works. This is an asset of moderate value, with a low to moderate impact, which would result in a moderate adverse effect.

7.4.11 Extensive medieval and post-medieval agricultural landscape, with fields, boundaries, and holloways, survives to the west of the WCML at Madeley in part as earthworks visible in LiDAR data and in part as cropmarks visible on aerial photographs, running east from Beechfields Farm towards Bower End Farm. These are assets of low value. The Proposed Scheme will cut across them during construction, removing approximately 30% of the visible earthworks in this area. This constitutes a medium adverse impact and would result in a moderate adverse effect.

7.4.12 One significant effect would occur as a result of permanent impact on the setting of a heritage asset. This would be at the Grade II listed Hey House, an asset of moderate value. The setting of this 18th century country house has already been altered as a result of the construction of the WCML 100m to the east. Its current use as commercial kennels and cattery has led to the laying down of extensive hard-standing to the north, east and south upon which the temporary kennel structures stand. Notwithstanding these changes to its setting, its elegant main façade looks westwards across the rural landscape of the Lea Valley, these views being an important part of historic significance. Consequently, the house would be subject to a change in its setting due to the construction and presence of the Lea North embankment and Manor Road overbridge, obstructing these views to the north and west. This would constitute a medium adverse impact and moderate adverse effect.

Other mitigation measures

7.4.13 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 with the aim to reduce further the significant effects described above. These refinements will include the identification of:

- suitable locations for advance planting, to reduce impacts on the setting of heritage assets; and
- locations where the physical impact on below ground heritage assets can be reduced through the design of earthworks.

Summary of likely residual significant effects

7.4.14 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 including medieval and post-medieval landscape features east of Beechfield and the Grade II listed milepost on Bar Road. There would also be

permanent residual effects on the setting of the Grade II listed building Hey House due to the presence of the Proposed Scheme.

7.5 Effects arising during operation

Avoidance and mitigation measures

7.5.1 The following measures, as shown on Map Series CT-06, in Volume 2, CA4 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 to increasingly reduce impacts on the setting of the designated assets within the study area as it matures.

Assessment of impacts and effects

7.5.2 There will be no significant effects on heritage assets as the result of operational impacts from the Proposed Scheme. This is partly a reflection of the increasing proximity of the WCML, which means that heritage assets along the route already experience noise and movement impacts from the existing railway. The additional effect of the Proposed Scheme on heritage assets such as Hey House is therefore not considered to be significant.

Other mitigation measures

7.5.3 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures beyond those included within the Proposed Scheme design have been identified. Potential opportunities for further mitigation have not been identified at this time, but will be considered as part of the ongoing design development.

Summary of likely residual significant effects

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

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 Whitmore Heath to Madeley 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, Cheshire Wildlife Trust, Royal Society for the Protection of Birds, Woodland Trust, NBC, SCC and landowners has been undertaken. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, and 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, CA4 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 have been 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 consideration of impacts and effects reported in Sections 8.4 and 8.5.

8.3.2 The land required for the construction of the Proposed Scheme and adjacent to it consists mainly of agricultural land, woodland and villages. The Proposed Scheme in the Whitmore Heath to Madeley area would pass directly through Whitmore Wood, an Ancient Woodland Inventory Site (AWIS) and over marshy grassland within the Lea valley to the south of Madeley.

8.3.3 Statutory and non-statutory designated sites are shown on CT-10 Map Series in the Volume 2, CA4 Map Book.

8.3.4 Midlands Meres and Mosses Phase 1 Ramsar Site (Betley Mere SSSI component) is 1.7km to the north of the Proposed Scheme. The site supports rare species of plants associated with wetlands, such as elongated sedge, six stamened waterwort, needle spike-rush, and cowbane and marsh fern.

8.3.5 There are no statutory sites within 500m of the land required for the Proposed Scheme.

8.3.6 Four local wildlife sites (LWS) and four AWIS sites are considered to be potentially subject to significant effects, and are relevant to the assessment. Due to the habitats and species present, these sites are considered to be up to county/metropolitan value.

8.3.7 Whitmore Wood LWS and AWIS is a semi-natural woodland part of which is located within the land required for the construction of the Proposed Scheme. Large areas of the woodland have been replanted with conifers including larch (Larix spp) and a stand of semi-natural broadleaved woodland, with most of the diversity in the ground flora confined to rides and tracksides. A stream supports wet woodland vegetation.

8.3.8 Barhill Wood LWS and AWIS is a semi-natural broadleaved woodland and the northern edge falls within the extent of the Proposed Scheme.

8.3.9 Hey Sprink LWS and AWIS is a semi-natural broadleaved woodland located approximately 30m to the north east of the proposed scheme.

8.3.10 Grafton's Wood LWS and AWIS is a semi-natural woodland located approximately 40m to the north east of the proposed scheme.

8.3.11 A review of woodlands not currently listed on the Ancient Woodland Inventory (AWI), but that lie within the land that would be required for construction of the Proposed Scheme or within 500m of it, has been undertaken based on historical mapping. The review found the following woodland sites to be potentially ancient woodland, and which would be partially within the land required for construction of the Proposed Scheme:

- two unnamed woodland strips between Whitmore Wood and Hey Sprink; and
- area of remnant potential ancient woodland around Wrinehill Wood.

8.3.12 The review findings and any further ecology field surveys undertaken to assess this woodland will be provided in the formal EIA Report. On a precautionary basis pending the findings of field surveys, these woodlands are considered to be of up to county/metropolitan value.

8.3.13 In addition to the aforementioned woodlands, there are eight small areas of semi-natural lowland deciduous woodlands totalling an area of 0.1ha (which may qualify as habitats of principal importance, and local biodiversity action plan (BAP) habitats[37]), which would be within, or partly within, the land that would be required for

[37] Staffordshire Biodiversity Action Plan (BAP).

construction of the Proposed Scheme. On a precautionary basis pending the findings of field surveys, these woodlands are considered to be of up to district/borough value.

8.3.14 Other habitats located outside of the designated sites identified above and which are relevant to the assessment include the following main watercourses; Meece Brook, Checkley Brook and the River Lea, and three additional unnamed smaller watercourses (tributaries of the River Lea) all of which would be crossed by the land required for construction of the Proposed Scheme. The main watercourses are considered likely to be habitats of principal importance and local BAP habitats, and on a precautionary basis in the absence of survey information are considered to be of up to county/metropolitan value. The smaller unnamed watercourses are considered to be of up to district/borough value. These require compliance assessment under the Water Framework Directive (WFD)[38] and relevant surveys, such as fish, invertebrate and invasive plant species will be undertaken.

8.3.15 There are 12 ponds located within, or partly within, the land that would be required for construction of the Proposed Scheme. There are a further 57 ponds beyond the area required for construction and within 250m 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 up to county/ metropolitan value.

8.3.16 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 as Important hedgerows specified in the Hedgerows Regulations 1997[39]. 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.

8.3.17 Grassland outside designated areas that are within the land required for construction of the Proposed Scheme include floodplain grazing marsh within the Lea Valley to the west of Madeley. 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.

8.3.18 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 Whitmore Heath to Madeley area

Resource/receptor	Value	Rationale
Bats	Up to country/metropolitan for the majority of bat species, with potential for up to regional for some rarer species.	There are no records of roosting bats within the land required for construction of the Proposed Scheme, but there are records of roosts of common bat species such as pipistrelle species and brown long eared bat within 2km, and other records of Noctule, Daubenton's bat and Myotis species. The woodland and hedgerows are likely to be used by a range of bat species for foraging and commuting. Trees and buildings have been identified with potential to support roosting bats at

[38] EU Water Framework Directive http://ec.europa.eu/environemt/water/water-framework/index_en.html
[39].The Hedgerows Regulations (1997). SL1997 No 1160. Her Majesty's Stationery Office.

Resource/receptor	Value	Rationale
		numerous locations within the land required for construction of the Proposed Scheme, and a 100m buffer around it.
Otter and water vole	Up to county/ metropolitan	Populations of otter are rare in Staffordshire, although habitat suitable for this species is present along the watercourses and drainage ditches, and prints were observed along the Meece Brook during an on-site meeting. There are also records within 2km of the land required for 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. Records were identified along Meece Brook, within 2km of the land required for construction of the Proposed Scheme.
Hazel dormouse	Up to county/metropolitan	Populations of hazel dormice are rare in Staffordshire. Habitats suitable for this species do occur between Whitmore and Madeley, including areas of woodland situated within and adjacent to land required for construction of the Proposed Scheme. There are records of hazel dormouse from Wrinehill Wood which lies within approximately 150m of the Proposed Scheme.
Polecat	Up to county/metropolitan	Populations of polecat are rare in Staffordshire, and there are no records in this area, although suitable habitat is present. Incidental sightings of this species have been recorded within adjacent areas to the Whitmore Heath to Madeley area.
Great crested newt	Up to county/metropolitan	A number of records of great crested newts were identified within 500m of the land required for construction of the Proposed Scheme, indicating that populations are likely to be found within suitable habitat across the Whitmore Heath to Madeley area.
Birds	Up to county/metropolitan	There is suitable habitat for breeding and wintering birds across the farmland including in the woodlands, hedgerow network and grazing marsh. Notable records from within 2km include goshawk, firecrest and crossbill. Records of breeding barn owls have been identified within 1km of the land required for construction of the Proposed Scheme, and wintering waders such as lapwings are known to occur.
Aquatic and terrestrial invertebrates	Up to district/borough	Suitable habitat is abundant, particularly in watercourses such as River Lea, Meece Brook and Checkley Brook, and terrestrial habitats including woodland rides and edges, dead wood resource in mature trees, hedgerows, less intensively managed grassland and scrub.
Fish	Up to district/borough	Fish may be present in the Meece Brook, the River Lea and Checkley Brook and other unnamed smaller watercourses.

Resource/receptor	Value	Rationale
		There is one notable record of a European bullhead (a species listed on Annex II of the Habitats Directive[40]) from the River Lea.
Reptiles	Up to district/borough	Suitable habitat is present and there are records of adder, common lizard and grass snake within 2km of the land required for construction of the Proposed Scheme.
Badger	Up to district/borough	Suitable habitat is present within the land required for construction of the proposed scheme, and there are known records including within the land required for construction of the Proposed Scheme.

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 Map Series CT-06 in the Volume 2, CA4 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:
- construction of viaducts over Meece Brook and the River Lea which would avoid direct effects to these watercourses and allow free passage of wildlife beneath them including along the rivers and their banks;
- new woodland planting would help towards offsetting the losses of non-ancient woodland sites to enhance connectivity between remaining woodlands;
- provision of new ponds for those lost if they support great crested newts, (e.g. west of the Meece Brook, around the A53 Newcastle Road, south of the Manor Road overbridge, south of the A525 Bar Hill overbridge, south of Grafton's Wood), which would form part of the mitigation measures required to reduce any effects on great crested newts to not significant;
- provision of new species-rich hedgerows, using appropriate native species, to help towards offsetting 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, as well as in specific areas such ponds and surrounding areas;
- grassland habitat creation, including species rich and wet grasslands to help towards offsetting the losses from the Proposed Scheme; and

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

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 potential impacts and effects on ecological features as a consequence of construction of the Proposed Scheme. All assessments are on a precautionary basis at this stage while survey information is collected for the formal EIA Report and take account of the baseline ecological value as presented in Section 8.3 of this report.

8.4.4 A Habitats Regulations Assessment (HRA) was undertaken for Midland Meres and Mosses Phase 1 Ramsar site (HS2, 2012[41]). The Betley Mere section of the Ramsar site was screened out from the HRA on the basis that there were no potential effects.

8.4.5 The construction of the route through Whitmore Wood LWS/AWIS would result in the loss of approximately 6ha (33%) of the existing habitat, and would result in an effect on the integrity of the site which would be significant at the country/metropolitan level.

8.4.6 The loss of approximately 0.5ha along the edge of Barhill Wood AWIS (8% of the habitat area) would result in an effect on the integrity of the site which would be significant at the country/metropolitan level.

8.4.7 Approximately 0.05 ha (7%) of an unnamed strip of potential ancient woodland between Whitmore Wood and Hey Sprink lie within the boundary of the land required for construction of the Proposed Scheme, and would be lost. This would result in an effect which would be significant at the county/metropolitan level.

8.4.8 Area of remnant potential ancient woodland around Wrinehill Wood are included in the boundary of the land required for construction of the Proposed Scheme. These areas are specifically included for the purpose of woodland enhancement.

8.4.9 Construction would result in the loss of approximately 0.1ha of other semi-natural lowland broadleaved woodland. The permanent loss of this woodland would result in an effect that would be significant at up to the district/borough level.

8.4.10 The design of the Proposed Scheme includes viaducts across the Meece Brook and the River Lea. 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 diversion of sections of other smaller unnamed 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.

8.4.11 Twelve ponds would be lost as a result of 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.

[41] HS2 (2012). HRA Screening Report for Midland Meres and Mosses Phase 1 Ramsar Site.

8.4.12 The Proposed Scheme would cross 81 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 13km of hedgerows, and would result in severance of the network in many places, adversely affecting connectivity with the surrounding area. The Proposed Scheme would include new hedgerow planting which would help offset losses. Further hedgerow planting would 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.

8.4.13 Construction of the Proposed Scheme would result in the loss of grassland outside designated sites including approximately 2ha of floodplain grazing marsh within the Lea Valley to the west of Madeley. 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 district/borough level.

8.4.14 Otters and water voles have been recorded along Meece Brook within 2km of the Proposed Scheme. The creation of the Meece Brook viaduct would avoid loss of habitat along the river corridor. Indirect effects from construction activities such as increased light and noise could result in disturbance to these species during the construction period, and prevent them from moving along the corridor. However, it is anticipated that these indirect effects would be controlled through measures in the draft CoCP. Habitat loss would result at several smaller watercourses crossed by the Proposed Scheme. On a precautionary basis, in the absence of survey findings, impacts to otters and water vole would result in an adverse effect on the conservation status of these species that would be significant up to the county/metropolitan level.

8.4.15 Hazel dormice are rare in Staffordshire, but the loss of deciduous woodland including AWIS and hedgerows in particular could affect hazel dormouse if surveys show this species to be present. The loss of these habitats along with grassland and arable land could also affect polecat (if found to be present). On a precautionary basis in the absence of survey information, the effects of permanent habitat loss on these species are assumed to be of up to county/metropolitan significance.

8.4.16 Habitat loss may have impacts on bats, as it would reduce the availability of foraging resource, and potentially result in the loss of roosts and fragmentation of commuting routes. This could particularly affect breeding populations of at least seven 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.

8.4.17 It has been assumed that nine ponds and (surrounding terrestrial habitat) within the land required for construction of the Proposed Scheme may support great crested newts, and would be lost during construction. 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. On a precautionary basis in the absence of survey information, it has been assumed that all ponds which would be lost support great crested newts. 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.

8.4.18 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 species on Schedule 1[42] which has been recorded in the Whitmore Heath to Madeley area adjacent to the land required for construction of 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.

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

8.4.20 The Proposed Scheme would pass over main watercourses on viaducts, and any 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[43]. However, other smaller watercourses would still be affected and may require assessment under the WFD. 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 on fish that would be significant.

8.4.21 The land required for the construction of the Proposed Scheme would result in the loss of habitat suitable for reptiles including grassland areas, scrub and ponds and records of adder, common lizard and grass snake within 2km of the land required for construction of the Proposed Scheme. On a precautionary basis in the absence of survey information, it has been assumed that Proposed Scheme would result in permanent adverse effect that would be significant at up to the district/borough level.

8.4.22 Effects on all other habitats and species are 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.

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

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

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

Other mitigation measures

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

- provision of additional broadleaved woodland to replace that lost, and/or enhancement of remaining woodlands;
- provision of additional hedgerows which would offset the losses and maintain the connectivity of the network;
- options to create new species-rich grasslands (including translocation where appropriate) to offset grassland losses including 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 outside of the area of construction, on a two for one basis as required, and suitable terrestrial habitat around all ponds created with habitat links to allow dispersal.

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

Summary of likely residual significant effects

8.4.26 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/receptor	Residual effect	Level at which the effect would be significant
Whitmore Wood LWS/AWIS	Permanent adverse effect on site integrity due to loss of approximately 6ha (33%) of ancient woodland and LWS.	County/metropolitan
Barhill Wood AWIS	Permanent adverse effect due to loss of approximately 0.5ha (8%) of ancient woodland.	County/metropolitan
Unnamed area of potential ancient woodland site located between Whitmore Wood and Hey Sprink and area of remnant potential	Permanent adverse effect due to loss of approximately 0.05ha (5%) potential ancient woodland. Loss of remnant potential ancient woodland site around Wrinehill Wood.	Up to county/metropolitan

Resource/receptor	Residual effect	Level at which the effect would be significant
ancient woodland around Wrinehill Wood.		
Other broadleaved woodland	Permanent loss of approximately 0.1ha	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 12 ponds	Up to county/metropolitan
Hedgerows	Permanent loss of sections of approximately 81 hedgerows, some of which may be Important, and approximately 13km of hedgerows. Adverse effect on connectivity within the wider area.	Up to district/borough
Grassland	Permanent loss of grassland including approximately 2ha of floodplain grazing marsh.	Up to district/borough
Bats	Potential permanent adverse effect on conservation status due to loss of roosts, foraging habitat and fragmentation.	Up to country/metropolitan for the majority of bat species, with potential for up to regional for some rarer 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
Polecat	Loss of habitat suitable for polecat.	Up to county/metropolitan
Hazel dormouse	Loss of habitats suitable for hazel dormouse	Up to county/metropolitan
Great crested newts	Loss of nine 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 breeding birds, especially of farmland and woodland. Barn owl, a Schedule 1 species, may be affected.	Up to county/metropolitan
Fish	Permanent loss of habitat from smaller watercourses.	Up to district/borough
Reptiles	Permanent loss of habitat suitable for reptiles.	Up to district/borough

Resource/receptor	Residual effect	Level at which the effect would be significant
Aquatic and terrestrial invertebrates	Permanent loss of suitable habitat.	Up to district/borough

8.5 Effects arising during 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 Meece Brook and the River Lea would avoid direct effects to these watercourses and allow free passage of wildlife beneath them including along the rivers and their banks;

Assessment of impacts and effects

8.5.2 The following section considers the potential effects on ecological receptors during operation of the Proposed Scheme. All assessments have been made on a precautionary basis 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 struck 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 no more than local/parish level. 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 at a safe distance from the line (informed by species dispersion modelling being undertaken for HS2 Ltd by the British Trust for Ornithology); and
- green bridges, culverts and/or other structures to reduce the likelihood of bats foraging in proximity to or attempting to cross the open line and to facilitate their safe passage when the Proposed Scheme is operational.

Summary of likely residual significant effects

8.5.7 Taking into account mitigation included as part of the Proposed Scheme design, and the assumption that further mitigation would be developed, the anticipated significant residual ecological effects during operation are detailed in Table 6.

Table 6: Anticipated significant residual ecological effects during operation

Resource/receptor	Residual effect	Level at which the effect would be significant
Bats	Potential permanent adverse effect on conservation status due to collision with trains.	Up to country/metropolitan for the majority of bat species, with potential for up to regional for some rarer 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 Whitmore Heath to Madeley area that would be subject to impacts associated with the Proposed Scheme and describes how the changes 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 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, CA4 Map Book.

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

9.2.2 This section deals specifically with impacts at a local level within the Whitmore Heath to Madeley area. Health effects across the Proposed Scheme as a whole are assessed in the route-wide health assessment contained in Volume 3, Route-wide effects.

9.2.3 The health determinants of relevance within the Whitmore Heath to Madeley area are:

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

9.2.4 The geographic extent of the health assessment covers those areas where impacts on health determinants are predicted to occur.

9.2.5 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.

9.2.6 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.

9.2.7 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.

9.2.8 Maps showing the location of the key environmental features and the key construction and operational features of the Proposed Scheme can be found in the Volume 2, CA4 Map Book.

9.3 Environmental baseline

9.3.1 The Whitmore Heath to Madeley area has a relatively small population, commensurate with the rural nature of the land use. Data provided by the Office of National Statistics[44] and the Association of Public Health Observatories[45] show that this population 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 generally more resilient than the national average with regard to changes in the relevant health determinants, and with relatively few vulnerabilities. One such vulnerability is a slightly higher than average proportion of older people (the 65 – 84 years category) across the Whitmore Heath to Madeley area. Additionally it is noted that Madeley has higher than average health and disability deprivation levels (ranked in the 20% most deprived nationally[46]), and there is a higher than average prevalence of long term health problems or disability in households across the Whitmore Health and Madeley area (possibly related to the age profile of the population). The Whitmore part of the area is ranked within the 10% most deprived for access to housing and social services, in common with many other rural areas of the country.

9.3.3 The available data permits a profile to be made of the whole population in the Whitmore Heath to Madeley area and provides detail down to ward level[47]. 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.

[44] The Office of National Statistics 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.
[45] http://www.apho.org.uk/
[46] Department for Communities and Local Government, 2015. English Indices of Deprivation, 2015.
[47] Electoral wards are the spatial units used to elect local government councillors. National Census data are published at ward level.

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 mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people. Examples of the mitigation measures incorporated into the design of the Proposed Scheme include the following:

- reducing the loss of property and community assets as far as reasonably practicable;
- reducing visual intrusion and noise as far as reasonably practicable; and
- incorporating landscape design and screening into the design.

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

9.4.3 In the Whitmore Heath to Madeley area, a bored tunnel would reduce the loss of residential properties in Whitmore Heath, and the area of land required for construction has been designed to reduce the loss of residential properties around Manor Road and the River Lea viaduct, the Madeley tunnel eastern portal and the A525 Bar Hill Road realignment.

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

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

9.4.5 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.

9.4.6 In the event of any loss of a community facility, the options for mitigating significant community effects 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

9.4.7 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.

9.4.8 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. Three residential properties would be demolished as a result of land requirements in the Whitmore Heath to Madeley area, comprising one property on Manor Road and two on the A525 Bar Hill Road, located to the east of Bar Hill Wood. This is not considered to affect social capital at community level. (The effects on residents directly affected by property demolitions are assessed in the health section in Volume 3, Route-wide effects).

9.4.9 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 for motorists, cyclists and pedestrians. The A53 Newcastle Road (continuing to the A53 Whitmore Road) would be temporarily diverted during the construction of the route beneath the road. Six residential properties located to the west of Madeley would be surrounded by works to construct the Proposed Scheme, in particular the southern portal of Madeley tunnel and the realignment of the A525 Bar Hill Road. Construction traffic and disruption to the local road network would be likely to result in increased journey times to these properties during construction. Residents of these properties would experience increased journey times to nearby social and/or family networks, as well as community facilities in the vicinity. This would cause inconvenience and may deter people from travelling, potentially reducing levels of social interaction, resulting in a reduction of the beneficial health effects that are gained through access to community facilities, social contact and support.

9.4.10 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

9.4.11 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.

9.4.12 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 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. Visibility of the Proposed Scheme would be low from towns 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.

9.4.13 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.

9.4.14 At this stage, it is not anticipated that construction traffic emissions (NO_2, NO_x, PM10 and PM2.5) 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.

9.4.15 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 on a precautionary basis locations where residential communities may be adversely affected by construction traffic noise, as follows:

- Snape Hall Road in Whitmore Heath; and
- Manor Road through Madeley.

9.4.16 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: Hill Chorlton, Whitmore Heath, around both the southern portal and northern portal of Whitmore Heath tunnel, Madeley Park Wood, Bar Hill, Madeley and at Moor Hall/Moss House Farm.

9.4.17 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 Whitmore Heath to Madeley 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.

9.4.18 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 antisocial 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 antisocial behaviour resulting from the Proposed Scheme are likely to be extremely low, as construction sites would be appropriately fenced and secured. The potential for crime and anti-social behaviour would be minimised through measures set out in the draft CoCP, such as worksite security, site lighting, hoarding, fencing and screening.

9.4.19 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

9.4.20 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. At this stage no areas of green space have been identified as being affected by the Proposed Scheme in the Whitmore Heath to Madeley area.

9.4.21 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 footways and crossing roads with increased HGV traffic is also likely to deter walkers, particularly those with young children. It is expected that HGVs would access construction compounds primarily from the A53 Newcastle Road, Manor Road and the A525 Bar Hill Road. Where reasonably practicable, HGVs would use the haul road along the route of the Proposed Scheme to reduce the impact on the local road network. 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. These effects will be reported in the formal EIA Report.

9.4.22 There would be temporary alternative routes for a number of PRoW during construction. Users would be re-routed around construction compounds and areas of construction activity, 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. The Newcastle Way promoted PRoW (which connects Madeley Footpath 33 and Madeley Footpath 10 via Manor Road) would require permanent diversion to follow the realigned Manor Road. This is unlikely to affect its appeal as a recreational walking route.

Access to services, health and social care

9.4.23 Impacts on access to services may arise as a result of increased demand for services (e.g. from the construction workforce), direct effects 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.

9.4.24 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.

9.4.25 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 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 likely remain in the area on a temporary basis for the duration of the works, and would not be expected to contribute to long term population growth.

9.4.26 As set out in the draft CoCP, HS2 Ltd or the nominated undertaker would provide occupational health care 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 accident and emergency services.

9.4.27 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.

9.4.28 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), as well as accessing basic needs, such as food shopping. The Whitmore Heath to Madeley 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 is likely to affect residents using the A53 Newcastle Road and A525 Bar Hill Road, which would be temporarily diverted during construction, and Snape Hall Road, which would be permanently closed.

Other mitigation measures

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

9.5 Effects arising during 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 If a need is identified for mitigation to reduce impacts on health determinants during the operation of the Proposed Scheme in this area, the mitigation will be described 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 Whitmore Heath to Madeley area in relation to land quality, and reports the likely impacts and significant effects resulting from construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, historical, mineral exploitation or mineral resources point of view including geological SSSI and local geological sites (LGS), areas of historical brine extraction and areas of designated mineral resources. Consideration is also given to petroleum (gas) prospects and licencing. Mitigation measures are presented and any likely residual significant 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 can 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 the BGS, SCC, LDC, the Environment Agency and FERA has been undertaken. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, and obtain relevant baseline information. Engagement 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, CA4 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 Volume 1 and the draft SMR.

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 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, BGS, Coal Authority, SCC, Public Health England (PHE), Environment Agency, Natural England and 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 needed to confirm the exact location and condition of the identified infill areas and will be reported in the formal EIA Report.

Geology

10.3.4 This section describes the underlying ground conditions within the Whitmore Heath to Madeley area. Recent changes in lithostratigraphic classifications by the BGS have been incorporated where appropriate[48].

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. These 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 Superficial glacial deposits from several glacial phases are present beneath parts of the study area. Post-glacial sediments within this area include alluvium, river terrace deposits and peat.

[48] 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 Between Chorlton Mill Farm and the A53 Newcastle Road, the Proposed Scheme is shown to be underlain by alluvial and river terrace sand and gravel. Peat is indicated to be present approximately 500m north-west of Shelton under Harley Farm, and approximately 600m south of where the Proposed Scheme crosses the A53 Newcastle Road.

10.3.8 Most of the Proposed Scheme between Whitmore Heath and the River Lea is underlain by deposits of glacial sediments ranging from clay to boulder sized particles. Peat is also present along this part of the Proposed Scheme. Most of the Proposed Scheme between the River Lea and Checkley Brook is reported to be underlain by glacial sediments, or glaciofluvial sands and gravels. Alluvium is also present in the vicinity of the River Lea and Checkley Brook.

Bedrock geology

10.3.9 The bedrock underlying the area from Whitmore Heath to Madeley comprises Carboniferous and Triassic age rocks.

10.3.10 The Wildmoor Sandstone Member of the Wilmslow Sandstone Formation, part of the Sherwood Sandstone Group, is found from the southern end of the Whitmore Heath to Madeley area, near Shelton under Harley, to a point just to the south-east of Whitmore Heath. A conglomerate unit of the Wildmoor Sandstone Member is shown south-east of Hill Chorlton. Whitmore Heath is underlain by sandstone and conglomerate of the Chester Formation of the Sherwood Sandstone Group.

10.3.11 North of Whitmore Heath to just north of the River Lea viaduct (where the Proposed Scheme would cross the WCML), the bedrock comprises mudstones, sandstones and conglomerates of the Salop Formation of the Warwickshire Group. The Salop Formation is reported to contain no significant coal seams, however, the Pennine Coal Measures Group beneath the Salop Formation has been extensively mined. The literature also indicates the presence of limestone beds and carbonate cemented sediments in the lower part of the Salop Formation.

10.3.12 From the River Lea viaduct to the A525 Bar Hill Road overbridge, the bedrock comprises grey-green mudstone, siltstone and sandstone of the Halesowen Formation of the Warwickshire Group. Thin coal, conglomerate and limestone beds may be present within the Halesowen Formation. North of the A525 Bar Hill Road to a point approximately 1km west of Madeley, the bedrock predominantly comprises the red-brown pebbly sandstone and subordinate mudstone of the Chester Formation.

10.3.13 The remainder of the area up to Checkley Brook is underlain by red-brown mudstone and siltstone of the Sidmouth Mudstone Formation, part of the Mercia Mudstone Group. Breccias formed by the dissolution of salt are common throughout the formation. Gypsum/anhydrite also occurs throughout the formation as nodules and veins.

Radon

10.3.14 Radon is a radioactive gas formed by the radioactive decay of naturally occurring uranium in rocks and soils. Three sections of the Proposed Scheme lie within a radon affected area, as defined on PHE's UK Radon online maps[49]:

- the section of the Proposed Scheme between Stableford and Whitmore Heath;
- where the Proposed Scheme would cross the WCML on the River Lea viaduct to just north of the A525 Bar Hill Road; and
- the section of the Proposed Scheme between Bowerend Farm and Wrinehill Mill.

10.3.15 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) for residential properties. For the remainder of the area between Whitmore Heath and Madeley, radon levels are reported to be less than 1% of homes above action level.

Groundwater

10.3.16 Four categories of aquifer have been identified within the Whitmore Heath to Madeley area, as defined by the Environment Agency.

10.3.17 The Wildmoor Sandstone Member has been designated as a principal aquifer. The Chester Formation is designated variably as a Principal aquifer or a Secondary A aquifer, depending on the particular geological member being considered.

10.3.18 The Salop Formation and the Halesowen Formation have been designated as Secondary A aquifers. The Sidmouth Mudstone Formation has been designated as a Secondary B aquifer.

10.3.19 Glaciofluvial sand and gravel deposits and alluvium are classified as Secondary A aquifers, and the glacial sediments are classified as Secondary (undifferentiated) aquifers. Peat is classified as unproductive strata.

10.3.20 The Proposed Scheme would pass over Zone 1, Zone 2 and Zone 3 of a groundwater source protection zone[50] (SPZ) adjacent to Chorlton Mill Farm. The study area runs directly through the centre of Zone 1, which extends approximately 140m north-east and 240m south-west either side of the Proposed Scheme. The abstraction is located approximately 1.2km south of Whitmore. The Zone 2 and Zone 3 SPZ extend south of Checkley Mill Farm. The limit of Zone 3 extends to the northern border of Whitmore Heath along Snape Hall Road. Beyond Snape Hall Road, the Proposed Scheme would not traverse any additional SPZ within the study area.

10.3.21 BGS data indicates that there are seven water wells in the study area. The Environment Agency reports that there are a total of three licensed abstractions from groundwater sources within 1km of the Proposed Scheme in the Whitmore Heath to Madeley area.

[49] www.ukradon.org/information/ukmaps
[50] 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.

10.3.22 According to Local Authority records, there are three private groundwater supplies which do not require a permit within the study area.

10.3.23 Further detail on the groundwater beneath the study area can be found in Section 15, Water resources and flood risk.

Surface water

10.3.24 The main watercourses in this part of the Proposed Scheme are the Meece Brook and the River Lea. The Proposed Scheme crosses Meece Brook, which flows generally north to south, at the southern end of the area, approximately 1km east of Baldwin's Gate. The Proposed Scheme crosses the River Lea close to Hey Sprink woodland to the south of Madeley, and again at Checkley Brook at a point close to Wrinehill Hall near the northern boundary of the area.

10.3.25 No surface water abstractions (licenced or unlicensed) have been identified within 1km of the Proposed Scheme.

10.3.26 Further information on surface waters is provided in Section 15, Water resources and flood risk.

Current and historical land use

10.3.27 Current potentially contaminative land uses within the study area are mainly restricted to activities on farms, engineering works and light industrial units including those located at Wrinehill Mill and Netherset Hey Lane, and potentially active/recent landfill sites identified along the Proposed Scheme.

10.3.28 Other historical potentially contaminative land uses identified along the study area include former pits or quarries, historical landfills, a cemetery located to the east of Manor Road in Madeley, a cemetery located at a place of worship on the corner of the A525 and Manor Road in Madeley, a timber treatment works located to the east of Manor Road in Madeley, and historical evidence of fuel/storage tanks near the Coney Greave property near Baldwin's Gate.

10.3.29 Historical human burial sites have been identified approximately 320m east of Manor Farm and approximately 430m south of Bower End Farm.

10.3.30 Three historical landfill sites have been identified, one in the vicinity of Snape Hall Road, Whitmore Heath, and two near Bower End Lane, to the west of Madeley. 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.

10.3.31 In addition to the above, a number of former quarries or pits are identified within the study area. It is possible that such features have been backfilled with waste materials.

Other regulatory data

10.3.32 The regulatory data reviewed includes pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). Of note are 14 minor pollution incidents. The significant incidents involved sewage/slurry, oils/fuels or inert suspended solids.

10.3.33 There are no ecological designations as defined in the land quality section of the draft SMR[51] located within the 250m study area.

Mining/mineral/gas resources

10.3.34 SCC is responsible for the overall mineral and waste local plans for the county. The new Minerals Local Plan for Staffordshire 2015 to 2030 (final draft June 2015)[52] 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 the year 2030.

10.3.35 Data provided by SCC in March 2016 indicates that the Proposed Scheme would cross three Mineral Safeguarding Areas (MSA) contained in the New Minerals Plan for Staffordshire. This is indicated for an area between the southern area of the boundary and Baldwin's Gate, in the proximity of Whitmore and south of Madeley up to the northern boundary of the area. The MSAs relate to sand and gravel resources.

10.3.36 Data available on the SCC website indicates that there are no operational mineral sites within the study area.

10.3.37 The SCC New Minerals Plan indicates the following hydrocarbon and petroleum resources are present within the county:

- coal;
- conventional gas, where the gas is trapped in geological structures and reservoir rocks;
- coal mine methane, where the methane gas is drained from active or disused underground coal mine workings; and
- coal bed methane, which is contained within unworked coal seams and its extraction is feasible at depths of 200m – 1500m.

10.3.38 Coal measures are present at depth beneath the area. BGS data[53] indicates that between the southern boundary of the area and Bower End Lane, Madeley the coal measures are present beneath the study area at depths of between 50m and 1,200m. Between Bower End Lane and the northern boundary of the area, the coal measures are indicated to be present at depths of greater than 1,200m.

10.3.39 Data from the UK Oil and Gas Authority indicates the following:

- the study area between a point approximately 740m north-west of Shelton under Harley and a point approximately 170m south-east of Heath Road, Whitmore Heath is covered by a Licence to Search and Bore For and Get Petroleum (Licence number PEDL56) held by Island Gas Limited and Regent Park Energy Limited; and

[51] National designations such as SSSI
[52] Staffordshire County Council, 2015. The new Mineral Local Plan for Staffordshire 2015 to 2030. Final Draft June 2015.
[53] http://mapapps2.bgs.ac.uk/geoindex/home.html?submit=Open+the+onshore+GeoIndex

- the study area between Licence PEDL56 and the A525 Bar Hill Road is covered by a Licence to Search and Bore For and Get Petroleum (Licence number PEDL40) held by Island Gas Limited and Regent Park Energy Limited.

Geo-conservation resources

10.3.40 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

10.3.41 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 bedrock aquifer of sandstone and conglomerate	High
		Secondary B bedrock aquifer	Low to moderate
		Secondary A superficial aquifer	Moderate
		Secondary undifferentiated aquifer	Low to moderate
	Surface waters	Meece Brook, Checkley Brook	Moderate
		River Lea	Moderate
		Unnamed tributaries, ponds and drains	Low to moderate
	Built environment	Buildings and properties	Low to high
		Underground services and structures	Low
Impacts on mining/mineral/ petroleum (gas) sites	Mining/mineral/ petroleum (gas) sites	Sand and gravel MSAs	Low to moderate
		Petroleum (gas) exploration and production	Low
		Coal deposits	Low

10.4 Effects arising during construction

Avoidance and mitigation measures

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

10.4.2 The 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, takes place in order to confirm the full extent of areas of contamination. It also requires a risk assessment to be undertaken to determine what, if any, site specific remediation measures would be 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 Environment Agency guidance CLR11[54] and British Standards BS10175[55] and BS8576[56].

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 should be required as a result of the Proposed Scheme, 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[57]. 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, CA4 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 that present low risk have

[54] Environment Agency, (2004), CLR11 Model Procedures for the Management of Land Contamination.
[55] British Standard, (2011), BS10175+A1:2013 Investigation of Potentially Contaminated Sites.
[56] British Standard, (2013) BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).
[57] 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 are 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 to detailed risk assessments. The following factors determine the need for detailed risk assessments:

- whether the site is on or off the route of the Proposed Scheme or associated works;
- the vertical profile of the route;
- the presence of underlying sensitive groundwater aquifers (Principal or Secondary A), SPZs or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

10.4.9 Clusters of potentially contaminated sites will be grouped, and assessed together, where appropriate.

10.4.10 A summary of the baseline CSM is provided in Table 8. The potential impacts and baseline risks quoted are 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 reference[58]	Area name	Main potential impacts	Main baseline risk
CA4-1, CA4-27, CA4-50, CA4-53, CA4-60 and CA4-61	Infilled pits and ponds	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/low
		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).	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).	Low to moderate/low
CA4-11	Timber treatment works	Potential impact on human health on-site (direct contact, ingestion, inhalation of dusts and vapours from	Moderate/low

[58] Each area is assigned a unique identification number.

Area reference[58]	Area name	Main potential impacts	Main baseline risk
		contaminated soils and groundwater and inhalation of ground gases).	
		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).	Low
		Potential impact on groundwater quality (leaching, vertical and lateral migration from soils and water).	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).	Low
CA4-36	WCML running lines	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/low
		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).	Low
		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).	Very low
		Potential impact on property receptors on-site and off-site (direct contact with soils and water, exposure to explosive gases).	Very low
CA4-39	WCML running lines and disused lines	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/low
		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).	Low
		Potential impact on groundwater quality (leaching, vertical and lateral migration from soils and water).	Low

Area reference[58]	Area name	Main potential impacts	Main baseline risk
		Potential impact on surface water quality (lateral migration through groundwater, direct runoff from site).	Low
		Potential impact on property receptors on-site and off-site (direct contact with soils and water, exposure to explosive gases).	Very low
CA4-65 and CA4-66	Historical landfill sites near Beechfields and Bowerend Farm	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/low
		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).	Low to 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).	Low to moderate/low
CA4-72	Former Barr Hill Garage	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/low
		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).	Low
		Potential impact on groundwater quality (leaching, vertical and lateral migration from soils and water).	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).	Very 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 are 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 a summary of the resulting temporary (construction) effects. This shows that based upon 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 is it considered that there may still be temporary minor adverse (non-significant) effects during the construction period particularly from ground disturbance in areas of localised backfilling.

Table 9: Summary of temporary (construction) effects

Area ref[59]	**Main baseline risk**	**Main construction risk**	**Temporary effect and significance (Y/N)**
CA4-1, CA4-27, CA4-50, CA4-53, CA4-60 & CA4-61 Infilled pits and ponds	Potential impact on human health on-site = Moderate/low	Low	Minor beneficial effect (N)
	Potential impact on human health off-site = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on groundwater quality = Moderate/low	Moderate	Minor adverse effect (N)
	Potential impact on surface water quality = Very low	Low	Minor adverse effect (N)
	Potential impact on property receptors on-site and off-site = Low to moderate/low	Moderate/low to moderate	Minor adverse effect (N)
CA4-11 Timber treatment works	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on surface water quality = Very Low	Very low	Neutral effect (N)

[59] Each area is assigned a unique identification number.

Area ref[59]	Main baseline risk	Main construction risk	Temporary effect and significance (Y/N)
	Potential impact on property receptors on-site and off-site = Low	Low	Neutral effect (N)
CA4-36 WMCL running line	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Moderate	High	Minor adverse effect (N)
	Potential impact on surface water quality = Very low	Low	Minor adverse effect (N)
	Potential impact on property receptors on-site and off-site = Very low	Very low	Neutral effect (N)
CA4-39 WMCL running line and disused line	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on surface water quality = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on property receptors on-site and off-site = Very low	Very low	Neutral effect (N)
CA4-65 and CA4-66 Historical landfill sites near Beechfields and Bower End Farm	Potential impact on human health on-site = Moderate/low	Moderate	Minor adverse effect (N)
	Potential impact on human health off-site = Low to Moderate/low	Moderate/low	Minor adverse effect (N)
	Potential impact on groundwater quality = Moderate/low	Moderate	Minor adverse effect (N)
	Potential impact on surface water quality = Very low	Low	Minor adverse effect (N)
	Potential impact on property receptors on-site and off-site = Low to Moderate/low	Low to Moderate/low	Neutral effect (N)

Area ref[59]	Main baseline risk	Main construction risk	Temporary effect and significance (Y/N)
CA4-72 Former Barr Hill Garage	Potential impact on human health on-site = moderate/low	Moderate	Minor adverse effect (N)
	Potential impact on human health off-site = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on groundwater quality = Low	Moderate/low	Minor adverse effect (N)
	Potential impact on surface water quality = Very low	Low	Minor adverse effect (N)
	Potential impact on property receptors on-site and off-site = very low	Very 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 would 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 subjected to detailed risk assessment in the formal EIA Report.

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

Area ref[60]	Main baseline risk	Main post-construction risk	Post-construction effect and significance (Y/N)
CA4-1, CA4-27, CA4-50, CA4-53, CA4-60 & CA4-61 Infilled pits and ponds	Potential impact on human health on-site = Moderate/low	Low	Minor beneficial effect (N)
	Potential impact on human health off-site = Low	Low	Minor beneficial effect (N)
	Potential impact on groundwater quality = Moderate/low	Low	Minor beneficial effect (N)
	Potential impact on surface water quality = Very low	Very low	Neutral effect (N)

[60] Each area is assigned a unique identification number.

Area ref[60]	Main baseline risk	Main post-construction risk	Post-construction effect and significance (Y/N)
	Potential impact on property receptors on-site and off-site = Low to moderate/low	Low to moderate/low	Neutral effect (N)
CA4-11 Timber treatment works	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Low	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 = Low	Low	Neutral effect (N)
CA4-36 WMCL running line	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Moderate	Moderate	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 = Very low	Very low	Neutral effect (N)
CA4-39 WMCL running line and disused line	Potential impact on human health on-site = Moderate/low	Moderate/low	Neutral effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Low	Low	Neutral effect (N)
	Potential impact on surface water quality = Low	Low	Neutral effect (N)

Area ref[60]	Main baseline risk	Main post-construction risk	Post-construction effect and significance (Y/N)
	Potential impact on property receptors on-site and off-site = Very low	Very low	Neutral effect (N)
CA4-65 and CA4-66 Historical landfill sites near Beechfields and Bowerend Farm	Potential impact on human health on-site = Moderate/low	Low	Minor beneficial effect (N)
	Potential impact on human health off-site = Low to Moderate/low	Low	Minor beneficial effect (N)
	Potential impact on groundwater quality = Moderate/low	Low	Minor beneficial 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 = Low to Moderate/low	Low	Minor beneficial effect (N)
CA4-72 Former Barr Hill Garage	Potential impact on human health on-site = moderate/low	Low	Minor beneficial effect (N)
	Potential impact on human health off-site = Low	Low	Neutral effect (N)
	Potential impact on groundwater quality = Low	Very low	Minor beneficial 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 = very low	Very low	Neutral effect (N)

10.4.17 Following remediation for sites located within the study area, there would generally be overall neutral to minor beneficial effects (non-significant). At some sites and depending on the type of remediation undertaken, beneficial effects could include an improvement in groundwater quality or reduction in risk to human health as a result of removal of impacted material or the breaking of gas migration pathways.

Mining/mineral/gas resources

10.4.18 Construction of the Proposed Scheme could have 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.

10.4.19 Construction of the Proposed Scheme could also have the potential to affect areas of petroleum (gas) exploration and/or production. This could potentially occur due to reduced opportunity of access for exploration and/or possible production activities, including geophysical surveys and/or the installation of wells. It is unlikely that the resource itself would be impacted.

Temporary effects

10.4.20 The majority of effects on mining and mineral sites would be permanent. However, temporary adverse effects 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. Similarly, construction works may temporarily limit access to potential petroleum (gas) exploration sites located within Licence to Search and Bore For and Get Petroleum areas.

Permanent effects

10.4.21 The Proposed Scheme would cross an MSA for sand and gravel extraction. 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.

10.4.22 The Proposed Scheme would cross an area which is underlain by coal reserves and construction may require the sterilisation of a strip of land in which future coal mining could be constrained.

10.4.23 The Proposed Scheme would cross Licence to Search and Bore For and Get Petroleum areas. It is possible that this could impact on future gas exploration and/or production activities. Similarly, opportunity for access to possible future shale gas exploration and/or production (subject to appropriate licensing) could be affected.

10.4.24 Table 11 presents the assessment of effects from construction on the mining, mineral and petroleum (gas) resources identified.

Table 11: Summary of effects for mining, mineral and petroleum (gas) resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance (Y/N)
PEDL 40 PEDL56	Licenced by UK Oil and Gas Authority	Licence to Search and Bore For and Get Petroleum	Low	Minor	Negligible (N)

[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.

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance (Y/N)
MSA – sand and gravel	MSA	MSA for sand and gravel extraction, defined by Staffordshire County Council13	Medium	Minor	Minor adverse (N)
South Staffordshire Coalfield	Unknown	Coal seams	Likely to be of low sensitivity	Negligible	Negligible (N)

10.4.25 On this basis it is anticipated that there would be no significant permanent effects with respect to mining and mineral resources.

Other mitigation measures

10.4.26 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 the site specific remediation strategies that would be developed at the detailed design stage if required. These measures would ensure that risks to people and property from contaminants in the ground would be controlled such that they would not be significant.

10.4.27 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 would not adversely affect the Proposed Scheme or the wider environment as a consequence of the Proposed Scheme.

10.4.28 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 would 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.

10.4.29 It is currently considered unlikely that mitigation measures to manage the effects of the Proposed Scheme on petroleum (gas) or shale resources would be required. However, the option of undertaking petroleum or shale gas exploration ahead of the construction of the Proposed Scheme could be advantageous.

Summary of likely residual significant effects

10.4.30 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 during operation

10.5.1 Users of the Proposed Scheme (i.e. rail passengers), whilst within trains, would be, 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 one auto-transformer station, which would be located at Bitterns Lane. 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 likely 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.

Summary of likely residual significant effects

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

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 Whitmore Heath to Madeley 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 character and visual receptors during construction arising from the presence of construction plant and compounds, construction of tunnels and porous portals, viaducts, road diversions and realignments, overbridges and underbridges, embankments and retaining walls, excavation of cuttings and culverts, removal of existing trees and vegetation, and traffic 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 Whitmore Heath tunnel and Madeley tunnel portals, Whitmore Heath cut and cover tunnel, River Lea viaduct, Meece Brook viaduct, Bitterns Lane auto transformer station, road and PRoW diversions and realignments, overbridges and underbridges, plus associated earthworks and presence of noise barriers.

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 2016 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 NBC 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[62]. Engagement with these stakeholders will continue as part of the design 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, CA4 Map Book.

[62] 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 ZTV 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 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 Baldwin's Gate, Whitmore, Whitmore Heath, Madeley Park Wood and Madeley.

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

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, and based on information known at present. The assessment covers the situation in winter and summer of year 1 and summer of year 15. Likely significant effects for year 60 will be reported in the formal EIA Report.

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.

11.3 Environmental baseline

Landscape baseline

11.3.1 The study area extends from north of Whitmore Heath in the south to Madeley in the north. The area includes a section of the WCML and the M6, as well as the Meece Brook and River Lea valleys. Much of the area encompasses gently undulating lowland and settled river valley landscapes, with occasional lowland bog and floodplain pasture at lower levels. Land cover is a combination of dairy pasture, arable and occasional horse grazing. Areas of heath on higher ground occur in combination with mixed species woodland and ancient woodland, particularly on the plateaux and ridgelines. There is a robust field pattern defined by typically well-maintained hedgerows and mature hedgerow trees.

11.3.2 Other key features are the hall and parkland of Whitmore Hall and historic Whitmore village, plus the remnant designed landscapes and parklands at Maer. A number of historic settlements are associated with the rural lane network, notably Acton, Baldwin's Gate and Hill Chorlton. Modern housing developments at Whitmore Heath to Madeley Park Wood are integrated into the landscape by mature woodland and the larger nucleated villages of Madeley, Little Madeley and Middle Madeley lie to the north of the area.

11.3.3 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[63], Staffordshire Landscape Guidelines[64] and the Cheshire Landscape Character Assessment[65].

11.3.4 For the purposes of this assessment, the study area for Whitmore Heath to Madeley has been subdivided into 17 LCAs. A summary of these is provided below.

Upper Meece Brook Valley Alluvial Lowlands

11.3.5 This LCA is defined by low lying, gently undulating fields of rough grazing, marsh and heath within the broad valley of the Meece Brook and extending up into narrower stream valleys. It is a large scale agricultural landscape which contrasts with the surrounding smaller scale more elevated farmland. Tree cover is sparse, with willow carr (a form of lowland wet woodland) present along Meece Brook and an area of raised bog near Chorlton Moss. There are few historic sites evident other than some properties dating back to the Industrial Revolution and the area does not appear to be well used for recreation, other than a small PRoW network and Whitmore Cricket Club to the north-east. Infrastructure in the area includes the WCML, the A51 London Road and A53 Newcastle Road. The overhead line equipment of the WCML is visible in the valley to the west and south-west and the rail line restricts PRoW and vehicular access

[63] 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.
[64] 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.
[65] Cheshire County Council Transport and Regeneration Service (2008), Cheshire Landscape Character Assessment. Available online at: http://www.cheshireeast.gov.uk/environment/heritage_natural_environment/landscape/landscape_character_assessment.aspx.

across the area. The scenic quality of the landscape has been eroded through a decline in traditional farming practices, resulting in some field enlargement and hedgerow loss. The landscape is not particularly secluded, tranquil or remote, partly due to its large scale open character and partly to the presence of road and rail infrastructure. For these reasons, the value of this landscape is considered to be low-medium.

Baldwin's Gate Sandstone Hills and Heaths

11.3.6 This LCA comprises rolling hills and lowlands supporting a typical pastoral landscape of small to medium sized fields. The farmland rises up to distinctive sandstone hills and ridgelines with woodland and heath. The hedgerow network has good interconnectivity with the copses, woodlands and shelterbelts of the lower lying land and the woodlands on the higher ground. Horse grazing is found around Chorlton Moss. Indications of historic continuous settlement are evident with historic buildings at Sandy Lane and the Grade II listed 17th century Maer Hall and Grade II registered Maer Hall Registered Park and Garden to the west. The stream out of Maer Pool, the main feature of the 19th century park, is a SSSI and the headwater of the River Tern. Dispersed properties and hamlets, such as Maer and Hill Chorlton punctuate the landscape and are well integrated into the rolling farmland. The PRoW network includes the regionally promoted Newcastle Way, whilst Slaters Village is a popular destination. The landscape is attractive, particularly to the west where fields tend to be smaller and tree cover and hedgerows more prevalent. Although secluded and tranquil in the sheltered valleys and wooded hills, this is not a remote landscape, and parts of it contain road and rail infrastructure including the A53 Newcastle Road, the A51 London Road and the WCML, which follows the eastern boundary of the LCA. For these reasons the value of this landscape is considered to be of medium-high sensitivity, although the larger scale farmland to the east of the LCA is at the lower end of this scale.

Upper Meece Brook Valley Ancient Redlands

11.3.7 This LCA lies north-west of Swynnerton Old Park (which falls in the Stone and Swynnerton area (CA3) and is defined by a gently rolling ridge and valley landform, which contrasts with the alluvial lowlands of the upper Meece Brook valley. Medium to large scale, often rectilinear arable fields dating back to the post-medieval (1486-1799) period and pastures are bounded by hedgerows with mature hedgerow trees. Woodlands are not a characteristic feature, although views to hilltop woodlands outside the LCA, such as Swynnerton Old Park, The Rookery and Whitmore Hall to the north are an important influence. There are few apparent natural, historic or recreational features in this landscape other than a small PRoW network. Baldwin's Gate lies just outside the western edge of the LCA but within the LCA there are only two isolated farmsteads. The scenic quality of the landscape has been eroded by hedgerow loss which has resulted in field enlargement and hedgerow loss. Infrastructure including the A53 Newcastle Road, which runs parallel to part of the LCA's northern boundary, and the WCML, which defines the western boundary, reduce the sense of tranquillity. For these reasons the value of the landscape is considered to be low-medium.

Meece Ancient Redlands

11.3.8 This LCA lies north of Swynnerton Old Park. The rolling landform includes a distinctive ridgeline known as 'The Rookery', which is further emphasised by copses, shelterbelts and parkland trees that link it to the adjacent Swynnerton Village Sandstone Hills and Heaths and Whitmore Hall Valley Ancient Redlands LCAs. This area displays a largely intact small to medium scale landscape of pastures, arable fields and woodland. Hedgerows and hedgerow trees impart a sense of enclosure and intimacy particularly around Acton. The landscape does not appear to have many historic or recreational features, although a small network of PRoW provide links to Swynnerton Old Park and Stableford. To the north of the LCA, infrastructure including the A53 Newcastle Road and electricity pylons reduce the sense of tranquillity and scenic quality, which is found to the south around the village of Acton. For these reasons the value of this landscape is considered to be medium.

Whitmore Hall Valley Ancient Redlands

11.3.9 This LCA covers a small section of rolling lowland valley along Meece Brook. It is characterised by the historic estate and parklands of Whitmore Hall, valley floor woodlands, meadows, an estate village and historic buildings. Ancient woodland and mature parkland trees are important elements. To the north a commercial fishery set within the woods and meadows is one of the largest recreational fisheries in the UK. The parkland has a robust hedgerow pattern, which links to copses and woodland within the estate and the wider area. The nearby Pleck Wood, Moat Wood, and Holbrook Wood ancient woodlands are also of habitat and wildlife value. A small PRoW network connects the valley to Whitmore Heath. The value of this area derives from its scenic quality, its relatively intact parkland and farmland, historic associations and recreational value (both the estate and the fishery). Away from the commercial fishery and A53 Newcastle Road to the south, the landscape is generally undisturbed, tranquil and secluded. For these reasons the value of this landscape is considered to be medium-high.

Baldwin's Gate Built Area

11.3.10 This LCA comprises the small linear settlement of Baldwin's Gate, which has developed either side of the A53 Newcastle Road. The distinctive rural character and scenic quality of the village derives from its valley position, surrounding fields and wooded hills. The historic built core lies to the western end of the village and has associations with the nearby 17th century Maer manorial estate, which is in the adjoining LCA, although the remainder of the village mainly comprises late 20th century buildings. The WCML bisects the village perpendicularly to the A53 Newcastle Road and both have influenced housing development and village expansion. Areas of designed greenspace within the village impart local identity and offer opportunities for informal recreation. Several PRoW provide access from the village into the surrounding farmland. Although the village has an attractive setting and some tranquil areas, the lack of architectural cohesion, combined with the presence of the A53 Newcastle Road and WCML, locally affect scenic quality and levels of tranquillity. For these reasons the value of this landscape is considered to be medium.

Upper Lea Valley Ancient Redlands

11.3.11 This LCA is a broad flat valley landscape of extensive managed farmland and areas of floodplain pasture, which forms part of the wider setting of Whitmore Heath, Madeley Park Wood. The valley floor comprises large scale, often rectilinear fields bounded by gappy hedgerows or post and wire fences, which contrasts with the woodlands along the lower valley sides (outside of this LCA) and includes Whitmore Wood Ancient Woodland. These woodlands provide enclosure and visual variety to the otherwise open and simple land cover pattern. The vegetated and wooded disused Silverdale line and Madeley Chord are distinctive landscape features which bisect the valley near Hey Sprink.

11.3.12 There are few historic or recreational features, other than a PRoW network and the regionally promoted Newcastle Way. The WCML is well integrated into the landscape, running at ground level along the valley floor with the wooded valley sides as a backdrop. The built form present within this landscape is limited to three residential properties, as well as some industrial/ commercial building and a cemetery. The value of the landscape derives from its role in providing a rural and relatively tranquil setting for the elevated residential areas of Whitmore Heath, Madeley Park Wood in neighbouring LCAs. For these reasons the value of this landscape is considered to be medium-high.

Maer Sandstone Hills and Heaths

11.3.13 This LCA comprises rolling pastures and prominent wooded ridgelines overlooking the River Lea valley. Other land cover includes heath and grassland both within and on the periphery of the woodland. The area has evidence of long historic settlement and associations with 17th century Maer Hall and estate. There is a scheduled monument at Berth Hill. The woodland helps integrate the suburban residential development at Madeley Wood Park into the wider landscape. The scenic quality of this LCA results from its high tree cover and woodland which create a sense of seclusion and tranquillity, although partial replanting of Maer Hills Wood with conifers has slightly reduced the scenic quality. Although the tranquillity is locally disturbed by intermittent noise from the nearby WCML and roads, much of the area has a secluded, remote and tranquil character. For these reasons the value of this landscape is considered to be medium-high.

Hey Sprink Ancient Redlands and Woodlands

11.3.14 This LCA is defined by a rolling plateau edge landform overlain by a pattern of small scale fields interspersed with medium and large woodland blocks, including Hey Sprink and Whitmore Wood ancient woodlands. North of Whitmore Wood, sinuous linear tree belts extend up from the valley sides and link to the woodlands, shelterbelts and copses of the higher flatter plateau. Farmsteads and residential properties are dispersed throughout the area and include the larger, elevated settlement of Whitmore Heath, a suburban residential development, where the high tree cover integrates the housing into the wider landscape and contributes to the extensive wooded horizon character. This is a landscape of high scenic quality derived from the high proportion of tree cover and natural features, rather than the presence of historic sites or recreational assets. The PRoW network provides limited access through the woodland. Vehicular access to the area is also limited. The rural roads

that serve this area (including Snape Hall Road) are commonly narrow and winding in nature and often have banks to either side. The WCML to the west and M6 to the north-east are intermittently audible and in places locally disturb the otherwise remote and tranquil character. Electricity pylons cross the plateau, but they rarely protrude above the horizon line and have little effect on landscape character. For these reasons the value of this landscape is considered to be medium-high.

Madeley Ancient Redlands

11.3.15 This LCA provides the setting for the eastern and south-eastern edge of Madeley. The undulating landform wraps around the lower lying Upper Lea Valley LCA. Land cover comprises large open arable fields and pastures bounded mainly by post and wire fencing with occasional gappy and intermittent hedgerows. The well-wooded disused Silverdale line and Madeley Chord to the south (outside this LCA) form a prominent landscape feature. The farmland is extensively grazed and comprises of large open fields defined predominately by fencing and/or low hedgerows. There is a limited amount of tree cover within the landscape, and apart from a number of scattered small ponds, it has few other natural features of note. Historic buildings include Offley Well Head near Manor Road. Public access through the area is limited as many of the lanes and tracks are private and there are few PRoW. The character of this low-lying intensively grazed farmland has been eroded through a decline in traditional farming practices, with field enlargement and loss of hedgerows. Industrial units on the edge of Madeley, electricity pylons, transport infrastructure, including the M6, which cuts across the eastern edge of the LCA, and the WCML, which bisects the LCA, also affect the scenic quality and rural character. For these reasons the value of this landscape is considered to be low-medium.

Old Madeley Manor Ancient Redlands

11.3.16 This LCA is a low lying, valley floor landscape along the River Lea. Much of the LCA comprises large scale pastures and arable fields dating back to the post-medieval period (1486-1799) and bounded by hedgerows with occasional hedgerow trees. The valley is the site of two former moated manor houses, Lea Head Manor (and associated scheduled monument) to the west of the area at the source of the River Lea, and to the south the remains of Old Madeley Manor, a scheduled monument with moats, ponds and former gardens. Mature and veteran parkland trees and moated ponds are prominent features. The well wooded disused Silverdale line and Madeley Chord follow the southern boundary of the LCA and areas of ancient woodland are found at Upper and Lower Bitterns Wood, with wetter ground and willow planting in the valley near Aston Cliff to the west of the area. There is a limited PRoW network, but this includes the regionally promoted Newcastle Way, which runs close to the Old Madeley Manor site. Some of the farmland character has been eroded through a decline in traditional farming practices, with field enlargement and loss of hedgerows. Despite occasional noise from Manor Road, the LCA has a typically tranquil character being sheltered by trees, woodland and landform. It is also valued for the historic features associated with Old Madeley Manor, ancient woodlands and areas of high scenic quality. For these reasons the value of this landscape is considered to be medium-high.

Onneley Sandstone Hills and Heath

11.3.17 This LCA comprises the slightly elevated, rolling landform which forms the foothills of the wooded Maer Hills beyond. The sandstone outcrops at Bar Hill are a distinctive feature. The landform is overlain by an irregular patchwork of small to medium scale fields bounded by an intact network of robust hedgerows and mature hedgerow trees with areas of sandstone heath. Hedgerow trees add to the varied land cover and visually extend the tree cover of the skylines and Maer Hills. Historic buildings and sites include Lea Head moated site scheduled monument and several listed buildings, including the farmsteads of Aston Cliff and Lea Head Manor. An extensive PRoW network connects into the wider area and includes a well maintained bridleway between Aston Cliff and Madeley. The landscape is strongly rural in character with few detracting features and little vehicular access, imparting a strong sense of seclusion and tranquillity. For these reasons the value of this landscape is considered to be medium-high.

Madeley Built Settlement

11.3.18 Situated between the M6 and the WCML, this LCA includes the settlements of Madeley, Middle Madeley, and Little Madeley. The historic core of Madeley is situated along the A525 Bar Hill Road and course of the River Lea. Other historic landscape features include Madeley Mill, Madeley Pool and Madeley Old Hall (now a country house hotel). The nearby ruins of Heighley Castle are a scheduled monument. Areas of maintained green space add to the overall scenic quality as does the wetland/ scrub/ willow habitat and marsh along the River Lea and around Madeley Pool. An extensive PRoW network, including the regionally promoted Newcastle Way provides connections to the wider area and the village, which also includes play areas, playing fields and community allotments. Along the northern, eastern and southern fringes of the village, modern development is starting to encroach on the farmland and change its character with recreational pressures (including playing fields and horse paddocks), and loss of hedgerows to enable field enlargement. More recent housing expansion and the fact that the wider setting of the village has been impacted by infrastructure, including some electricity pylons visible above the tree line to the north-east, has slightly reduced the value. Some parts of the village are very tranquil but other areas are impacted by noise from the A525 Bar Hill Road and intermittently from the nearby WCML. For these reasons the value of this landscape is considered to be medium-high.

Madeley Manor Ancient Redlands

11.3.19 This LCA lies to the north of Madeley village and is an area of higher ground surrounding the Grade II listed Madeley Manor. Much of this area is a relatively intact designed parkland landscape with estate woodland, shelterbelts, small scale fields and parkland with areas of wood pasture, former manor gardens and ponds. A robust hedgerow network with many mature hedgerow trees provides good connectivity between the wooded areas, including Bowsey ancient woodland. The mere east of Madeley Manor is also an important landscape features and natural habitat. A scheduled monument at Heighley Castle has associations with Madeley Manor and Madeley. Heighley Castle Way housing is well integrated into the wider landscape. The PRoW network provides connections to the wider area and some nearby visitor and retail facilities. The landscape has an historic and tranquil quality despite some

noise from the nearby M6 and the A531 Main Road. For these reasons the value of this landscape is considered to be medium-high.

Madeley North Ancient Clay Farmlands

11.3.20 This LCA lies north of Madeley village and is characterised by rolling pastoral farmland with some large dispersed farmsteads. The intact field pattern is defined by a robust hedgerow network with a high prevalence of hedgerow trees which provides good interconnectivity to nearby woodland and wooded streams. Occasional ponds and areas of heath create add further interest. The area has a history of settlement and traditional farming practices with a Grade II listed farmhouse at Higher Thornhill. The hedged lanes include Furnace Lane, which is a narrow, single lane rural track with hedged banks and mature trees along its length. These lanes and private tracks impart a sense of seclusion and tranquillity. A PRoW network is a local recreational resource although access to the landscape is otherwise limited. This is a small scale farmed landscape, which although attractive is impacted by the visibility of electricity pylons which appear on the horizon in places. To the west, the WCML runs along the lower lying ground (outside but close to this LCA), although it does not influence the character of the landscape. For these reasons the value of this landscape is considered to be medium-high.

Madeley Ancient Clay Farmlands

11.3.21 This LCA is defined by rolling farmland with dispersed farmsteads and properties and views to a wooded backdrop. Fields ranging from small irregular fields dating back to the medieval period (1066 – 1485) to large rectangular fields dating from the 20th century are bounded by robust hedgerows with mature hedgerow trees, connecting to shelterbelts and copses in the wider area. Larger tracts of woodland include Beech Wood and Barhill Ancient Woodland. Stream valleys and former marl pits are also important landscape features and together with the rolling and manicured landscape of Onneley Golf Course add a layer of complexity to the traditional farmed landscape. Historic features include some listed buildings and the mature lime avenue at Moor Hall. The area is an important local recreational resource with an extensive PRoW network, the golf course and Maer Cricket Club. Vehicular access is largely confined to farm tracks and private roads although an extensive network of PRoW provides access across large parts of the LCA. This is generally a well-managed and intact landscape. Some modern farm buildings, A525 Bar Hill Road, electricity pylons, a wind turbine and the WCML are found around the eastern edge of the LCA and have a localised rather than widespread influence. Much of the landscape is scenic and has a sense of tranquillity. For these reasons the value of the landscape is considered to be medium-high.

Madeley Valley

11.3.22 This LCA is defined by the narrow incised course of the River Lea, with linear woodlands and areas of wet grassland and marsh in the valley floor giving way to gorse covered upper valley slopes. The Lum and Grafton's Wood ancient woodlands follow the upper course of the River Lea before joining the tree lined Checkley Brook, which forms most of the northern boundary of the LCA. The valley becomes less narrow further north, opening up into the larger scale more open and undulating farmland around Wrinehill Hall and Mill. This area of farmland shows evidence of field

enlargement and loss of hedgerows. A small PRoW network provides access through the valley and across the WCML which bisects the river valley between The Lum and Grafton's Wood. Low level noise from passing trains intermittently disturbs the tranquillity of this remote and secluded landscape. For these reasons the value of the landscape is considered to be medium-high.

Visual baseline

11.3.23 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, CA4 Map Book). In each case, the middle number (xxx.**xx**.xxx) identifies the type of receptor that is present in this area – 1: Protected Views (none within this area); 2: Residential; 3: Recreational[66]; 4: Transport; 5: Hotels/Healthcare Institutions (none within this area); and 6: Employment (none within this area).

11.3.24 Residential visual receptors within this area are located in and around the larger settlements of the combined village of Madeley, Middle Madeley and Little Madeley, the smaller village of Baldwin's Gate, hamlets such as Hill Chorlton and the residential developments of Whitmore Heath to Madeley Park Wood. Residential receptors are also found at numerous farmsteads and isolated properties.

11.3.25 A range of recreational visual receptors are located at Manor Road allotments and the playing field south-west of Madeley, Whitmore Cricket Club and users of the extensive PRoW network. Other recreational visitor receptors include visitors to Whitmore Hall and village, and users of Onneley Golf Course, Cudmore fisheries and the Unreal Paintball site on Manor Road.

11.3.26 Key transport visual receptors within this area are located on the A51 London Road, the A53 Newcastle Road, the A525 Bar Hill Road, a network of B roads and minor rural roads and lanes.

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 practicably be mitigated. Such effects are temporary and would 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

[66] Reference to specific civil parish numbers for footpaths is provided where available otherwise the adjacent road name is used as a reference to the footpath

construction programme. The majority of the main and satellite compounds are assumed to be in place for the whole of this phase.

11.4.3 The construction works that have been taken into account in determining the potential effects on landscape and visual receptors includes:

- 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 nine satellite compounds, as described in Section 2.3;
- construction of transfer nodes;
- diversion of Bent Lane (North), Manor Road, Red Lane and the A525 Bar Hill Road;
- permanent closure of a section of Snape Hall Road;
- construction of culverts, including at Dab Green drop inlet, Whitmore Wood, Madeley Park, Wrinehill South and two culverts associated with proposed underbridges;
- construction of Snape Hall Road inverted siphon, Drummers Stile inverted siphon and Bar Hill aqueduct;
- construction of eight balancing ponds for railway drainage;
- construction of viaducts over Meece Brook and the River Lea;
- construction of the Stableford North embankment, Meece embankment; Lea South embankment, Lea North embankment; the A525 Bar Hill Road embankment and Checkley South embankment;
- excavation of the Whitmore South cutting, Whitmore North cutting and Madeley cutting;
- construction of Whitmore Heath cut and cover tunnel;
- construction of Whitmore Heath bored tunnel and Madeley bored tunnel (including porous portals, head houses, emergency assembly areas and access roads);
- construction of overbridges, including, Whitmore Wood overbridge, Manor Road overbridge and the A525 Bar Hill Lane overbridge;
- temporary realignment of the A53 Newcastle Road;
- temporary PRoW diversions of Whitmore Footpath 4, Madeley Footpath 6, Madeley Footpath 14; Madeley Bridleway 1, and Madeley Bridleway 2;
- permanent PRoW diversions and realignments of Swynnerton Footpath 10, Madeley Footpath 14, Madeley Bridleway 1 and Madeley Bridleway 5;

- demolition of one residential property on Manor Road, and two residential properties on the A525 Bar Hill Road;
- construction of an auto-transformer feeder station at Bitterns Lane; 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[67];
- 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. Implementation of these measures has been taken into account in the assessment of the construction effects.

Assessment of impacts and effects

Introduction

11.4.5 The most apparent changes to landscape character and visual receptors during construction would relate to the presence of construction plant, the excavation of cuttings, pile driving and reception of viaducts, construction of embankments, soils and materials storage and stockpiling and the removal of existing landscape elements, including trees and hedgerows, as well as the permanent closure and diversion of existing roads, lanes and PRoW. Other key changes include the construction of overbridges and underbridges, compounds and transfer nodes, plus property demolitions.

11.4.6 Effects in relation to landscape and visual receptors are summarised below.

Landscape assessment

11.4.7 Based on the current Proposed Scheme design it is anticipated that potentially significant effects on landscape character would occur to the following LCAs:

11.4.8 Baldwin's Gate Sandstone Hills and Heaths LCA, a landscape of medium-high susceptibility and medium-high sensitivity to change resulting from the Proposed

[67] BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations, 2012, British Standard

Scheme. It would be indirectly impacted by construction of the Meece Brook viaduct and realignment of the A53 Newcastle Road. This would affect the perceptual characteristics of the scenic and relatively intact landscape along the eastern edge of this LCA. Construction of the Proposed Scheme would introduce a localised medium magnitude of change and an overall moderate adverse significant effect.

11.4.9 Upper Meece Brook Valley Ancient Redlands LCA, a landscape of low-medium susceptibility and medium sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the Meece Brook viaduct and embankments, Bent Lane diversion, realignment of the A53 Newcastle Road and Whitmore Heath tunnel, including southern portal and headhouse, with loss of vegetation and a high degree of disturbance. Construction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse significant effect.

11.4.10 Upper Meece Brook Valley Alluvial Lowlands LCA, a landscape of low-medium susceptibility and low-medium sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the Meece Brook viaduct, Bent Lane diversion, realignment of the A53 Newcastle Road and Whitmore Heath tunnel, including portals and headhouses, with removal of vegetation and a high degree of disturbance. The cutting slopes for the Whitmore south tunnel portal would also directly affect the topography, cutting into a ridgeline, which is part of the defining characteristics of the local landscape. Construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.11 Whitmore Hall Valley Ancient Redlands LCA, a landscape of high susceptibility and high sensitivity to change resulting from the Proposed Scheme. The south western edge of this landscape would be directly impacted by the realignment of the A53 Newcastle Road and construction of Whitmore Heath tunnel, including portals and headhouses, with removal of vegetation and a high degree of disturbance. Visibility of the construction of the Proposed Scheme to the south, including the Meece Brook viaduct, would also impact the setting of southern and south western aspects of this landscape. For these reasons, and despite the proposals impacting only the southern and south western aspects of the landscape, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.12 Hey Sprink Ancient Redlands and Woodlands LCA, a landscape of medium-high susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the Whitmore Heath tunnel, including portals and headhouses, Snape Hall Road closure (creating localised change to rural road character) and Whitmore Wood retaining wall. Substantial change to the character of this rural landscape is anticipated due to removal of part of Whitmore Wood and removal of trees around Snape Hall Road. Despite the presence of the WCML, much of the area has a sense of remoteness and tranquillity and the construction works would introduce a high degree of additional disturbance. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.13 The Upper Lea Valley Ancient Redlands LCA, a landscape of medium susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the Whitmore Heath tunnel, including portals and headhouses, River Lea viaduct and Manor Road diversion with removal of vegetation, including sections of the linear tree belts north of Whitmore Wood. The wooded landscape around the disused Silverdale Line and Madeley Chord would be completely altered by construction of the viaduct. Despite the presence of the WCML, much of the area has a sense of remoteness and tranquillity and the construction works would introduce a high degree of additional disturbance. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.14 Old Madeley Manor Ancient Redlands LCA, a landscape of medium susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the River Lea viaduct, Manor Road and the A525 Bar Hill Road diversions, by severing the historic hedgerow field pattern and interrupting the scale of the landscape. Although existing infrastructure locally reduces the tranquillity of this LCA, the construction works would introduce a high degree of additional disturbance. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.15 Madeley Ancient Redlands LCA, a landscape of low-medium susceptibility and low-medium sensitivity to change resulting from the Proposed Scheme. A small part would be directly impacted and a larger area indirectly impacted, due to construction of the River Lea viaduct and Manor Road, Red Lane and the A525 Bar Hill Road diversions. Although existing infrastructure reduces the tranquillity of this LCA, the works would introduce a high degree of additional disturbance. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.16 Madeley Ancient Clay Farmlands LCA, a landscape of medium-high susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. It would be directly impacted by construction of the A525 Bar Hill Road diversion and the Madeley tunnel. This would result in removal of trees and hedgerows including loss of trees adjoining Barhill Wood Ancient Woodland. Field patterns and visual connections between this woodland and properties on Bar Hill Road and the edge of Madeley would be severed. Although existing infrastructure locally reduces the tranquillity of this landscape, the works would introduce a high degree of additional disturbance. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

11.4.17 Checkley Farms and Woods LCA, a landscape of medium-high susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. A small part of this landscape would be directly impacted by construction of the Checkley South embankment, which would introduce a high degree of disturbance into the secluded and tranquil rural landscape which lies between Wrinehill and Grafton's Wood ancient woodlands and would sever the visual connection between the woodlands. For these reasons, construction of the Proposed Scheme would potentially introduce a high

magnitude of change and overall major adverse significant effect, although this would be very localised and most of the landscape would remain unaffected.

11.4.18 Madeley Valley LCA, a landscape of medium-high susceptibility and medium-high sensitivity to change resulting from the Proposed Scheme. It would be indirectly impacted by construction of the Checkley South embankment in the adjacent Checkley Farms and Woods LCA. The landscape is relatively remote and tranquil in character and construction activity would introduce a high degree of disturbance and change to horizon character. For these reasons, construction of the Proposed Scheme would potentially introduce a high magnitude of change and overall major adverse significant effect.

Visual assessment

11.4.19 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 would experience significant effects at night time arising from additional lighting, these are also presented in this section.

11.4.20 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity would be lower than those reported.

11.4.21 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 paragraph 11.4.32 for further detail of construction lighting effects). Where there would be no direct foreground visibility of additional lighting, no further assessment has been undertaken.

View east from Whitmore Footpaths 5, 6 and 11 east of Baldwin's Gate

11.4.22 From viewpoints 020-03-008, 020-03-009, 021-03-010, 020-03-011 and 020-03-022 (maps LV-11-120b and 121 in Volume 2, CA4 Map Book), there would be medium range views of construction works related to the Stableford North embankment, Meece Brook viaduct, Meece embankment, Bent Lane (North) diversion, Whitmore South cutting and realignment of the A53 Newcastle Road. The prominence and scale of construction activity including earthworks, erection of viaduct piers and spans, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the rural outlook across the Meece Brook valley. For these reasons, a high magnitude of visual change and potentially major adverse effects are anticipated.

View south-west from entrance to Whitmore Cricket Club

11.4.23 From viewpoint 020-02-018 (map LV-11-120b in Volume 2, CA4 Map Book), there would be medium range views of construction works related to the Stableford North embankment, Meece Brook viaduct, Meece embankment, Bent Lane North diversion, Whitmore South cutting and the A53 Newcastle Road realignment. The prominence and scale of the construction activity including earthworks, erection of viaduct piers

and spans, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the rural outlook across the Meece Brook valley. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

View south-east from residences and Whitmore Footpath 4 near Rectory Lane near Baldwin's Gate

11.4.24 From viewpoint 020-02-016 (map LV-11-120b in Volume 2, CA4 Map Book), there would be slightly elevated medium range views of construction works related to the A53 Newcastle Road temporary realignment and works associated with the southern end of the Whitmore Heath tunnel. The prominence and scale of construction activity including earthworks, presence of equipment, movement of construction vehicles, movement of material and stockpiles would substantially change the rural outlook. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

View south and south-west from residences on Snape Hall Road at Whitmore Heath

11.4.25 From viewpoint 021-04-004 (map LV-11-121 in Volume 2, CA4 Map Book), receptors would experience close range views of construction works related to the northern end of the Whitmore Heath tunnel and Snape Hall Road closure. Extensive tree removal would be required to facilitate the construction. The prominence and scale of construction activity including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the current outlook. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Views north-east from Whitmore Footpath 5 within the Lea Valley near Whitmore Wood

11.4.26 From viewpoints 021-03-007, 021-02-008, 021-02-009 and 021-02-005 (map LV-11-121 in Volume 2, CA4 Map Book) there would be medium range views of construction works on the eastern valley side related to the northern end of the Whitmore Heath tunnel and excavation of the Whitmore North cutting and Whitmore Wood retaining wall. A linear swathe of trees would be removed in Whitmore Wood to facilitate the construction. Construction works related to the Lea South embankment and River Lea viaduct would also be distantly visible. The prominence and scale of construction activities including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the current views towards the opposite valley side. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Views north-east from residences on Manor Road

11.4.27 From viewpoints 022-04-001 and 021-03-013 (map LV-11-121 in Volume 2, CA4 Map Book), there would be medium range to distant views of construction works related to the Lea North embankment and River Lea viaduct, including extensive tree removal around the disused Silverdale line and Madeley Chord. The prominence and scale of construction activities including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially

change the rural outlook and views to the horizon. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Views north and north-east from residences on Manor Road east of Lower Bitterns Wood

11.4.28 From viewpoints 022-02-002, 022-03-003 and 022-02-004 (map LV-11-122 in Volume 2, CA4 Map Book), including Manor Farm, Manor Farm Cottages and Radwood Cottages) there would be medium range to distant views of construction works in the River Lea valley. These are related to the Lea North embankment, Bitterns Lane auto-transformer station, River Lea viaduct and Manor Road diversion, including extensive tree removal along Manor Road and around the disused Silverdale line and Madeley Chord. The prominence and scale of construction activities including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the rural outlook and views to the horizon. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Views west and south from Red Lane and residences on the A525 Bar Hill Road

11.4.29 From the viewpoints 022-02-018, 022-02-022, 022-02-012 and 023-02-001 (maps LV-11-122 and 123a in Volume 2, CA4 Map Book), there would be close range views of construction works. These are related to the A525 Bar Hill Road and Red Lane diversions, excavation of Madeley cutting and the southern end of the Madeley tunnel. Construction of the Bar Hill aqueduct would form a local feature of the horizon above the tree line. The construction works, which would include major earthworks for the Madeley cutting and Madeley tunnel excavation, would be seen both elevated and ground level and would interrupt views of Barhill Wood. The prominence and scale of construction activities including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles, would dominate views. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

View east from Madeley Bridleway 2 near Wrinehill Wood

11.4.30 From viewpoint 023-03-010 (map LV-11-123a in Volume 2, CA4 Map Book), there would be slightly elevated medium range views of construction works related to the Proposed Scheme, the northern end of Madeley tunnel and associated structures and Checkley South embankment. The prominence and scale of the construction activity including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles would substantially change the rural outlook and views to Grafton's Wood and The Lum would be obstructed. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Views south from Madeley Bridleway 2 and Madeley Footpath 28 next to River Lea at Wrinehill Hall

11.4.31 From viewpoint 023.03.016 on the PRoW (Madeley Bridleway 2 and Madeley Footpath 28), (map LV-11-123a in Volume 2, CA4 Map Book), there would be close range views of construction works. These are related to the Proposed Scheme, Checkley South

embankment (and the Checkley Brook viaduct in the adjacent South Cheshire area (CA5)) and Madeley Bridleway 2 accommodation underbridge. The prominence and scale of construction activities including earthworks, presence of equipment, movement of construction vehicles, movement of material and stock piles, would dominate views would give rise to a high magnitude of visual change. Existing views of Wrinehill Wood would potentially be impacted due to the height of the construction activities and emerging embankments. For these reasons a high magnitude of visual change and potentially major adverse effects are anticipated.

Night time effects

11.4.32 Night time surveys will be undertaken and reported in the formal EIA Report. Potential visual impacts arising from additional lighting at night during construction within the Whitmore Heath to Madeley area may arise from continuous working and overnight working at Whitmore Heath tunnel and Madeley tunnel.

11.4.33 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

11.4.34 To further reduce the significant effects described above, consideration will be given to where planting could be established early in the construction programme as part of the design development. 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. Directional lighting would also be considered in relation to construction activity. 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 residual effects 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. It is anticipated that the following significant effects would remain after implementation of construction phase mitigation:

- major adverse effects in relation to the Upper Meece Brook Valley Ancient Redlands LCA, Upper Meece Brook Valley Alluvial Lowlands LCA, Whitmore Hall Valley Ancient Redlands LCA, Hey Sprink Ancient Redlands and Woodlands LCA, Upper Lea Valley Ancient Redlands LCA, Old Madeley Manor Ancient Redlands LCA, Madeley Ancient Clay Farmlands LCA, Madeley Ancient Redlands LCA, Checkley Farms and Woods LCA and Madeley Valley LCA;
- moderate adverse landscape effects in relation to the Baldwin's Gate Sandstone Hills and Heaths LCA;

- major adverse visual effects in relation to Whitmore Footpaths 5, 6 and 11, Whitmore Cricket Club, Whitmore Footpath 4, Madeley Bridleway 2 and Madeley Footpath 28; and
- major adverse visual effects in relation to residential and recreational receptors near Rectory Lane, Snape Hall Road, Manor Road and the A525 Bar Hill Road.

11.5 Effects arising during 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:

- presence of the Proposed Scheme and associated overhead line equipment (most prominently on the proposed viaducts and embankments);
- permanent highway diversions at Bent Lane (North), Snape Hall Road, Manor Road and the A525 Bar Hill Road;
- presence of culverts at Dab Green Drop, Whitmore Wood Stream, Madeley Park, Wrinehill South and plus a siphon at Snape Hall Road and aqueduct at Barr Hill;
- presence of balancing ponds for railway drainage;
- presence of viaducts over the Meece Brook and the River Lea;
- presence of the Stableford North, Lea South, Lea North and Checkley South embankments;
- presence of the Whitmore South, Whitmore North and Madeley cuttings;
- presence of the porous portals, headhouses, emergency assembly areas and access roads at Whitmore Heath tunnel and Madeley tunnel;
- presence of the Whitmore Heath cut and cover tunnel;
- presence of overbridges at Whitmore Wood, Manor Road and the A525 Bar Hill Lane;
- ongoing effect on character at the operational stage resulting from the re-alignment of Swynnerton Footpath 10, and permanent diversions of Madeley Footpath 14, Madeley Bridleway 1 and Madeley Bridleway 5;
- permanent loss of commercial/ farm buildings at Bent Lane, Whitmore, a residential property on Manor Road, and two residential properties at Bower End Lane;
- the presence of fencing and noise barriers; and
- presence of an auto-transformer station at Bitterns Lane.

Avoidance and mitigation measures

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 would also consider the relationship to surrounding land uses and management such as agriculture;
- replacement or additional 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 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
- replacement of field ponds with new wetlands, water balancing and biodiversity wetland features.

Assessment of impacts and effects

Introduction

11.5.2 The likely effects on landscape character and visual receptors during operation of the Proposed Scheme relate to the presence of new structures, elements, permanent road and PRoW diversions in the landscape.

Landscape assessment

11.5.3 Based on the current Proposed Scheme design it is assessed that, in both summer and winter of year one of operation, there is the potential for significant effects on landscape character.

11.5.4 Both parts of the Upper Meece Brook Valley Ancient Redlands LCA would be directly impacted by the presence of the Meece Brook viaduct, Bent Lane diversion and Whitmore Heath tunnel. Mitigation earthworks (including slackening of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. In the southern part of the landscape, where the WCML and the Proposed Scheme would run in proximity to each other, the Proposed Scheme would intensify perceptual impacts on scenic quality and tranquillity. . Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.5 The Upper Meece Brook Valley Alluvial Lowlands LCA would be directly impacted by the presence of the Meece Brook viaduct, Bent Lane diversion and Whitmore Heath tunnel. Mitigation earthworks (slackening of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would be appear changed. The

Proposed Scheme would intensify perceptual impacts on scenic quality and tranquillity, near the realigned Bent Lane where the WCML and Proposed Scheme would run in proximity to each other. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.6 Although the Proposed Scheme would be in tunnel under Whitmore Heath, the landscape at either end of the tunnel which lies within the western edge of the Hey Sprink Ancient Redlands and Woodlands LCA, would be directly impacted by the presence of the Whitmore Heath tunnel, Snape Hall Road closure (due to changes to rural road character) and Whitmore Wood retaining wall. The Proposed Scheme would substantially change the character of the rural landscape in terms of both landform and pattern of land cover. Whitmore North cutting would permanently visually and perceptually sever Whitmore Heath ancient woodland and the closure of Snape Hall Lane, together with the presence of the porous portal and other infrastructure, would change the character of the local landscape of the northern side of Whitmore Heath. Mitigation earthworks (including grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. In addition, the Proposed Scheme would reduce scenic quality and introduce intermittent disturbance which would locally affect the tranquillity of the landscape. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.7 The Upper Lea Valley Ancient Redlands LCA would be directly impacted by the presence of the Whitmore Heath tunnel, River Lea viaduct and noise barriers plus underbridges, culverts and embankments, and the diverted Manor Road. The wooded landscape around the disused Silverdale line and Madeley Chord would be completely changed due to the presence of the large River Lea viaduct, underbridges, culverts, embankments and noise barriers. The presence of overhead line equipment on the River Lea viaduct would substantially change the existing landscape and skyline character. Mitigation earthworks (including grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. The Proposed Scheme would reduce the naturalistic appearance of the landscape along the disused rail lines and introduce intermittent disturbance which would locally affect the tranquillity of the landscape and intensify the effects of the WCML. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.8 Old Madeley Manor Ancient Redlands LCA would be directly impacted by the presence of the River Lea viaduct, Manor Road, Red Lane and the A525 Bar Hill Road diversions. This is a low lying valley floor farming landscape associated with the course of the River Lea. Mitigation earthworks (including grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. The presence of the Lea North embankment, south of the A525 Bar Hill Road, would change the valley landform and setting, causing severance

of the historic hedgerow field pattern and interruption of landscape scale across the valley. An area of farmland between the WCML and the Proposed Scheme would be encircled by rail infrastructure which would change the perceptual characteristics of the landscape within an increased sense of severance and a reduction in tranquillity and scenic quality. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.9 A small part of the Madeley Ancient Redlands LCA would be directly impacted by the presence of the River Lea viaduct and the Manor Road, Red Lane and the A525 Bar Hill Road diversions. A larger part of the landscape would potentially be indirectly impacted through a change in perceptual landscape character due to the construction works associated with the River Lea viaduct and Manor Road diversion. Mitigation earthworks, including a planted landscape bund south of the A525 Bar Hill Road and planting would help to integrate these elements into the landscape, but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. An area of farmland between the WCML and the Proposed Scheme would be encircled by rail infrastructure which would change the perceptual characteristics of the landscape within an increased sense of severance and a reduction in tranquillity and scenic quality. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.10 Madeley Ancient Clay Farmlands is a large LCA which would be affected by the presence of the A525 Bar Hill Road diversion and the Madeley tunnel, portals and north and south cuttings. Mitigation earthworks (including grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. The presence of the Madeley cuttings and the portal for the Madeley tunnel would substantially change the landscape north of the A525 Bar Hill Road, causing severance of the historic hedgerow field pattern and interruption of landscape scale across the valley. Visual connections between the elevated Barhill ancient woodland which is a prominent landscape feature and properties on the A525 Bar Hill Road and the edge of Madeley would be severed. The rural setting of the woodland and the properties along the A525 Bar Hill Road would be substantially changed and operation of the Proposed Scheme would intensify the effects of the WCML in terms of reduction in tranquillity and scenic quality as the WCML and Proposed Scheme would both run in close proximity and parallel to each other between Barhill Wood and the edge of Madeley. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.11 Within the Checkley Farms and Woods LCA a small part of this landscape would be directly impacted, and a larger area indirectly impacted through a change in perceptual landscape character, due to the presence of the Checkley South embankment. Mitigation earthworks (grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. The presence of Checkley South embankment would change the character of the rural landscape which lies between Wrinehill and Grafton's Wood ancient

woodlands, causing severance of the historic hedgerow field pattern and interruption of landscape scale across the valley. It would also break the visual and perceptual connection between Wrinehill and Grafton's Wood ancient woodlands which are on opposite sides of the Proposed Scheme. The character of the farmland which is currently secluded, remote and tranquil would be substantially changed, as it would introduce new large scale infrastructure and intermittent disturbance from passing trains into an area which is currently unaffected by the WCML. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.12 The northern part of the Madeley Valley LCA would be affected by the presence of the Checkley South embankment. Mitigation earthworks (including grading of embankment slopes) and planting would help to integrate these elements into the landscape but at year 1 before the planting matures, the landform and land cover pattern would appear substantially changed. The presence of this feature would affect the openness of the farmland causing visual severance and interruption of landscape scale across the valley. An area of farmland between the WCML and the Proposed Scheme, which includes the historic Wrinehill Mill and Wrinehill Hall, would be encircled by rail infrastructure which would change the perceptual characteristics of the landscape within an increased sense of severance and a reduction in tranquillity and scenic quality. Introduction of the Proposed Scheme would introduce a high magnitude of change and an overall major adverse effect on the character of the landscape.

11.5.13 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 still be significant (moderate adverse) due to the level of severance created by the Proposed Scheme.

Visual assessment

11.5.14 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.

11.5.15 Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity would be lower than those reported.

11.5.16 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 potential exception of the tunnel portals). Where there would be no direct foreground visibility of additional lighting, no further assessment has been undertaken.

View east from Whitmore Footpaths 5, 6 and 11 east of Baldwin's Gate

11.5.17 In winter and summer of year 1, from viewpoints 020-03-008, 020-03-009, 021-03-010, 020-03-011 and 020-03-022 (Map LV-11-120b in Volume 2, CA4 Map Book), there

would be medium range views across the WCML of the Proposed Scheme, Meece Brook viaduct and Stableford North embankment, together with the diverted Bent Lane (North). The upper elements of the Proposed Scheme such as the overhead line equipment and movement of trains may also be visible. The new structures and loss of landscape features, including hedgerows and field boundaries, would substantially change the rural outlook across the Meece Brook Valley. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse visual effects.

11.5.18 The effects may reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.19 It is likely that significant visual effects would remain at year 15, although these would reduce to moderate adverse as views would be partially obscured and filtered by the maturing mitigation planting and the viaduct, embankments and associated earthworks would be more integrated within the views.

View south-west from entrance to Whitmore Cricket Club

11.5.20 In winter year 1, from viewpoint 020-02-018 (map LV-11-120b in Volume 2, CA4 Map Book), there would be medium range views of the Meece Brook viaduct, Meece embankment and the Whitmore South cutting. The upper elements of the Proposed Scheme such as the overhead line equipment and movement of trains may also be visible. The new structures and landform combined with the loss of landscape features, including hedgerows and field boundaries, would change the rural outlook. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects.

11.5.21 The effects may reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.22 It is likely that significant visual effects would remain at year 15, although these would reduce to moderate adverse as views would be partially obscured and filtered, by the maturing mitigation planting. The Meece Brook viaduct, Meece embankment and the Whitmore South cutting would be more integrated within their landscape context.

View south-east from residences and Whitmore Footpath 4 near Rectory Lane near Baldwin's Gate

11.5.23 In winter year 1 from viewpoint 020-02-016 (map LV-11-120 in Volume 2, CA4 Map Book), there would be medium range views of the Proposed Scheme in particular works associated with the southern end of the Whitmore Heath tunnel. The new structures and reconfigured landform combined with the loss of landscape features, including hedgerows and mature trees, would substantially change the view. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse visual effects.

11.5.24 The effects may reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views.

11.5.25 It is likely that effects would reduce such that they would not be significant at year 15, due to views being partially obscured and filtered by the maturing mitigation planting,

which would assist in integrating the tunnel portal, headhouse and emergency area into their context.

View south-west from Snape Hall Road at Whitmore Heath

11.5.26 In winter year 1 from viewpoint 021-04-004 (map LV-11-121 in Volume 2, CA4 Map Book), there would be close range views of the Proposed Scheme, Whitmore Heath porous portal at the northern end of Whitmore tunnel, associated structures such as the tunnel head house and a surface water pump station. Snape Hall Road would be permanently closed leading to severance of views and a new landscape created. The new structures and reconfigured landform combined with the loss of landscape features, including the road landscape, hedgerows and mature trees, would substantially change this part of Whitmore Heath. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse visual effects.

11.5.27 The effects may reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.28 It is likely that by year 15, the new mitigation planting would be maturing and views, although different to those currently experienced would not necessarily be adverse. Elements of the Proposed Scheme such as the cutting slopes, Whitmore Heath tunnel portals, tunnel headhouses and emergency assembly areas would be more integrated within their context and substantially screened from public view. For these reasons it is anticipated there would be a minor and therefore not significant adverse effects.

Views north-east within the Lea Valley near Whitmore Wood

11.5.29 In winter and summer of year 1 from viewpoints 021-03-007, 021-02-008, 021-02-009 and 021-02-005 (map LV-11-121 in Volume 2, CA4 Map Book), there would be views of the Proposed Scheme emerging from the northern end of the Whitmore Heath tunnel and running through Whitmore Wood in the Whitmore North cutting and Whitmore Wood retaining wall. North of Whitmore Wood, the Proposed Scheme would also be seen on the Lea South embankment on the approach to the River Lea viaduct, where the route would cross the WCML. A noise fence barrier would be visible on the top of the western side of the Lea South embankment and River Lea viaduct as would the upper elements of the scheme such as the overhead line equipment and movement of trains. The new structures and landform would be prominent landscape features, and combined with the loss of vegetation, including hedgerows, mature trees and a section of ancient woodland, would substantially change the rural outlook across the Lea valley. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects.

11.5.30 The effects would reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.31 It is likely that effects would reduce such that they would not be significant at year 15, as the mitigation planting along the east side of the Lea valley would be maturing and the outlook, although different to those currently experienced would not be adverse. The planting would screen most views of the Proposed Scheme although there may be glimpsed views of the overhead line equipment.

Views north-east from residences on Manor Road

11.5.32 In winter year 1 from viewpoints 022-04-001 and 021-03-013 (maps LV-11-121 and 122 in Volume 2, CA4 Map Book), there would be medium range to distant views of the Proposed Scheme, Lea North embankment and River Lea viaduct. The Lea South embankment would be clearly visible on the opposite side of the valley. The River Lea viaduct itself would also form a horizon feature. A noise fence barrier would be visible on the top of the viaduct as would the upper elements of the scheme such as the overhead line equipment and movement of trains. The new structures and landform would be prominent landscape features, and combined with the loss of vegetation, including hedgerows and mature trees would substantially change the rural outlook and obscure some views of Hey Sprink Wood on the opposite valley side. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects. The effects would reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.33 It is likely that significant visual effects would remain at year 15, although these would reduce to moderate adverse as views would be partially obscured and filtered by the maturing mitigation planting and the River Lea viaduct, embankments and associated earthworks would be more integrated within their context. For these reasons it is anticipated there would be moderate adverse visual effects.

Views north and north-east from Manor Road east of Lower Bitterns Wood

11.5.34 In winter year 1 from 022-02-002, 022-03-003 and 022-02-004 (map LV-11-122 in Volume 2, CA4 Map Book), there would be close range views of the River Lea viaduct and Lea North embankment, particularly from viewpoint 022-02-004. The River Lea viaduct would form a prominent horizon feature with the upper elements of the Proposed Scheme including the overhead line equipment visible. Noise barriers on the western side of the viaduct structure would largely screen the movement of passing trains. To the north there would be views of the diverted Manor Road, crossing the Proposed Scheme via a new overbridge. The combined effects of the new structures and landform, and loss of landscape features, including tree removal around the disused Silverdale line and Madeley Chord, would be visible across a wide area. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects. The effects would reduce slightly in summer in year 1 due to intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.35 It is likely that significant visual effects would remain at year 15, although these would reduce to moderate adverse as views would be partially obscured and filtered by the maturing mitigation planting and the River Lea viaduct, Lea North embankment and associated earthworks would be more integrated within their context.

Views west and south from Red Lane and residences on the A525 Bar Hill Road

11.5.36 In winter year 1 from viewpoints 022-02-018, 022-02-022, 022-02-012 and 023-02-001 (maps LV-11-122 and 123 in Volume 2, CA4 Map Book), there would be views of the Proposed Scheme, Madeley cutting and Madeley tunnel portal tunnel head house

emergency assembly area and surface water pumping station. The Bar Hill aqueduct would form a new horizon feature. A new landscape bund running parallel with the eastern side of the line would be constructed south of the A525 Bar Hill Road. Noise barriers on the northern side of the A525 Bar Hill road would extend along the north side of the Madeley cutting and the landscape bund south of the road. This barrier would largely screen the movement of passing trains. The A525 Bar Hill Road, which would be realigned both horizontally and vertically to cross the Proposed Scheme via a new overbridge, would be prominent in southerly foreground views from the front of the cottages along the A525 Bar Hill Road. The effects of the new structures and landform combined with loss of landscape features including hedgerows and mature trees would substantially change the views in this area. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects.

11.5.37 The effects may reduce slightly in summer in year 1 due to vegetation along the A525 Bar Hill Road being in leaf and obscuring some views, although the level of effect would not change.

11.5.38 It is likely that significant visual effects would remain at year 15. Although views would be partially obscured and filtered by the maturing mitigation planting although the rural outlook would be completely changed by the presence of the structures described above. For these reasons it is anticipated there would still be major adverse effects.

View east from Madeley Bridleway 2 near Wrinehill Wood

11.5.39 In winter year 1 from viewpoint 023-03-010 (map LV-11-123 in Volume 2, CA4 Map Book), there would be slightly elevated medium range views of the Proposed Scheme, the northern end of Madeley tunnel, portal, tunnel headhouse and emergency assembly area and Checkley South embankment. Although the Checkley South embankment would be returned to agriculture, the new structures and landform would be prominent landscape features, and would substantially change the rural outlook across the valley. Views to Grafton's Wood and The Lum would be partially obscured. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse visual effects. The effects may reduce slightly in summer in year 1 due to the occasional field boundary trees being in leaf and obscuring some views, although the level of effect would not change.

11.5.40 It is likely that significant visual effects would remain at year 15, although these would reduce to moderate as views of the northern end of Madeley tunnel and associated portal and headhouse would be partially obscured and filtered by the maturing mitigation planting. Checkley South embankment would be more integrated within their context.

Views south from Madeley Bridleway 2 and Madeley Footpath 28 next to River Lea at Wrinehill Hall

11.5.41 In winter year 1 from viewpoint 023.03.016 (Map LV-11-101 in Volume 2, CA4 Map Book), on the PRoW (Madeley Bridleway 2 and Madeley Footpath 28), there would be close range views of the Proposed Scheme, Checkley South embankment and the Checkley Brook viaduct in the South Cheshire area) and Madeley Bridleway 2

accommodation underbridge. The prominence and scale of these elements, would substantially change the rural outlook. Existing views of Wrinehill Wood would be partially obscured due to the height of the embankments. For these reasons it is anticipated there would be a high magnitude of visual change and major adverse effects on these receptors.

11.5.42 The effects may reduce slightly in summer in year 1 due to the intervening vegetation being in leaf and obscuring some views, although the level of effect would not change.

11.5.43 It is likely that significant visual effects would remain at year 15. Although these would reduce slightly as views of the embankment would be partially obscured and filtered by the maturing mitigation planting and both structures would be more integrated within their context, they would nevertheless remain prominent features, which would change the rural outlook. For these reasons it is anticipated there would still be major adverse visual effects on these receptors.

Night time effects

11.5.44 Night time surveys will be undertaken and potential visual effects arising from the additional lighting needed for the operation of the Proposed Scheme will be reported in the formal EIA Report. Where lighting is required at new road junctions, this would generally be close to areas and roads which are already lit throughout the night and these will not be considered as part of the night time assessment.

Other mitigation measures

11.5.45 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

11.5.46 In most cases, significant effects would 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 in relation to the Upper Meece Brook Valley Alluvial Lowlands LCA due to the presence of the Meece Brook viaduct, embankments and elevated overhead line equipment. The Proposed Scheme would substantially change the open rural landscape character and would affect most of the small scale valley landscape either directly or indirectly in terms of loss of rural character and perceptual qualities such as tranquillity;
- major adverse effects in relation to Upper Meece Brook Valley Ancient Redlands LCA. The Meece Brook viaduct, Bent Lane diversion and Whitmore Heath tunnel would directly affect this LCA. Despite the mitigation measures

proposed, including screen planting and landscape earthworks, the presence of these elements would adversely affect the perceptual qualities of the landscape, including scenic quality and tranquillity;

- moderate adverse effects in relation to the Hey Sprink Ancient Redlands and Woodlands LCA. Although in tunnel through part of this LCA, the presence of the Whitmore Heath tunnel porous portals and associated infrastructure would substantially change the local landscape character. This is in terms of landform, loss of mature tree cover, severance of landscape pattern and perceptual qualities such as tranquillity;
- major adverse effects in relation to the Upper Lea Valley Ancient Redlands LCA due to the presence of the Lea Valley viaduct, embankments and associated elevated overhead line equipment and noise barriers. The Proposed Scheme would substantially change the rural landscape character with associated reduction in perceptual qualities such as tranquillity;
- major adverse effects in relation to the Old Madeley Manor Ancient Redlands LCA due to the presence of the Proposed Scheme and associated overhead line equipment and A525 Bar Hill Road diversion. Although in cutting, these new elements would introduce uncharacteristic linear features and change the character of the farmland in terms of landform, severance of landscape pattern and perceptual qualities such as tranquillity;
- major adverse effects) in relation to the Madeley Ancient Redlands LCA due to the presence of the Proposed Scheme and associated overhead line equipment, Lea North embankment and Manor Road diversion. These new elements would change the rural landscape and horizon character in terms of loss of rural character and perceptual qualities such as tranquillity;
- major adverse effects in relation to the Madeley Ancient Clay Farmlands LCA Proposed Scheme. Although in tunnel through part of this LCA, the presence of the Madeley tunnel porous portals and associated infrastructure, and A525 Bar Hill Road diversion would substantially change the landscape character. This is in terms of landform, severance of landscape pattern and perceptual qualities such as tranquillity and enclosure;
- major adverse effects in relation to the Checkley Farms and Woods LCA due to the presence of the Checkley South embankment. These large scale elements would substantially change the open rural landscape character and would affect most of the small scale valley landscape either directly or indirectly in terms of loss of rural character, changes to landform, severance of landscape pattern and effects on perceptual qualities such as tranquillity;
- major adverse effects in relation to the Madeley Valley LCA due to the presence of the Checkley South embankment. This large scale element would substantially change the open rural landscape character and would affect most of the small scale valley landscape either directly or indirectly in terms of loss of rural character and perceptual qualities such as tranquillity;

- major visual effects for receptors using Red Lane and living on the A525 Bar Hill Road (viewpoints 022-02-018, 022-02-022, 022-02-012 and 023-02-001). This is due to visibility of structures at the southern end of the Madeley Tunnel and the A525 Bar Hill Road diversion, which would completely change the views in this area;
- major visual effects for receptors at Madeley Bridleway 2 and Madeley Footpath 28 next to the River Lea at Wrinehill Hall (viewpoint 023.03.016). This is due to the visibility of the Checkley South embankment;
- moderate visual effects for receptors using Whitmore Footpaths 5, 6 and 11, east of Baldwin's Gate (viewpoints 020-03-008, 020-03-009, 021-03-010, 020-03-011 and 020-03-022). This is due to the visibility of the Meece Brook viaduct and Meece embankment;
- moderate visual effects for receptors using the Whitmore Cricket Club (viewpoint 020-02-018). This is due to the visibility of the Meece Brook viaduct, Meece embankment and Whitmore South cutting;
- moderate visual effects for receptors living on Manor Road north of Madeley Park Wood (viewpoints 022-04-001 and 021-03-013). This is due to the visibility of the Lea South embankment and River Lea viaduct;
- moderate visual effects would remain for receptors using Manor Road east of Lower Bitterns Wood (viewpoints 022-02-002, 022-03-003 and 022-02-004). This is due to the visibility of Lea North embankment and River Lea viaduct; and
- moderate visual effects would remain for receptors using Madeley Bridleway 2 near Wrinehill Wood (viewpoints 023-03-010). This is due to the visibility of the Checkley South embankment.

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 significant effects during construction and operation of the Proposed Scheme within the Whitmore to Madeley 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 for the Whitmore Heath to Madeley area are reported within this section.

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

Construction

12.1.5 The proposed construction works have the following relevance in terms of socio-economics:

- 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 areas).

Operation

12.1.6 The operation of the Proposed Scheme would 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 This section provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area.

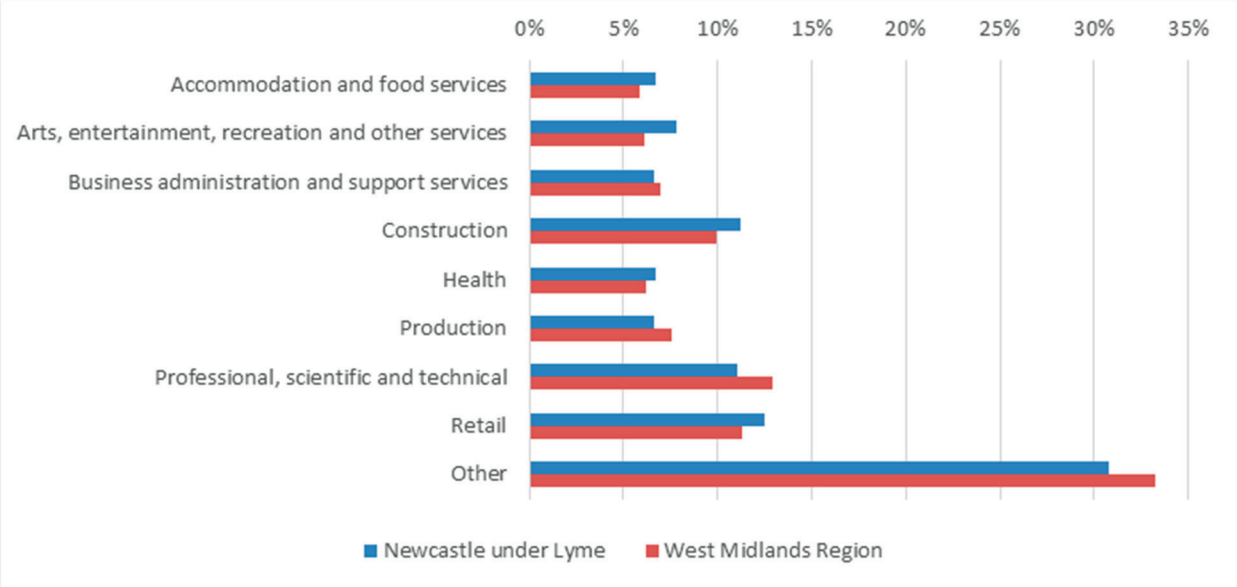
12.3.2 The Whitmore Heath to Madeley area lies within the administrative area of NBC within the County of Staffordshire. The area also falls within the Stoke-on-Trent and Staffordshire Local Enterprise Partnership area[68].

Business and labour market

12.3.3 Within the NBC area there is a wide spread of business types reflecting a diverse range of commercial activities. The retail sector accounts for the largest proportion of businesses (13%) followed by construction (11%) and professional, scientific and technical (11%). This is shown in Figure 6 [69]. For comparison within the West Midlands region, the largest sectors were: professional, scientific and technical (13%), followed by retail (11%) and construction (10%)[70].

12.3.4 For comparison within the West Midlands region, the largest sectors were: professional, scientific and technical (13%), followed by retail (11%) and construction (10%)[71].

Figure 6: Business sector composition in NBC and the West Midlands[72]



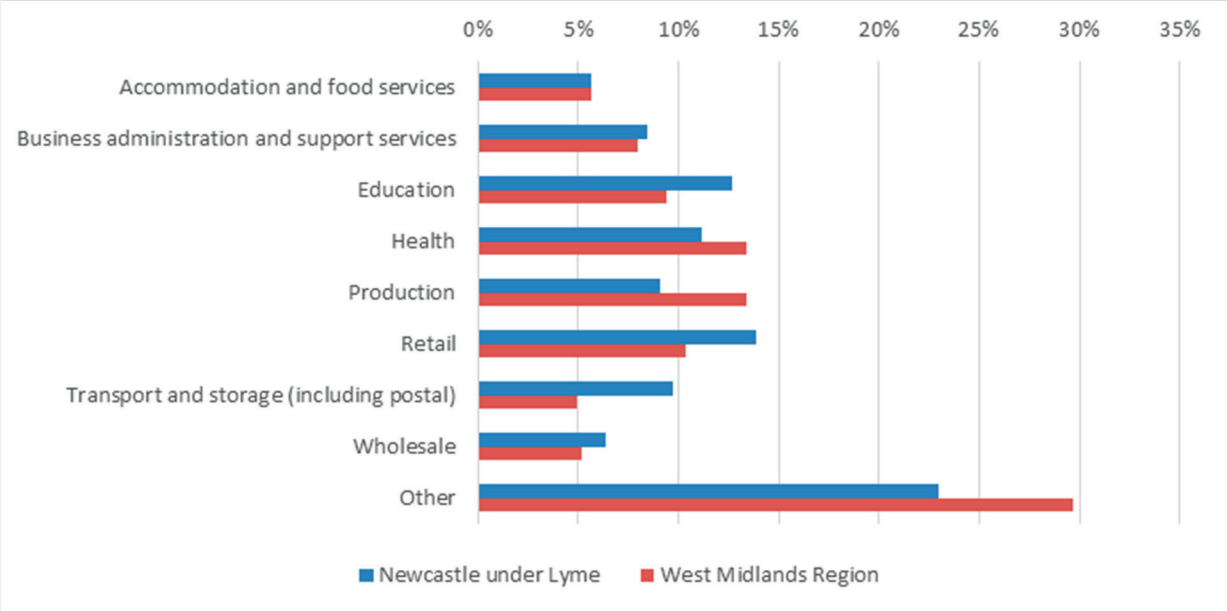
Source: Office for National Statistics (ONS), (2014), UK Business: Activity, Size and Location 2014; accessed: 11 January 2016.

12.3.5 In 2014[73], approximately 47,000 people worked in the NBC area. According to the Office of National Statistics (ONS) Business Register and Employment Survey 2014, the top five sectors in terms of share of employment in the NBC area are retail (14%); education (13%); health (11%); transport and storage (10%) and production (9%).

[68] Stoke-on-Trent and Staffordshire Local Enterprise Partnership, (2014), *Strategic Economic Plan Summary March 2014*
[69] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.
[70] Office for National Statistics (ONS), (2014), UK Business: Activity, Size and Location 2014; Accessed: 11 January 2016.
[71] Office for National Statistics (ONS), (2014), UK Business: Activity, Size and Location 2014; Accessed: 11 January 2016.
[72] "Other" includes: motor trades; transport and storage; finance and insurance; public administration and defence; and education sectors.
[73] Annual Population Survey, (2015), NOMIS, accessed 26 April 2016.

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: Employment by industrial sector in NBC and the West Midlands

Figure 7: Employment by industrial sector in NBC and the West Midlands[74]



Source: Office of National Statistics, (2012), Census 2011, accessed: 11 January 2016.

12.3.6 According to the Annual Population Survey (2016)[75], the employment rate[76] within the NBC area was 77% (61,000 people), which is higher than that recorded for both the West Midlands (70%) and England (74%). In 2016, unemployment[77] in the NBC area was 4% which was lower than the West Midlands (6%) and England (5%).

12.3.7 According to the Annual Population Survey (2015)[78], 28% of the NBC area 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 9% of residents had no qualifications, which was lower than that recorded for West Midlands (13%) but higher than England (8%).

Property

12.3.8 A review of employment land in 2015 identified a need for 5.1ha per year to 2039 for general business land in the NBC area and that sufficient provision existed at present[79].

[74] Other includes retail, construction, wholesale, information and communication, motor trades, public administration and defence, property, financial and insurance, and agriculture, forestry and fishing sectors.
[75] Annual Population Survey, (2015), NOMIS, Accessed: 25 July 2016.
[76] 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'.
[77] Refers to people without a job who were available to start work in the two weeks following their interview and who had either looked for work in the four weeks prior to interview or were waiting to start a job they had already obtained. As the unemployed form a small percentage of the population, the APS unemployed estimates within local authorities are based on very small samples so for many areas would be unreliable. To overcome this ONS has developed a statistical model that provides better estimates of total unemployed for unitary authorities and local authority districts (unemployment estimates for counties are direct survey estimates), NOMIS.
[78] Annual Population Survey, (2015), NOMIS, Accessed: 26 April 2016.
[79] NLP (2015) Joint Newcastle-under-Lyme and Stoke-on-Trent Employment Land Review. Based on 133 ha of employment land required between 2013 and 2039 (upper scenario).

12.3.9 Average vacancy rate for industrial and warehousing property in the NBC area in May 2016 has been assessed as 7% based on marketed space against known stock.

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 training and 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, comprising those that lie within land which 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 engaged in paintballing would be directly impacted by the Proposed Scheme. However, from an employment perspective, no significant direct effects on non-agricultural employment have been identified within the local area. Effects on agricultural businesses are reported separately in Section 4, Agriculture, forestry and soils, and total employment effects are reported in Volume 3, Route-wide assessment.

12.4.5 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[80] within this area. Taking into account the availability of alternative premises and the total number of people employed within the district (approximately 47,000), 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.

12.4.6 There would be nine satellite compounds for construction of the Proposed Scheme within the Whitmore Heath to Madeley area.

12.4.7 These sites could result in the creation of up to 1,600 person years of construction employment[81] opportunities, equivalent to 160 full-time equivalent permanent jobs[82]

[80] 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 from actual employment at the sites.

[81] 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.

[82] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

which depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been assessed as part of the route-wide assessment in Volume 3.

12.4.8 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 in Volume 3.

12.4.9 Any 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

12.4.10 No mitigation measures during construction of the Proposed Scheme are proposed in relation to business resources.

Summary of likely residual significant effects

12.4.11 Any likely residual significant socio-economic effects will be reported in the formal EIA Report.

12.5 Effects arising during 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 opportunities are considered unlikely to be accessed by residents of this area.

12.5.4 Operational effects are captured and assessed at a route-wide level in Volume 3. The combined effects of noise, vibration, visual, air quality or traffic 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 Whitmore Heath to Madeley 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[83]; 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'[84].

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[85] 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 NBC has been undertaken. The purpose of this engagement has been to obtain relevant information regarding residential and non-residential

[83] '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.
[84] Quiet areas are defined in the draft Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity.
[85] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

resources and existing baseline information. Engagement with NBC 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 the Map Series CT-10 in the Volume 2, CA4 Map Book. Map Series SV-01 shows areas of impact and proposed noise mitigation in the Whitmore Heath to Madeley 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 is 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. This assessment will be reported in the formal EIA Report.

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 The area is characterised by a mix of small towns, villages, hamlets and isolated residential properties in a predominantly rural setting. There are several major roads within this area including the A53 Newcastle Road (continuing to the A53 Whitmore Road) at the southern end of the area and the A525 Bar Hill Road, which runs through Madeley. Trains on the Stafford to Crewe section of the WCML also contribute to the sound environment, along with other local sound sources.

13.3.2 Sound levels close to these main transportation routes are high during the daytime, and are lower at night. Further away from the roads the sound levels are lower and some areas, particularly villages distant from the busy roads, experience low daytime sound levels.

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 would 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 draft 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, CA4 Map Book):

- Hill Chorlton, arising from construction activities such as earthworks, construction of the Meece Brook viaduct, road works and track base installation;
- Whitmore Heath South, arising from construction activities such as earthworks, tunnelling works at the Whitmore Heath tunnel southern portal, road works, and track base installation;
- Whitmore Heath North, arising from construction activities such as earthworks, tunnelling works at the Whitmore Heath tunnel northern portal, road works, and track base installation;
- Madeley Park Wood, arising from construction activities such as earthworks, concrete works and track base installation;
- Bar Hill, Madeley, arising from construction activities such as earthworks, tunnelling works for the Madeley tunnel, road works and track base installation; and
- Madeley, arising from construction activities such as earthworks, tunnelling works for the Madeley tunnel, road works 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. Snape Hall Road in Whitmore Heath and Manor Road through Madeley have been identified on a precautionary basis as having the potential for an adverse noise effect on occupants of any residential communities along this 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 presence of the permanent noise fence barriers.

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 in this area 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 ES. 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, CA4 Map Book).

13.5.4 In practice, barriers may differ from this description whilst maintaining the required acoustic performance. For example, where noise barriers are in the form of landscape earthworks they need to be higher above rail level to achieve similar noise attenuation to 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 fence 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 Noise Insulation Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Noise Insulation Regulations based upon the currently available information. Qualification for noise insulation under the Noise Insulation 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[86], where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the World Health Organization (WHO)'s Night Noise Guidelines for Europe[87], 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[88]. 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[89], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion. 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, CA4 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 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.

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 in

[86] National Planning Practice Guidance – Noise; http://planningguidance.planningportal.gov.uk.
[87] World Health Organization (2010), *Night time Noise Guidelines for Europe*.
[88] 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).
[89] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

the Noise Insulation Regulations and the Interim Target defined in the WHO'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 Whitmore to Madeley area.

13.5.16 A number of potential minor and moderate ground-borne noise and vibration impacts have been forecast at a small number of properties very close to the route. 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 expected 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:

- Hill Chorlton: occupants of residential properties on Kennels Lane and at Springfields located closest to the Proposed Scheme, identified by OSV04-C01 on Map SV-01-115b;

- Whitmore Heath North: occupants of residential properties north of Whitmore Heath located closest to the Whitmore Heath tunnel northern portal, identified by OSV04-C02 on Map SV-01-116; and
- Bar Hill, Madeley: occupants of residential properties on Bar Hill located closest to the Proposed Scheme, identified by OSV04-C03 on Map SV-01-118a.

13.5.20 The envisaged mitigation (especially track and track-bed design) described in this chapter, would substantially reduce the potential ground-borne noise and vibration effects that would otherwise arise from the Proposed Scheme. Nonetheless, this initial assessment has identified a potential significant adverse ground-borne noise effect due to increased ground-borne noise levels at occupants of residential properties on Heath Road and Snape Hall Road located closest to the Proposed Scheme, identified by OSV04-C04 on Maps SV-01-116. Further assessment will be undertaken for the formal EIA Report to confirm whether the impacts currently forecast are likely to occur.

13.5.21 The initial assessment indicates that, 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 Bar Hill, Madeley and Wrinehill. These properties are identified on Map Series SV-01 (Volume 2, CA4 Map Book).

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, CA4 Map Book) shows the draft non-residential locations to be considered in the sound, noise and vibration assessment as part of the formal EIA Report. This 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 Whitmore Heath to Madeley 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 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, CA4 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 potentially affected by the Proposed Scheme including: the M6, the A51 London Road, the A53 Whitmore Road/Newcastle Road between Whitmore and Baldwin's Gate, Manor Road, the A525 Bar Hill Road and local roads serving the settlements of Whitmore, Baldwin's Gate and Madeley.

14.2.3 The effects on traffic and transport are assessed qualitatively, based on 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 and Highways England (including the provision of information on public transport, PRoW and accident data) and desktop analysis.

14.3.2 Traffic surveys of all roads crossing the route or potentially affected by the Proposed Scheme were undertaken in November 2015 and February and March 2016, comprising 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 and Highways England. Assessment of the data indicates that the peak hours in the area are 08:00 to 09:00 and 17:00 to 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 would cross the route of the Proposed Scheme and any additional PRoW and roads that it is expected would 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 weekdays where routes may be influenced by commuting or other localised uses.

14.3.4 The Proposed Scheme would directly intersect six PRoW although others in the area could also be affected. The Proposed Scheme would cross seven roads/roadside footways, these are: Bent Lane (in two locations), the A53 Newcastle Road, Heath Road, Snape Hall Road, Manor Road, the A525 Bar Hill Road and Bower End Lane.

14.3.5 The M6 is the only strategic road that runs through the area. The M6 runs in a north-west/south-east alignment along the eastern boundary of the area. Junction 15 of the M6 is located on the south-east boundary of the area, and connects Newcastle-under-Lyme and Stoke-on-Trent to the strategic road network. The Proposed Scheme would not intersect the M6 in this area.

14.3.6 There are four primary A roads in the area: the A53 Newcastle Road/Whitmore Road, which passes through Baldwin's Gate and Whitmore; the A525 Bar Hill Road/Newcastle Road, which routes through the settlements of Onneley, Madeley and Madeley Heath; the A51 London Road, which traverses the western boundary of the area; and A5182 Trentham Road, which connects the A53 Whitmore Road to the A519 Newcastle Road, which is located in the adjacent Stone and Swynnerton area. The strategic and primary road network can get busy at peak times and delays can be experienced.

14.3.7 The main local roads that would be affected by the Proposed Scheme are Bent Lane, which connects the settlements of Whitmore and Stableford; Heath Road; Snape Hall Road and Manor Road, which all serve the village of Baldwin's Gate; and Bower End Lane, which connects a number of rural properties to the settlement of Madeley. The local road network generally operates well, although some localised delays can be experienced, particularly at peak times.

14.3.8 Relevant accident data for the road network has been obtained from SCC. Data for the latest three-year period (2012 to 2015) has been assessed and no clusters of accidents were identified within the Whitmore Heath to Madeley area.

14.3.9 Bus service provision in the area is focused on the major urban settlements of Newcastle-under-Lyme and Stoke-on-Trent to the east of the area boundary, with nearly all bus services from the surrounding areas terminating at these local centres. There are two bus corridors that would cross the route of the Proposed Scheme in this area, these are the A53 Newcastle Road/Whitmore Road via Whitmore and Baldwin's Gate and the A525 corridor, which passes through Madeley. An additional bus corridor along the A51 London Road via Stableford and Woore is also in the area but would not cross the route of the Proposed Scheme.

14.3.10 The A53 Newcastle Road/Whitmore Road corridor is served by one bus service, which provides connections to Newcastle-under-Lyme, Loggerheads and Hanley. Four bus services operate along the A525 Bar Hill Road corridor and these services provide

connections to Keele University, Newcastle-under-Lyme, Stoke-on-Trent, Nantwich, Woore and Madeley.

14.3.11 The WCML traverses the area in a broadly north-west/south-east alignment. There are no stations within the Whitmore Heath to Madeley area. National and local rail services are accessible via Stoke-on-Trent and Crewe stations and serve a range of destinations including London, Birmingham and Manchester. Rail users can interchange at both Stoke-on-Trent and Crewe as well as Newcastle-under-Lyme for regional and local destinations.

14.3.12 There are pedestrian footways in the built up areas of Baldwin's Gate, Madeley and Woore. There are few off-road cycle routes serving the settlements within the Whitmore Heath to Madeley area. However there are a number of advisory cycle routes passing through Madeley, Madeley Heath, Loggerheads, Ashley, Stableford and Baldwin's Gate.

14.3.13 There are no navigable waterways situated within the Whitmore Heath to Madeley area.

14.4 Effects arising during construction

Avoidance and mitigation measures

14.4.1 The following measures have been included as part of the engineering design of the Proposed Scheme and would avoid or reduce effects on transport users:

- creation of a haul route adjacent to the Proposed Scheme;
- construction materials and equipment would be transported along the haul road where reasonably practicable to reduce HGV movements on the public highway;
- the use of a railhead (located in the Stone and Swynnerton area (CA3)) to transport materials on the existing rail network to seek to reduce HGV movements;
- new highways to be constructed and operational prior to the 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 over-arching 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, meaning site staff and workers would generally arrive before the morning peak hour and depart after the evening peak hour; and
- excavated material reused where suitable and reasonably practicable along the route of the Proposed Scheme.

14.4.6 Where works could potentially affect Network Rail assets, disruption to travelling passengers and freight movements would be reduced as far as reasonably practicable. This includes measures such as:

- programming the construction works to coincide with possessions that are required and planned by Network Rail for the general maintenance of the railway;
- planning of the required construction works so that they can be undertaken in short overnight stages when passenger services are not disrupted; and
- programming longer closures at the weekend and on bank holidays to reduce as far as practicable the number of passengers affected.

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 areas.

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 would be nine construction compounds in this area, all of which would be satellite compounds. These satellite compounds would be managed from the A519 Newcastle Road main compound for civil engineering works and the Stone railhead main compound for railway systems works, both of which would be located in the Stone and Swynnerton area.

14.4.12 Details of proposed construction compounds are provided in Section 2.3 of this report.

14.4.13 It is expected that the M6, the A51 London Road, the A53 Newcastle Road/Whitmore Road and the A5182 Trentham Road would provide the primary access routes for construction vehicles, from which HGVs would access compounds via Bent Lane, the A525 Bar Hill Road/Newcastle Road, Manor Road, Common Lane/Snape Hall Road and Checkley Lane. Where reasonably practicable, HGVs would use the haul road alongside the 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:

- M6;
- A51 London Road;
- A53 Newcastle Road/Whitmore Road;
- A5182 Trentham Road;
- A525 Bar Hill Road/Newcastle Road; and
- Manor 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 is 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 A53 Newcastle Road would pass over the Whitmore Heath tunnel southern portal. During construction, the A53 Newcastle Road would be closed for a period of approximately six months. A temporary realignment to the south of the existing road would be provided and operational before the existing road is temporarily closed. It is therefore not expected that this would result in a significant effect. The A53 Newcastle Road would be reinstated over the tunnel portal on completion of the works.

14.4.18 The Proposed Scheme would include the permanent stopping up of Madeley Bridleway 5. The impact of this closure is reported under operational effects in this section.

14.4.19 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 (as shown on CA4 Map Series CT-05):

- Madeley Footpath 4;
- Madeley Footpath 14;
- Madeley Footpath 6;
- Madeley Bridleway 1; and
- Madeley Bridleway 2.

14.4.20 Non-motorised users would also be re-routed around construction compounds and areas of construction activity. The changes to PRoW 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

14.4.21 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 over-stated.

14.4.22 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

14.4.23 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 M6, the A51 London Road, the A53 Newcastle Road/Whitmore Road, the A5182 Trentham Road, the A525 Bar Hill Road/Newcastle Road and Manor 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.

14.4.24 Five PRoW would be affected and users would be temporarily diverted at different times during the construction period. One PRoW would be permanently stopped up. This could result in significant adverse effects on users. This 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 describes 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 would be no stations or depots within Whitmore Heath to Madeley area. The maintenance of the Proposed Scheme would generate limited vehicular trips and the effect would not be significant.

14.5.4 The operational impacts would therefore be primarily related to permanent diversion, realignment and stopping up of roads and the diversion and realignment of PRoW.

14.5.5 A section of Snape Hall Road would be permanently stopped up. Snape Hall Road is located on the northern edge of Whitmore Heath. The closure of a section of Snape Hall Road would not be expected to substantially change journey times and is unlikely to result in a significant effect for motorised users, as access would be maintained via both the retained part of Snape Hall Road, Heath Road (on the southern edge of Whitmore Heath and retained as the Whitmore Heath tunnel would pass underneath it) and Common Lane. The stopping up of Snape Hall Road could, however, result in a significant effect for non-motorised users.

14.5.6 It is proposed to permanently divert Bent Lane. Bent Lane crosses into this area from the adjacent Stone and Swynnerton area, and would be diverted to the northern side of the route and permanently stopped up to the south of the route. Manor Road, Red Lane and the A525 Bar Hill Road would also be permanently realigned. These realignments and diversions are not expected to substantially change journey times or result in a significant effect. However, they may impact on non-motorised users of these routes. Non-motorised users of Newcastle Way, which connects Madeley Footpath 33 and Madeley Footpath 10 via Manor Road, may also have an increase in journey distance. Any effects will be reported in the formal EIA Report.

14.5.7 Madeley Bridleway 5 would be permanently stopped-up between Madeley Footpath 28 and Madeley Bridleway 2. Users would be permanently diverted along Madeley Footpath 28 (which would be upgraded to a bridleway) to Madeley Bridleway 2 before crossing the route of the Proposed Scheme under the Madeley Bridleway 2 accommodation underbridge. The stopping up of Madeley Bridleway 5 is not expected to substantially increase travel distance and times for users although they would be required to cross the route of the Proposed Scheme via an underbridge.

14.5.8 A number of PRoW would be permanently realigned or diverted, these are:

- Madeley Footpath 14 would be diverted before crossing the Proposed Scheme and joining Madeley Footpath 6;
- Madeley Bridleway 1 would be diverted alongside the A525 Bar Hill Road before crossing the route of the Proposed Scheme over the A525 Bar Hill overbridge and rejoining Madeley Bridleway 1 via the Red Lane and Madeley Bridleway 1 diversion; and

- Madeley Bridleway 2 would be realigned locally as it crosses the route of the Proposed Scheme under the Madeley Bridleway 2 accommodation underbridge.

14.5.9 The realignment of some of the PRoW would increase journey distance and time for non-motorised users and some of the changes may result in a significant effect. These will be reported in the formal EIA Report.

Other mitigation measures

14.5.10 Any further traffic and transport mitigation measures required during the operation of the Proposed Scheme will 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

14.5.11 The Proposed Scheme would require the permanent stopping up of part of Snape Hall Road and this could impact significantly on non-motorised users of this route.

14.5.12 The Proposed Scheme would require a number of roads to be permanently realigned or diverted although this is not expected to change journey times substantially.

14.5.13 The Proposed Scheme would require the permanent stopping up of Madeley Bridleway 5. The stopping up is not expected to substantially increase travel distance and times for users although they would be required to cross the route of the Proposed Scheme via an underbridge.

14.5.14 It is currently expected that three PRoW would be permanently realigned or diverted. There is not expected to be an increase of over 500m in distance on any of these routes.

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 Whitmore Heath to Madeley 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 (who are the Lead Local Flood Authority (LLFA)), the Canal & River Trust and Severn Trent Water Limited (who are 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 the environmental features and the construction and operational components of the Proposed Scheme can be found in the Volume 2, CA4 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.

15.2.2 Unless indicated otherwise, the spatial scope of the assessment is based upon the identification of surface water and groundwater features within Whitmore Heath to Madeley that are within 1km of the centre line of the proposed route. This is the definition of the study area.

15.2.3 The assessment of surface waters focuses on the Meece Brook, the River Lea and tributary watercourses.

15.2.4 The groundwater assessment focuses on the Sherwood Sandstone Group, a principal aquifer, the Salop Formation and Halesowen Formation Secondary A aquifers and the Mercia Mudstone Group Secondary B aquifers which outcrop throughout the study area. The assessment also considers superficial deposits, groundwater abstractions and springs.

15.2.5 Impacts on biological receptors such as aquatic fauna and flora 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 be constructed in alternating sections of cuttings and embankments. These sections would be interspersed with two viaducts, which would span the floodplains of Meece Brook and the River Lea and two tunnelled sections at Whitmore Heath to Madeley.

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) (as far north as Baldwin's Gate/Whitmore) and the Upper Weaver catchment of the North West RBD (between Baldwin's Gate/Whitmore and Crewe).

15.3.3 The River Basin Management Plan (RBMP)[90] identifies the chemical[91] and ecological[92] condition of surface water bodies, and the quantitative[93] and chemical[94] status of 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 assessment as being of either high or very high value, sensitive to any 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 Whitmore Heath to Madeley area is provided in Table 12.

Table 12: Key surface water bodies and their WFD status

Water body name and identification number[95]	Crossing location description	Current WFD Status	WFD status objective
Meece Brook from source to Chatcull Brook GB104028053080	Meece Brook viaduct. Tributary watercourse crossings: - Culvert at Swynnerton Footpath 10 underbridge; - Snape Hall Road inverted siphon; - Whitmore Wood culvert;	Poor	Good by 2027

[90] Environment Agency (2015), Water for life and livelihoods Part 1: Humber river basin district: River basin management plan.
[91] The **chemical status** of surface waters reflects concentrations of priority and hazardous substances present.
[92] 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;
- **Physio-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.

[93] 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.
[94] 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.
[95] The Environment Agency has attributed each surface water and groundwater body a unique water body identification (ID) number.

Water body name and identification number[95]	Crossing location description	Current WFD Status	WFD status objective
	- Madeley Park culvert.		
River Lea GB112068055200	River Lea viaduct. Tributary watercourse crossings: - Wrinehill South culvert; - Culvert at Madeley Bridleway 2 underbridge.	Bad	Good by 2027

15.3.6 There are no licensed surface water abstractions or discharges in the study area.

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. This data indicates that there is no private unlicensed surface water abstractions registered within the study area. However, as there is no obligation to register private water supplies, there remains the possibility that others exist. Unregistered surface water supplies may be present that would also need to be protected.

15.3.8 The geology of the study area is described in Section 10, Land quality, and is summarised below.

15.3.9 The main bedrock geology consists of the Sherwood Sandstone Group, Halesowen Formation and Salop Formation (which both consist of mudstones, siltstones and sandstones) and the Mercia Mudstone Group.

15.3.10 The Sherwood Sandstone Group is classified as a Principal aquifer by the Environment Agency and is therefore a receptor of high value. The Salop and Halesowen Formations are classified as Secondary A aquifers, capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of baseflow to rivers.

15.3.11 The Mercia Mudstone Group 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.

15.3.12 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 may form an important source of baseflow to rivers. There can be hydraulic interaction between groundwater in these deposits influenced by groundwater recharge and the hydraulic behaviour of local surface water bodies responding to rainfall events. Deposits of peat and till are classed as Unproductive in this area and therefore have low value in terms of water resources.

15.3.13 A summary of the groundwater body locations, current overall WFD status and future overall status objectives associated with the designated groundwater bodies within the Whitmore Heath to Madeley 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	The sandstones in the southern section of the area, up to Whitmore Heath	Poor	Good by 2027
Staffordshire Trent Valley - Coal Measures Stoke GB40402G304600	In the southern section of the area, to the east of the route	Poor	Good by 2027
Cheshire South and Staffordshire North PT Sandstone Aquifers GB41201G103400	In the northern half of the area, around Madeley	Good	Good
Weaver and Dane Quaternary Sand and Gravel Aquifers GB41202G991700	Corresponding with the glaciofluvial deposits (sand and gravel) in the northernmost part of the study area	Poor	Good by 2027

15.3.14 There are three licensed groundwater abstractions located in the study area. Two of these are for private water supply, and one is a groundwater abstraction for public water supply (PWS) near Whitmore, protected by a source protection zone (SPZ).

15.3.15 The information on private unlicensed water abstractions obtained from the local authorities indicates that there are three unlicensed abstractions registered within the study area. Due to the absence of nearby surface watercourses, the water from these taps is assumed to be sourced from groundwater. The local authority data provided only indicates the location of the taps from which the supply is drawn. Unregistered groundwater supplies may also be present that would need to be protected.

15.3.16 There are 15 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 assume to comprise springs, which are high value receptors.

15.3.17 There are no designated Groundwater Dependent Terrestrial Ecosystems (GWDTEs) in the study area.

Flood risk and land drainage baseline

15.3.18 The Environment Agency's Flood Maps are the principal dataset 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, CA4 Map Book.

15.3.19 The following reports were used to help determine the baseline flood risk within the study area:

- Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011)[96]; Stoke-on-Trent City Council and NBC Strategic Flood Risk Assessments (SFRA) (2007)[97] [98].

15.3.20 These reports identified the following:

- The principal sources of flood risk are rivers and surface water. The area includes substantial areas of floodplain (Flood Zone 2 and 3) associated with the Meece Brook to the south of Whitmore, the Upper River Lea at the River Lea viaduct (where the route would cross the WCML) to the west of Hey Spink, and the Lower River Lea and Checkley Brook to the west of Wrinehill; and
- The NBC area within the SFRA study area coincides with the extent of the Whitmore Heath to Madeley area. The flood zones used in the SFRA maps are equivalent to the current Environment Agency Flood Map and present the best available flood risk information. The SFRA also collates available historical flooding information from Environment Agency historic fluvial flood outlines. These show the extent of recorded historic floods that have occurred along the Meece Brook near Whitmore, and along the River Lea.

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[99] includes a range of mitigation measures that are suitable to reduce impacts as far 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 River Lea, and their associated floodplains. Instead it would pass over the larger watercourses (rivers and streams) on viaducts spanning the floodplain. The only permanent

[96] Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011) Staffordshire County Council
[97] Stoke-on-Trent City Council Strategic Flood Risk Assessment (SFRA) (2008) Halcrow
[98] Newcastle-under-Lyme Borough Council Strategic Flood Risk Assessment (SFRA) (2008) Halcrow
[99] Volume 1, Appendix: Draft Code of Construction Practice.

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 water and groundwater.

15.4.3 Where permanent watercourse diversions and/or realignments are proposed, the design 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 in so 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[100] 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;

[100] 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 watercourses crossings include:

- the culvert at Swynnerton Footpath 10 underbridge;
- Snape Hall Road inverted siphon;
- Whitmore Wood culvert;
- Madeley Park culvert;
- Wrinehill South culvert; and
- culvert at Madeley Bridleway 2 underbridge.

15.4.6 Existing groundwater abstraction boreholes or monitoring points would be protected from physical damage, in so far as reasonably practicable. If boreholes are to be decommissioned and replaced with alternatives, the contractors would follow the latest good practice, 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 relocated.

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 pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions; and
- incorporating passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed around temporary structures allowing groundwater to bypass the below-ground works, without a rise in groundwater levels on the upstream side.

15.4.8 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:

- preparation of flood risk assessments and method statements for temporary works, including main construction and satellite compound drainage, watercourse crossings and realignments and temporary realignments in consultation with the Environment Agency, and where applicable, the LLFA and other relevant regulators;
- location of storage, machinery, equipment and temporary buildings outside flood risk areas where reasonably practicable;
- construction of outfalls during periods of low flow to reduce the risk of scour and erosion;
- design of temporary watercourse realignments with equivalent hydraulic capacity to the existing channels, ensuring that field subsurface drainage systems can be adapted to discharge into the new channel; and
- having regard to the requirement for construction activities to avoid any 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 impact on existing land drainage systems is limited as far as is reasonably practicable.

15.4.11 The design of the Proposed Scheme will aim to mitigate permanent 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;
- where new culverts would 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 would 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[101];
- runoff from the footprint of the infrastructure could occur more rapidly post-construction due to steeper slope angles and the permeability of the newly-created surfaces. The design of drainage systems 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 transfer 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.

[101] Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities

Permanent effects would be mitigated by a range of measures incorporated into the design that have been informed by the environmental assessment process.

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 the potential to affect abstractions and the water environment more generally. However, the practices outlined in the draft CoCP are considered adequate to mitigate any associated effects on water quality, such that no significant effects are anticipated.

15.4.14 The proposed Whitmore Heath tunnel and Madeley tunnel would intersect the Sherwood Sandstone Group Principal aquifer, the Salop Formation Secondary A aquifer and the glaciofluvial deposits Secondary A aquifer. The tunnel boring machine would be operated in a closed face mode when tunnelling within water bearing strata and the tunnel lining would be designed to reduce leakage rates to a minimum, thereby reducing the requirements for dewatering and drainage.

15.4.15 The cuttings in the study area would intersect the Sherwood Sandstone Group Principal aquifer, Halesowen Formation, Salop Formation and glaciofluvial deposits (Secondary A aquifers) and the Mercia Mudstone Group Secondary B aquifer. Whilst there are likely to be minor localised impacts, the implementation of 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.

15.4.16 The construction of Madeley tunnel may result in the loss or deterioration of two overlying springs as groundwater finds preferential pathways. The springs are currently assessed as high value receptors, pending the results of a site survey which will be reported in the formal EIA Report and the assessment therefore identifies these as significant (major adverse) effects.

15.4.17 The water quality and quantity discharging at another spring feature to the south of Grafton's Wood may also be impacted by construction of the Madeley tunnel and nearby cuttings, constituting a significant (moderate adverse) effect. No construction impacts on the other spring features in the area are anticipated.

15.4.18 Construction of cuttings, embankments, Meece Brook viaduct and realignment of the A53 Newcastle Road in the southern part of Whitmore Heath to Madeley area would impact on a groundwater SPZ1, 2 and 3 associated with a public water abstraction near Whitmore. Even with the draft CoCP measures taken into account the magnitude of impact to this very high value receptor could be major throughout construction and this has been assessed as a significant (major adverse) effect. There would be no significant effects on other licensed groundwater abstractions in the study area.

15.4.19 The permanent impacts of the Proposed Scheme on the SPZ and public groundwater supply abstraction near Whitmore have been assessed as not significant because the permanent works would allow continued abstraction from this borehole cluster and should not pose a pollution risk to the source. Potential impacts on other licensed groundwater abstractions have also been assessed as not significant.

15.4.20 Due to the proximity of the three unlicensed private groundwater abstractions to the Proposed Scheme these would likely be impacted by construction works. These have been assessed as significant (major adverse) effects.

15.4.21 The design of the Meece Brook and River Lea viaducts would aim to ensure that these structures do not prevent Meece Brook or the River Lea from achieving good status, in line with the WFD objectives in the RBMP.

15.4.22 Culverts at Swynnerton Footpath 10 underbridge, Snape Hall Road, Whitmore Wood, Madeley Park, Wrinehill South and Madeley Bridleway 2 underbridge would be required to permit drainage of watercourses beneath the route of the Proposed Scheme. These watercourses have been attributed a high value, pending the results of site survey, and, where a watercourse would be culverted for more than a few metres, this has been assessed as having a minor impact on its hydromorphological status. This has been assessed as having potential to result in significant (moderate adverse) effects at this stage.

15.4.23 The Dab Green drop inlet culvert, Madeley Park culvert, Snape Hall Road inverted siphon and the Drummer Stile inverted siphon would be required to maintain connectivity of existing overland flow routes. There are no existing channel features at these locations, so these structures would have no implications in terms for hydromorphology and would not result in significant effects.

15.4.24 There are no surface water abstractions that would be affected by the Proposed Scheme within the study area.

15.4.25 Permanent impacts on the three unlicensed private groundwater abstractions could be major due to their proximity to the Proposed Scheme. These have therefore been assessed as significant (major adverse) effects.

15.4.26 The springs near Madeley cutting and Madeley tunnel could be permanently impacted by the works. Based on available information these have been assessed as significant (major adverse) effects.

15.4.27 It is anticipated that there would be no significant effects on the other springs identified in the study area.

Flood risk and land drainage

15.4.28 Construction of viaducts over Meece Brook and the River Lea and their associated floodplains would require temporary working within flood zones. Construction sequencing and temporary works design would need to be carefully considered and assessed in terms of impacts on flood risk. These activities would be implemented in consultation with the Environment Agency. It is not anticipated that these temporary activities would result in significant effects on flood risk and land drainage.

15.4.29 The construction of the culverts at the Swynnerton Footpath 10 underbridge, Whitmore Wood Stream culvert, Wrinehill South culvert, and Madeley Bridleway 2 underbridge, the Snape Hall Road inverted siphon, and the channel diversions at Madeley tunnel drainage ditch would also require working within the channel, and as described above, would require careful consideration along with the implementation of the measures in the draft CoCP to ensure that there is a negligible effect during

construction on flood risk and land drainage systems. These activities are considered unlikely to result in significant effects.

15.4.30 The proposed permanent crossings of the River Lea and Meece Brook would be on viaduct. The design incorporates areas where provision could be made to compensate for the loss of floodplain storage areas associated with the footprint of any intermediate piers. The piers would avoid the channel and allow access for channel inspection and maintenance, where necessary. On that basis the assessment has identified no significant permanent effects related to flood risk in this area.

15.4.31 The design aim for the Swynnerton Footpath 10 underbridge, Dab Green drop inlet culvert, Whitmore Wood culvert, Madeley Park culvert, Wrinehill South, Madeley Bridleway 2 underbridge, Snape Hall Road inverted siphon, and Drummer Stile inverted siphon would be to accommodate the peak 1 in 100 (1%) annual probability flow, with an explicit allowance for potential future increases caused by climate change in accordance with current Environment Agency guidance. These structures are, therefore, unlikely to have a significant effect on flood risk.

15.4.32 The 10 permanent watercourse realignments proposed in the design to reduce the number, and hence the overall length, of culverts and more complex cross drainage structures, would aim to have equivalent capacity to the existing channels downstream and would be designed such that any existing field subsurface drainage systems could be connected-in. These realignments are, therefore, unlikely to have a significant adverse effect on flood risk and land drainage.

15.4.33 The design aim for the proposed five balancing ponds for railway drainage would be to ensure that the quantity and peak rate of runoff from the Proposed Scheme would be attenuated to current 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

15.4.34 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.

15.4.35 The precise form of these will be site specific and based on the outcome of detailed surveys, hydraulic modelling work and ongoing consultation with the Environment Agency and LLFA, as appropriate, and reported in the formal EIA Report.

15.4.36 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.

15.4.37 The potential spring features near Madeley tunnel, 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.

15.4.38 As summarised above, mitigation options for the construction impacts on the public abstraction borehole near Whitmore and its groundwater supply zone would be agreed with the Environment Agency and in consultation with the owner. Mitigation of potential impacts on the three unlicensed groundwater abstractions will also be developed following further investigation.

Summary of likely residual significant effects

15.4.39 Without the additional mitigation summarised above, the expected residual significant effects would be as follows:

- the significant (moderate adverse) effect of the culverts at Swynnerton Footpath 10 underbridge, Whitmore Wood, Madeley Park, Wrinehill South and Madeley Bridleway 2 underbridge on the relevant watercourses' hydromorphology;
- a significant (major adverse) temporary effect associated with impacts on the public groundwater abstraction near Whitmore;
- significant (major adverse) temporary effects associated with impacts on the three private unlicensed groundwater abstractions during construction;
- a significant (major adverse) effect associated with impacts on the two springs located in proximity of Madeley tunnel both throughout construction and permanently; and
- a (significant major adverse) temporary effect associated with impacts on the spring feature south of Grafton's Wood throughout construction.

15.4.40 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 of flow and 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 will be reported on in the formal EIA Report on a route-wide basis. 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 The design would take into account the policies in NPPF and would aim to 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 in the formal EIA Report. 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 would 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 Proposed Scheme has no adverse effects of significance to 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 water 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 the formal EIA Report.

Other mitigation measures

15.5.6 The route-wide assessments of accidental spillage risks, WFD compliance and alignment with the flood risk policies within NPPF will be reported in the formal EIA Report.

Summary of likely residual significant effects

15.5.7 It is currently not anticipated that there would be any significant residual effects on water resources and flood risk resulting from operation of the Proposed Scheme. However, until the route-wide assessments of accidental spillage risks, WFD compliance and alignment with the flood risk policies in NPPF have been completed, the risk of the scheme resulting in significant effects cannot be discounted. The results of these assessments will be reported in the formal EIA Report.

16 References

Annual Population Survey, (2015), NOMIS, accessed 26 April 2016

Annual Population Survey, (2015), NOMIS, Accessed: 25 July 2016

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

British Geological Survey (2016). Geology of Britain viewer, http://mapapps.bgs.ac.uk/geologyofbritain/home.html

British Standard, (2011), BS10175+A1:2013 Investigation of Potentially Contaminated Sites

British Standard, (2013) BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)

BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations, 2012, British Standard

Business register and employment survey, (2014)

Cheshire County Council Transport and Regeneration Service (2008), Cheshire Landscape Character Assessment. Available online at: http://www.cheshireeast.gov.uk/environment/heritage_natural_environment/landscape/landscape_character_assessment.aspx.

Cranfield University (2001), The National Soil Map.

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

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

Defra (2009), Soil Strategy for England

Department for Communities and Local Government, 2015. English Indices of Deprivation, 2015

Environment Agency, (2004), CLR11 Model Procedures for the Management of Land Contamination

Environment Agency (2015), Water for life and livelihoods Part 1: Humber river basin district: River basin management plan

Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities

EU Water Framework Directive http://ec.europa.eu/environemt/water/water-framework/index_en.html

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

Homes and Communities Agency (HCA) Employment Densities Guide 2nd Edition (2010).

House of Lords, 2005, Standing Orders of the House of Lords - Private Business, The Stationery Office

HS2 (2012). HRA Screening Report for Midland Meres and Mosses Phase 1 Ramsar Site

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

BGS Mapping Index. Available online at: http://mapapps2.bgs.ac.uk/geoindex/home.html?submit=Open+the+onshore+GeoIndex

Public Health England. Available online at: http://www.apho.org.uk/

Staffordshire Borough Council Minerals Local Plan policies, June 2015. Available online at: https://consultation.staffordshire.gov.uk/environment/staffordshire-minerals-local-plan/user_uploads/0100-the-new__---june-2015.pdf

HS2 Phase 2 West Midlands to Crewe Draft EIA Scope and Methodology Report. 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

HS2 Phase 2a Property Consultation report Response summary. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/526063/HS2_Phase_2a_Property_Consultation_2015_Response_Summary_Report.pdf

UK Government Noise Policy. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

Newcastle under Lyme and Stoke on Trent Core Spatial Strategy. Available online at: https://www.newcastle-staffs.gov.uk/sites/default/files/IMCE/Planning/Planning_Policy/Saved%20Policies%20of%20the%20Newcastle-under-Lyme%20Local%20Plan%20154KB.pdf

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

Shropshire Adopted plan. Available online at: http://shropshire.gov.uk/media/1900363/SAMDev-Adopted-Plan.pdf

Shropshire Core Strategy. Available online at:http://shropshire.gov.uk/media/830904/shropshire-core-strategy-2011-reduced.pdf

Staffordshire Borough Council Minerals Local Plan policies. Available online at: https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/MineralsLocalPlanadoptedsavedpolicieswebversion1.pdf

Staffordshire Borough Council, Adopted Staffordshire and Stoke on Trent Joint Waste Local Plan. Available online at: https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-(2010-to-2026)-(adopted-March-2013).pdf

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

National Planning Practice Guidance – Noise; http://planningguidance.planningportal.gov.uk .

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

Newcastle-under-Lyme Borough Council Strategic Flood Risk Assessment (SFRA) (2008) Halcrow

NLP (2015) Joint Newcastle-under-Lyme and Stoke-on-Trent Employment Land Review. Based on 133 ha of employment land required between 2013 and 2039 (upper scenario)

Office of National Statistics, (2012), Census 2011, accessed: 11 January 2016

Office for National Statistics (ONS), (2014), UK Business: Activity, Size and Location 2014; Accessed: 11 January 2016

Office of National Statistics (2015) Annual Population Survey claimants as a percentage of economically active persons aged 16 – 64 (includes employees, self-employed and actively seeking work)

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

Soil Survey of Great Britain - England and Wales (1964), The Soils of the West Midlands, Bulletin No. 2, Harpenden

Staffordshire County Council, 2015. The new Mineral Local Plan for Staffordshire 2015 to 2030. Final Draft June 2015

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

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

Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011) Staffordshire County Council

Stoke-on-Trent and Staffordshire Local Enterprise Partnership, (2014), Strategic Economic Plan Summary March 2014

Stoke-on-Trent City Council Strategic Flood Risk Assessment (SFRA) (2008) Halcrow

Sustainable Remediation Forum UK, (2010), A Framework for Assessing the Sustainability of Soil and Groundwater Remediation

The EC Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (http://eur-lex.europa.eu/eli/dir/1992/43/2013-07-01)

The Hedgerows Regulations (1997). SL1997 No 1160. Her Majesty's Stationery Office

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

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

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

UK Radon. Available online at: www.ukradon.org/information/ukmaps

World Health Organization (2010), Night-time Noise Guidelines for Europe

High Speed Two (HS2) Limited
One Canada Square
Canary Wharf
London E14 5AB

www.gov.uk/hs2